



CYP Solar Farm
TAN15: Flood Consequence Assessment
For Sirius Planning
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CYP Solar Farm

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EXECUTIVE SUMMARY

A solar farm would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FCA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable, and the development would be in accordance with the requirements of TAN15.

This FCA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of TAN15. The development should not therefore be precluded on the grounds of flood risk.

1.0 INTRODUCTION

1.1 Background

This Flood Consequence Assessment (FCA) has been prepared by KRS Environmental Limited to support a planning application for the proposed development of the CYP Solar Farm.

This FCA has been carried out in accordance with guidance contained in Technical Advice Note 15 Development and Flood Risk (TAN15)¹ and associated Development Advice Maps (DAM). This FCA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues.

1.2 Report Structure

This FCA has the following report structure:

- Section 2 describes the location area and the existing and proposed development;
- Section 3 discusses planning & flood risk;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 outlines mitigation measures used to reduce the overall level of flood risk;
- Section 6 discusses the surface water runoff from the proposed development;
- Section 7 details the Justification Test; and
- Section 8 presents a summary and conclusions.

¹ <https://www.gov.wales/technical-advice-note-tan-15-development-and-flood-risk-2004>

2.0 LOCATION & DEVELOPMENT DESCRIPTION

2.1 Site Location

The principal area of the application site measures 67.70 hectares (ha), this comprises proposed deployment land, grazing land, scrub and woodland that is situated on an elevated plateau, at circa 700 metres Above Ordnance Datum (mAOD) to the northeast of the village Glais and circa 2km to the east of the village Clydach.

A temporary laydown area will be located north west of the deployment area and measures approximately 0.23ha (see Figures 1 and 2). The site is situated within the administrative area of the City and County of Swansea Council.

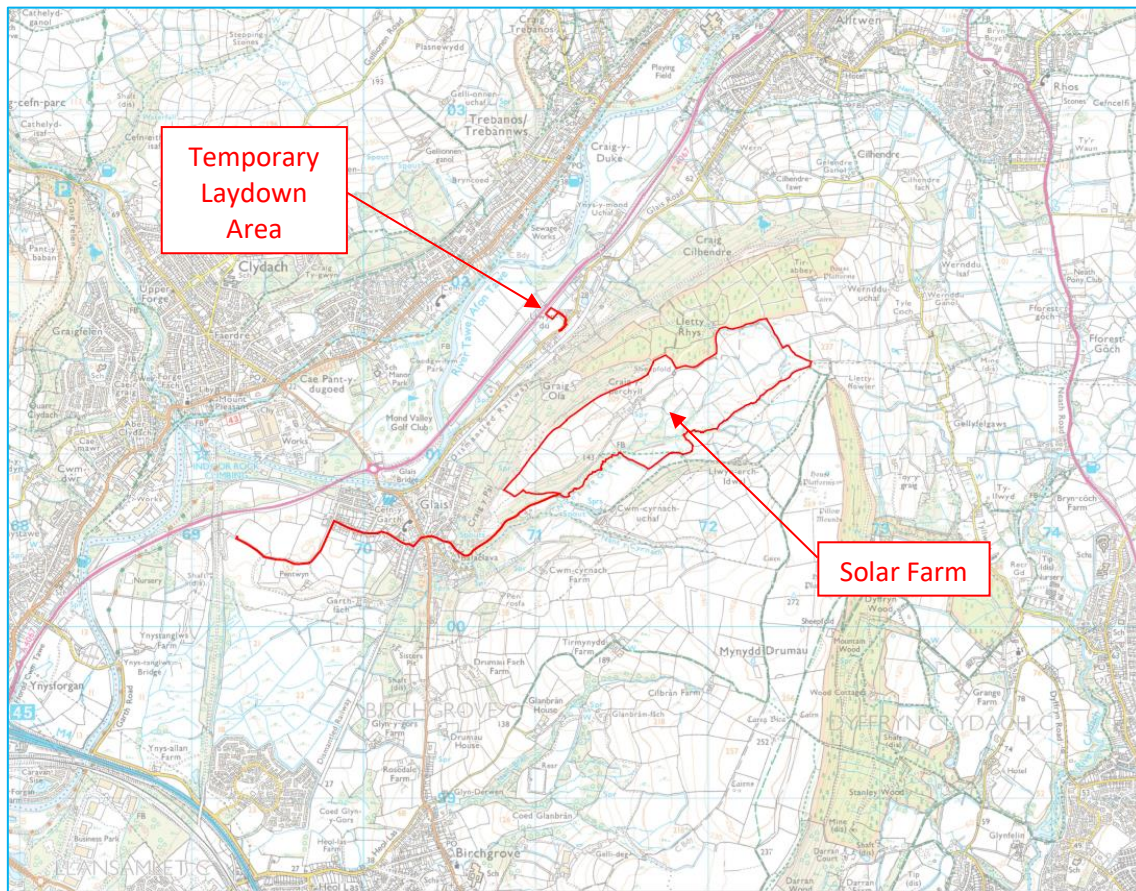


Figure 1 - Site Location



Figure 2 - Location of the Temporary Laydown Area

2.2 Existing Development

The site is currently grazing land and woodland/scrub. The surrounding area is a rural expanse of agricultural fields, with a mix of arable and pasture, drained by a network of drainage ditches and served by farms and other rural buildings. The proposed temporary laydown area is currently used for grazing horses as part of a livery yard.

The proposed site and surrounding areas are rural in nature characterised by farmland used for grazing, scrub land and established woodland. Derelict farm buildings are located centrally within the site.

2.3 Proposed Development

The proposals are for a solar farm including a temporary laydown area (see Appendix 1). The arrays are up to 3m in height, with the lower edge 0.80m above ground.

The temporary laydown area will be used for approximately 9 months for the storage of equipment and materials, will have modular cabins, accommodate parked vehicles, and will be reinstated to a grass field. The temporary laydown area will be used for storage of materials for a short period of time and the items stored will be transient in nature and will pass through the site briefly. The materials stored will not be vulnerable to flooding and will include the solar panels, cabling and stockpiles. Where possible to material will be stored on pallets and shrink wrapped for ease of transport and to protect the material. The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar with a minimum finished floor level of 22.60m AOD. The transformers will not be stored on the temporary laydown area and will be transported straight to the larger site area.

Further details with regard to the proposed development can be found in the accompanying information submitted with the planning application.

2.4 Ground Levels

A topographical survey of the site has recently been completed (see Appendix 2). The topography of the area of the site rises to the north and northeast.

The ground levels of the proposed solar farm rise from south to north and are at circa 700mAOD. The ground levels of the proposed temporary laydown area rise from the south, with a minimum ground level of 21.82mAOD, to the north, with a maximum ground level of 22.70mAOD.

The ground levels at the location of the storage cabins are 21.95 to 22mAOD, at the location of the office and welfare cabin are 22.15 to 22.25mAOD and at the car/van parking spaces are 21.99 to 22.15mAOD. The majority of the site ground levels are above 22.10mAOD.

2.5 Catchment Hydrology / Drainage

The Nant y Glais is located adjacent to the southern boundary of the area of the proposed solar farm and a number of small watercourses/drainage ditches are located within the vicinity of the proposed solar farm, these are tributaries of the Nant y Glais.

The River Tawe is located approximately 400m to the west of the temporary laydown area, between the site and the laydown area is the embanked A4067. The River Tawe is also located approximately 900m to the south west of the temporary laydown area. To the south of the temporary laydown area is a small tributary of the River Tawe. On the eastern boundary of the temporary laydown area is a small agricultural drainage ditch.

Currently the surface water runoff from the site discharges via infiltration to the ground or to the adjacent small watercourses/drainage ditches.

3.0 PLANNING & FLOOD RISK

3.1 The National Plan 2040

Future Wales: The National Plan 2040 (Adopted February 2021) is the national plan that sets the direction of development in Wales to 2040. It states:

“Wales can become a world leader in renewable energy technologies. Our wind and tidal resources, our potential for solar generation, our support for both large and community scaled projects and our commitment to ensuring the planning system provides a strong lead for renewable energy development, mean we are well placed to support the renewable sector, attract new investment and reduce carbon emissions.”

Policy 18 of Future Wales states that Proposals for renewable and low carbon energy projects (including repowering) qualifying as Developments of National Significance will be permitted subject to:

“there are no unacceptable adverse impacts on national statutory designated sites for nature conservation (and the features for which they have been designated), protected habitats and species;”

3.2 Planning Policy Wales

Planning Policy Wales (11th edition) sets out the land use planning policies of the Welsh Government. Chapter 6 ‘Distinctive and Natural Places’ outlines the Welsh Government’s objectives in terms of addressing flood risk. Development proposals in areas defined as being of high flood hazard should only be considered where:

- New development can be justified in that location, even though it is likely to be at risk from flooding; and
- The development proposal would not result in the intensification of existing development which may itself be at risk; and
- New development would not increase the potential adverse impacts of a flood event.

3.3 Technical Advice Note 15 (TAN15)

Planning Policy Wales is supplemented by a series of Technical Advice Notes (TAN). Technical guidance on development and flood risk is provided by TAN15. TAN15 was introduced in 2004 by the Welsh Assembly Government. It is technical guidance related to development planning and flood risk using a sequential characterisation of risk based on the Welsh Government's Development and Flood Risk Advice Map (DAM). Its initial requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

One of the key aims of TAN15 is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk.

It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall. A risk-based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FCA is required and should include:

- whether a proposed development is likely to be affected by current or future flooding from all sources;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate; and
- satisfy the justification test, including the acceptability of consequences.

A revised TAN15 was due to be implemented in December 2021 and then June 2023. This was to be supported by the new Flood Map for Planning (FMfP), which includes climate change information to show how this will affect flood risk extents over the next century. It shows the potential extent of flooding assuming no defences are in place. The coming into force of the new TAN15 and the FMfP has been suspended due to a further consultation on the TAN².

Natural Resources Wales may use the FMfP data as the ‘best available information’ on flood risk to inform their planning advice. As confirmed in the letter from Welsh Government dated 15 December 2021³, the FMfP represents better and more up-to-date information on areas at flood risk than the DAM. This has been reiterated by Natural Resources Wales in a number of recent planning applications where they have confirmed that the “*FMfP represents better and more up-to-date information on areas at flood risk than the DAM*” and should be used to define flood risk in detail rather than the DAM.

3.4 Swansea Local Development Plan

Swansea Local Development Plan 2010 to 2025 was formally adopted on 28 February 2019. The Plan sets out the vision, objectives, strategy and policies for managing development in Swansea and contains a number of local planning policies. It makes provision for the use of land for the purposes of housing, employment, retailing, recreation, transport, tourism, minerals, waste, and community uses.

Key policies of the Local Development Plan include:

Policy PS 2: Placemaking and Place Management is a strategic policy that seeks to protect Swansea’s natural and built environmental assets and reinforces that sensitive design and choice of location of new development can have a positive effect. It states that:

“Development should enhance the quality of places and spaces, and respond positively to aspects of local context and character that contribute towards a sense of place.

The design, layout and orientation of proposed buildings, and the spaces between them, should provide for an attractive, legible, healthy, accessible and safe environment. All proposals should ensure that no significant adverse impacts would be caused to people’s amenity. Depending on the nature, scale and siting of the proposal, development should also:

- Have regard to important elements of local heritage, culture, landscape, townscape, views and vistas;*
- Ensure neighbourhoods benefit from an appropriate diversity of land uses, community facilities and mix of densities that in combination are capable of sustaining vibrancy;*
- Create or enhance opportunities for Active Travel and greater use of public transport;*

² <https://www.gov.wales/technical-advice-note-tan-15-development-flooding-and-coastal-erosion>

³ <https://www.gov.wales/sites/default/files/publications/2021-12/letter-local-authorities-on-the-pause-of-tan-15-15-december-2021.pdf>

- iv. Integrate effectively with the County's network of multifunctional open spaces and enhance the County's green infrastructure network;*
- v. Enhance public realm quality, incorporating public art where appropriate;*
- vi. Provide for a hierarchy of interconnected streets and spaces;*
- vii. Ensure active frontages onto streets and spaces to provide natural surveillance and character;*
- viii. Provide an accessible environment for all;*
- ix. Provide appropriate parking and circulation areas for cars, cycles, motor bikes and service vehicles;*
- x. Deliver new, and/or enhance existing, connections to essential social infrastructure and community facilities;*
- xi. Maximise opportunities for sustainable construction, resource efficiency and contributions towards increased renewable or low carbon energy generation;*
- xii. Avoid the loss of land and/or premises that should be retained for its existing use or as an area of open space;*
- xiii. Avoid unacceptable juxtaposition and/or conflict between residential and non-residential uses;*
- xiv. Ensure no significant adverse impact on natural heritage and built heritage assets;*
- xv. Ensure resilience is not undermined and does not result in significant risk to human health, well-being or quality of life; and*
- xvi. Ensure that commercial proposals, including change of use proposals:*
 - a. incorporate active frontages and shopfront designs that make a positive contribution to the street scene,*
 - b. provide appropriate enclosure,*
 - c. relate well to the character of the host building,*
 - d. do not compromise the ability to deliver priority regeneration schemes.*
- xvii. Have regard to the implications for infrastructure and services"*

5.1.11 Policy ER 1: Climate Change seeks to reduce carbon emissions and provides against the impacts of climate change. The policy states:

"To mitigate against the effects of climate change, adapt to its impacts and ensure resilience, development proposals should take into account:

- i. Reducing carbon emissions;*
- ii. Protecting and increasing carbon sinks;*
- iii. Adapting to the implications of climate change at both a strategic and detailed design level;*
- iv. Promoting energy and resource efficiency and increasing the supply of renewable and low carbon energy;*

- v. Avoiding unnecessary flood risk by assessing the implications of development proposals within areas susceptible to flooding and preventing development that unacceptably increases flood risk; and*
- vi. Maintaining ecological resilience.”*

4.0 ASSESSMENT OF FLOOD RISK

4.1 Sources of Flooding

All sources of flooding have been considered, these are: fluvial (river) flooding, tidal (coastal) flooding, groundwater flooding, surface water (pluvial) flooding, sewer flooding and flooding from artificial drainage systems/infrastructure failure.

4.2 Natural Resources Wales

Information regarding the current flood risk at the application site and local flood defences has been obtained from Natural Resources Wales. Natural Resources Wales have confirmed that they do not hold detailed modelling for this area.

4.3 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within TAN15 recommends that the effects of climate change are incorporated into FCA.

Recommended precautionary sensitivity ranges for peak rainfall intensities, peak river flows and sea level rise are outlined in the following documents CL-03-16 - Climate Change Allowances for Planning Purposes⁴, Flood Consequence Assessments: Climate change allowances⁵ and Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales⁶. Table 1 show the peak river flow allowances by river catchment.

The 9th of January 2014 Welsh Government letter to all Chief Planning Officers (CPO) in Wales and CL-03-16 - Climate Change Allowances for Planning Purposes clarifies and refers to the Natural Resources Wales recommendations that the lifetime of development for residential development is 100 years, and for other development it is considered to be 75 years. However, the proposals are seeking a time limited consent for 40 years, it would be unreasonable to consider a longer life span of 75 years. It has been concluded that 40 years is a suitable lifespan for considering climate change therefore, the design flood event is the 1 in 100 year (+30%) event.

Table 1 - Peak River Flow Allowances by River Basin District

River Basin District	Allowance Category	2020's	2050's	2080's
West Wales	Upper end	+25%	+40%	+75%
	High central	+15%	+25%	+30%
	Central	+5%	+10%	+15%

4.4 Historic Flooding

Solar Farm

Natural Resources Wales has no recorded history of flooding for the area of the proposed solar farm (see Figure 3). There are no records of anecdotal information of flooding at the location of the proposed solar farm including within the British Hydrological Society "Chronology of British Hydrological Events". No other historical records of flooding for the proposed solar farm have been

⁴ <https://gov.wales/sites/default/files/publications/2018-11/cl0316-climate-change-allowances.pdf>

⁵ <https://gov.wales/sites/default/files/publications/2018-11/flood-consequence-assessments.pdf>

⁶ <https://gov.wales/sites/default/files/publications/2021-09/adapting-to-climate-change-guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales.pdf>

recorded. Therefore, it has been concluded that the area of the proposed solar farm has not flooded within the recent past.

Temporary Laydown Area

Natural Resources Wales data shows the area proposed temporary laydown area may have historically flooded in 1979, see Figure 3. The proposed laydown area has only flooded once since records began in 1956. The 1979 flood event is the largest flood event to have occurred on the River Tawe since records began, and is ranked number 1 at the Tawe at Ynystanglws (59001) gauging station, downstream from the site.

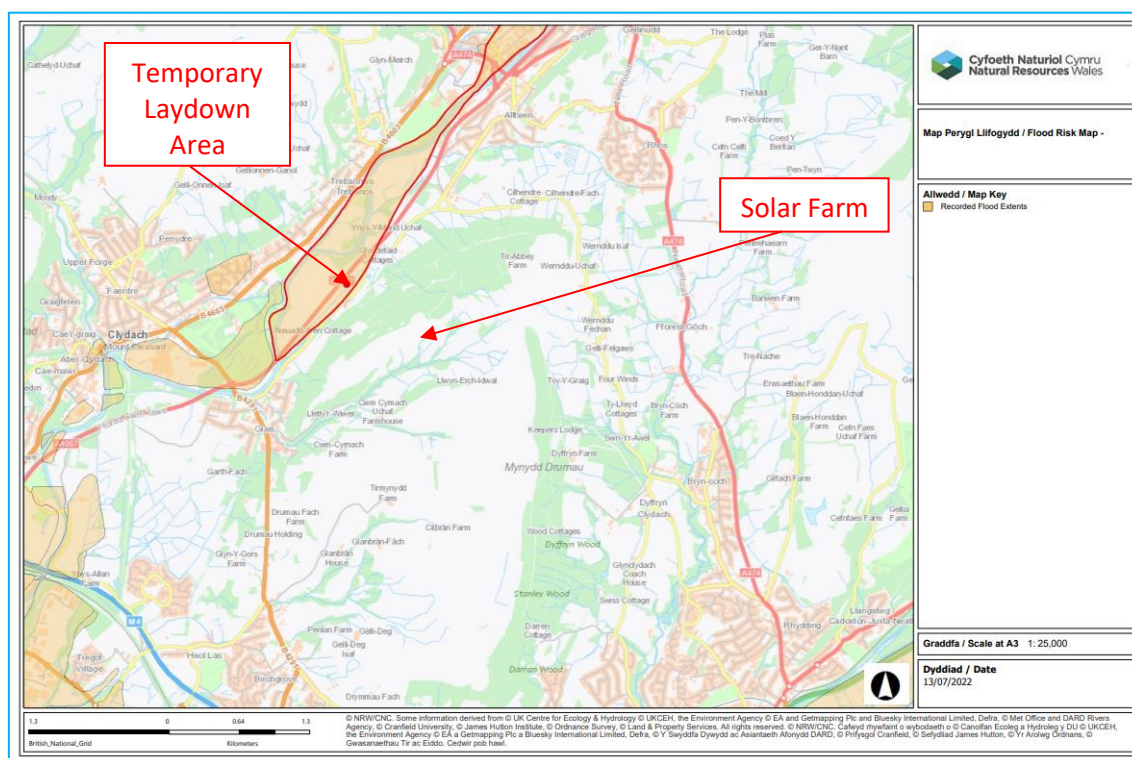


Figure 3 - Natural Resources Wales Historic Flood Outline

4.5 Existing and Planned Flood Defence Measures

The site is not protected against flooding by flood defence measures and the site is not located within the TAN15 Defended Zone.

4.6 Development Advice Map

The DAM which accompanies TAN15 has been assessed. Table 2 describes the composition and use of the DAM zones to control and manage development.

Solar Farm

The site of the proposed solar farm is located within Zone A - Considered to be at little or no risk of fluvial or tidal/coastal flooding (see Figure 4). Used to indicate that the justification test is not applicable and there is no need to consider flood risk further.

Temporary Laydown Area

The site of the proposed temporary laydown area is located within Zone C2 - Without significant flood defence infrastructure (see Figure 4). The entrance to the temporary laydown area will be located

within Zone A - Considered to be at little or no risk of fluvial or tidal/coastal flooding. Used to indicate that the justification test is not applicable and there is no need to consider flood risk further.

It should be noted that the temporary laydown area will only to be used on a temporary basis for approximately 9 months and will then revert back to grazing land.

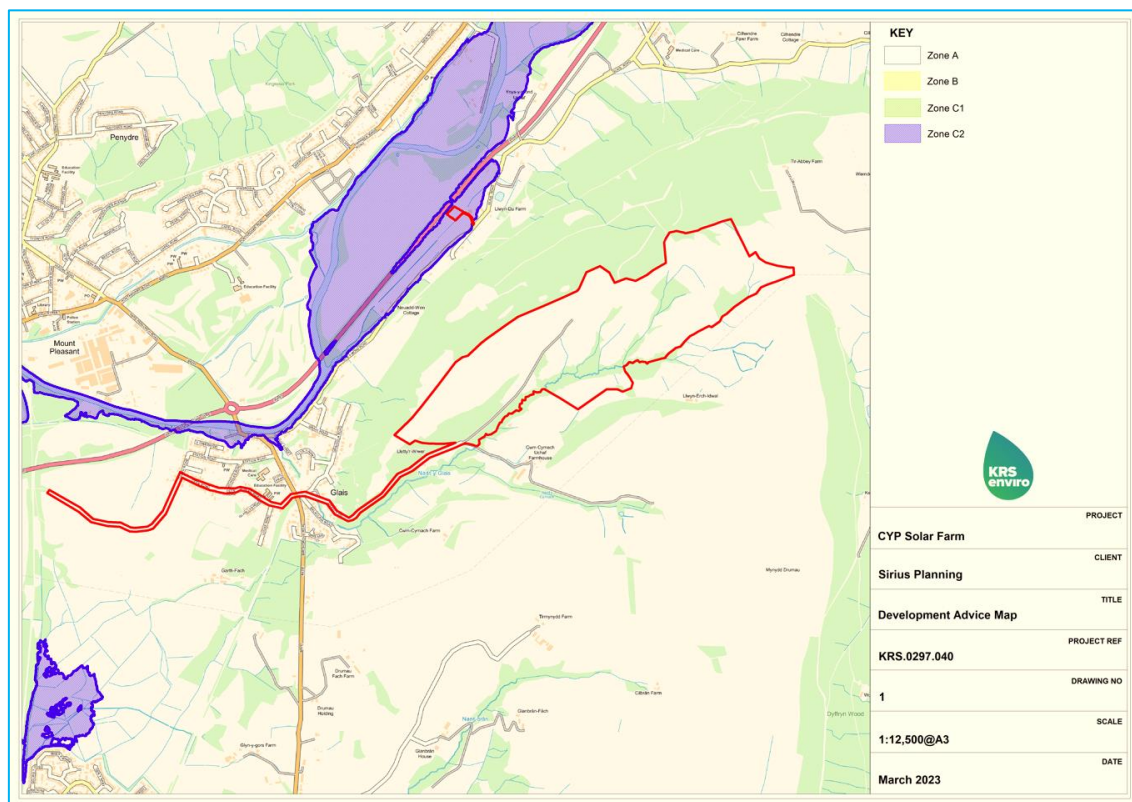


Figure 4 - Development Advice Map

Table 2 - Development Advice Map Zones

Description of Zone	Zone	Use within the precautionary Framework
Considered to be at little or no risk of fluvial or tidal/coastal flooding.	A	Used to indicate that the justification test is not applicable and there is no need to consider flood risk further.
Areas known to have been flooded in the past evidenced by sedimentary deposits.	B	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further.
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	C1	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.

Areas of the floodplain without significant flood defence infrastructure.	C2	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.
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4.7 Flood Map for Planning

The FMfP has no official status for planning purposes however, Natural Resources Wales may use the FMfP data as the 'best available information' on flood risk to inform their planning advice. As noted in Section 3.3, the FMfP represents better and more up-to-date information on areas at flood risk than the DAM and has therefore, been used within this FCA to assess the flood risk in detail. Table 3 provides details of the FMfP Flood Zones.

Table 3 - Flood Map for Planning Flood Zones

Flood Zone	Explanation
Rivers - Flood Zone 2	Areas with a 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers in a given year, including the effects of climate change.
Rivers - Flood Zone 3	Areas with more than a 1% (1 in 100) chance of flooding from rivers in a given year, including the effects of climate change.
Sea - Flood Zone 2	Areas with a 0.1% to 0.5% (1 in 1000 to 1 in 200) chance of flooding from the sea in a given year, including the effects of climate change.
Sea - Flood Zone 3	Areas with more than a 0.5% (1 in 200) chance of flooding from the sea in a given year, including the effects of climate change.
Surface Water and Small Watercourses - Flood Zone 2	Areas with a 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change.
Surface Water and Small Watercourses - Flood Zone 3	Areas with more than a 1% (1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change.

Solar Farm

The site of the proposed solar farm is located within Flood Zone 1 for flooding from rivers, sea, surface water and small watercourses, with a chance of flooding of less than 1 in 1000 (0.1%) years in a given year, including the effects of climate change (see Figures 5 and 6).

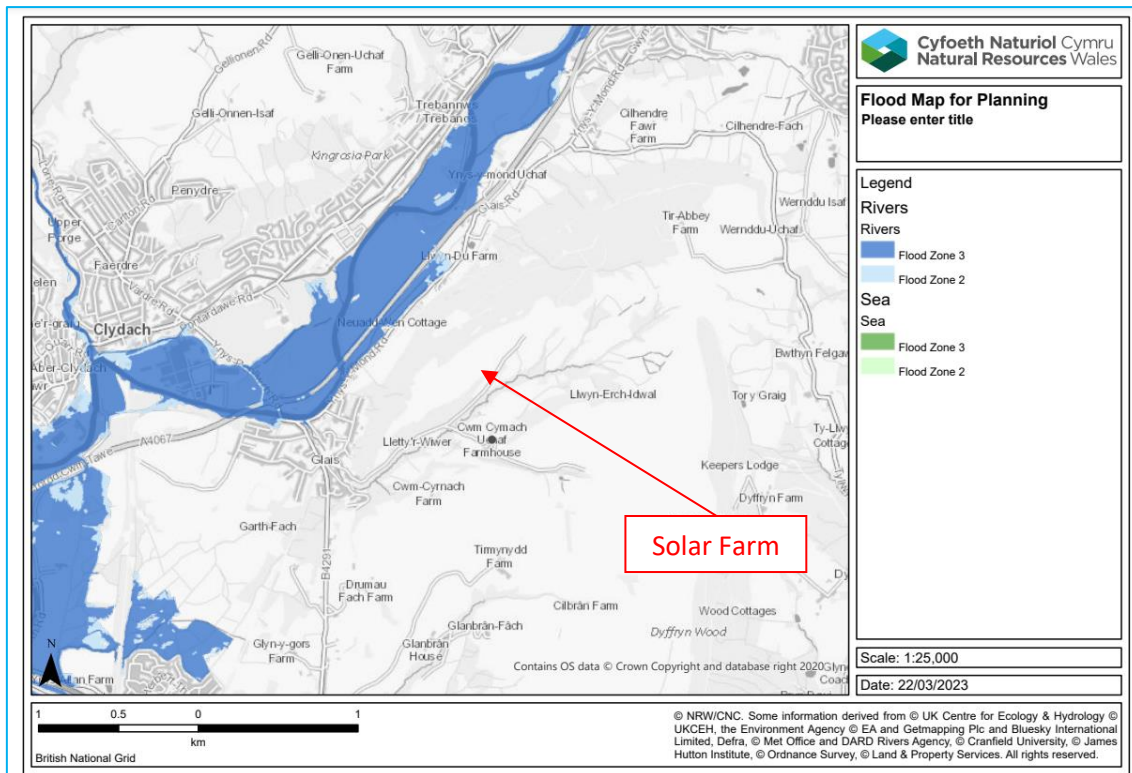


Figure 5 - Flood Map for Planning: Rivers and Sea: Solar Farm

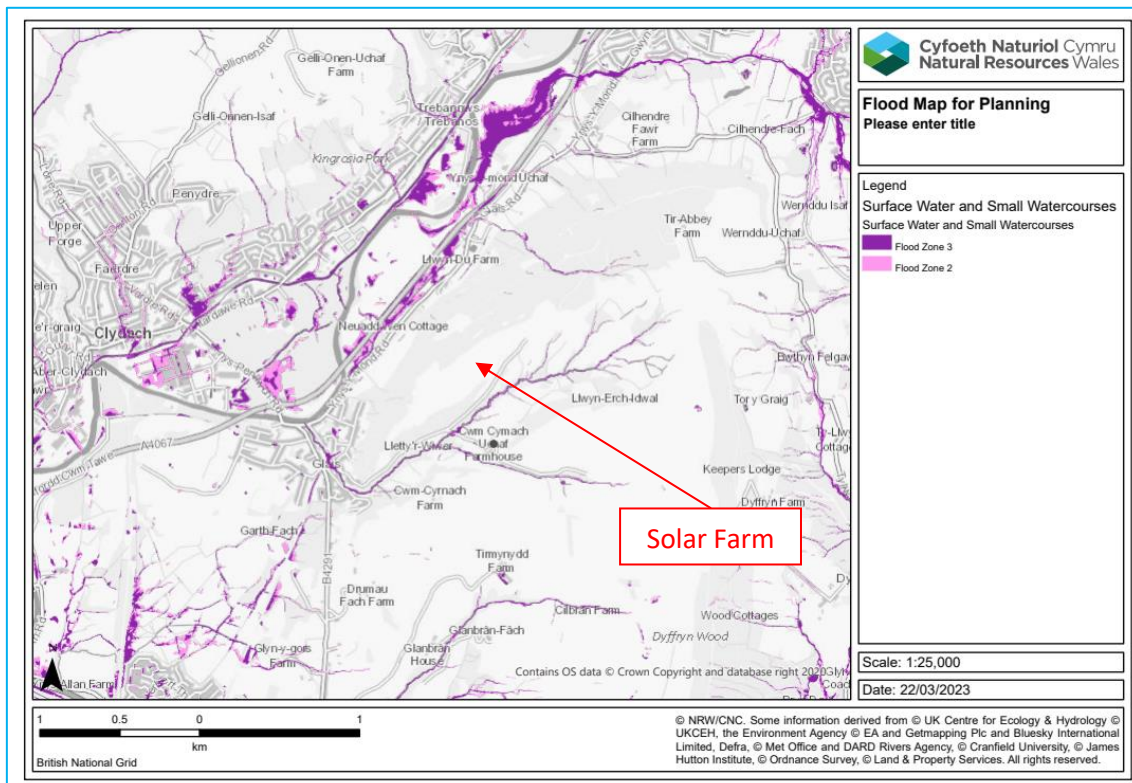


Figure 6 - Flood Map for Planning: Surface Water and Small Watercourses: Solar Farm

Temporary Laydown Area

The site of the proposed temporary laydown area is located within Flood Zone 1 for flooding from the sea, with a chance of flooding of less than 1 in 1000 (0.1%) years in a given year, including the effects of climate change (see Figure 7).

The site of the proposed temporary laydown area is located within Flood Zone 2 for rivers with a chance of flooding of 1 in 1000 to 1 in 100 (0.1% to 1%) year in a given year, including the effects of climate change. It should be noted that the temporary laydown area is located on the very edge of Flood Zone 2 for river flooding with areas immediately to the north and east being located within Flood Zone 1.

Small areas on the western and eastern boundary of the temporary laydown area are located within Flood Zone 3 for rivers, with a chance of flooding of 1 in 1000 to more than 1 in 100 (1%) years in a given year, including the effects of climate change. This is associated with the drainage ditches and the Flood Zone 3 outline is contained within the channel of the drainage ditches.

The site of the proposed temporary laydown area is located within Flood Zone 2 and 3 with a chance of flooding of 1 in 1000 to more than 1 in 100 (1%) years of flooding from surface water and small watercourses in any given year, including the effects of climate change (see Figure 8). The temporary laydown area is located on the very edge of Flood Zones 2 and 3 for surface water and small watercourses flooding.

The entrance to the temporary laydown area is located within Flood Zone 1 for flooding from rivers, sea, surface water and small watercourses, with a chance of flooding of less than 1 in 1000 (0.1%) years in a given year, including the effects of climate change (see Figures 5 and 6).

It should be noted that the temporary laydown area will only be used on a temporary basis for approximately 9 months and will then revert back to grazing land.

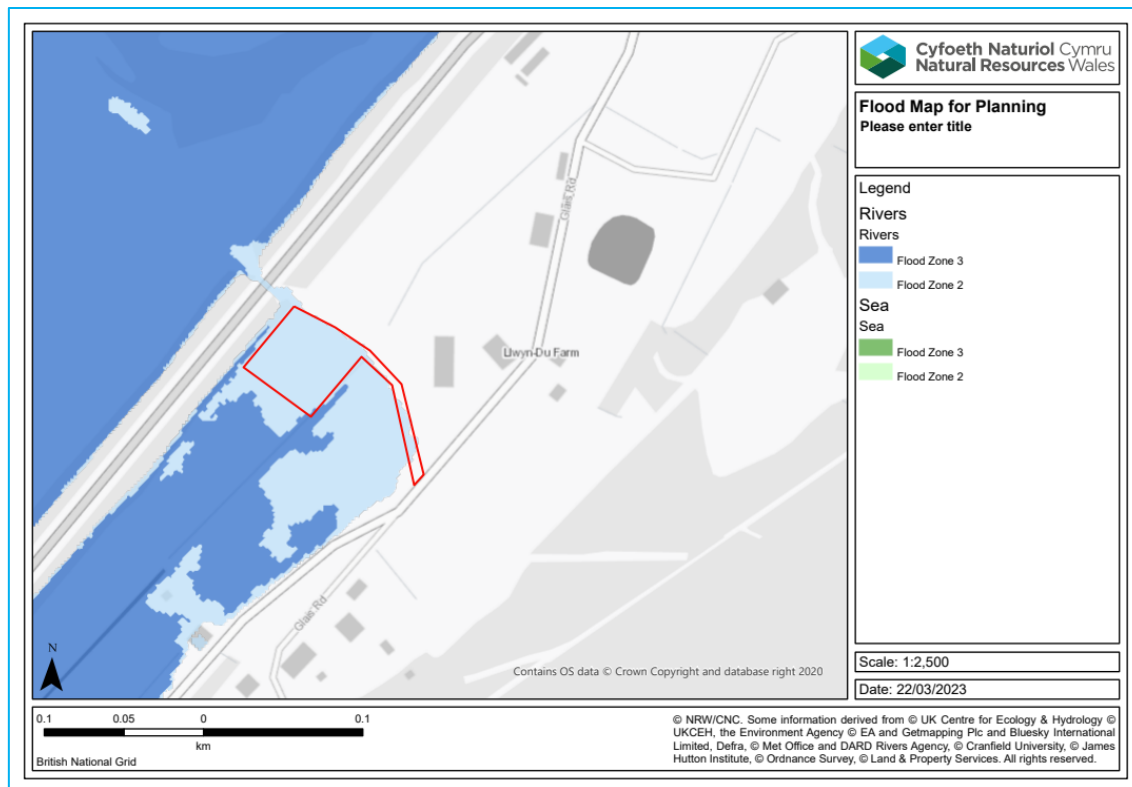


Figure 7 - Flood Map for Planning: Rivers and Sea: Temporary Laydown Area

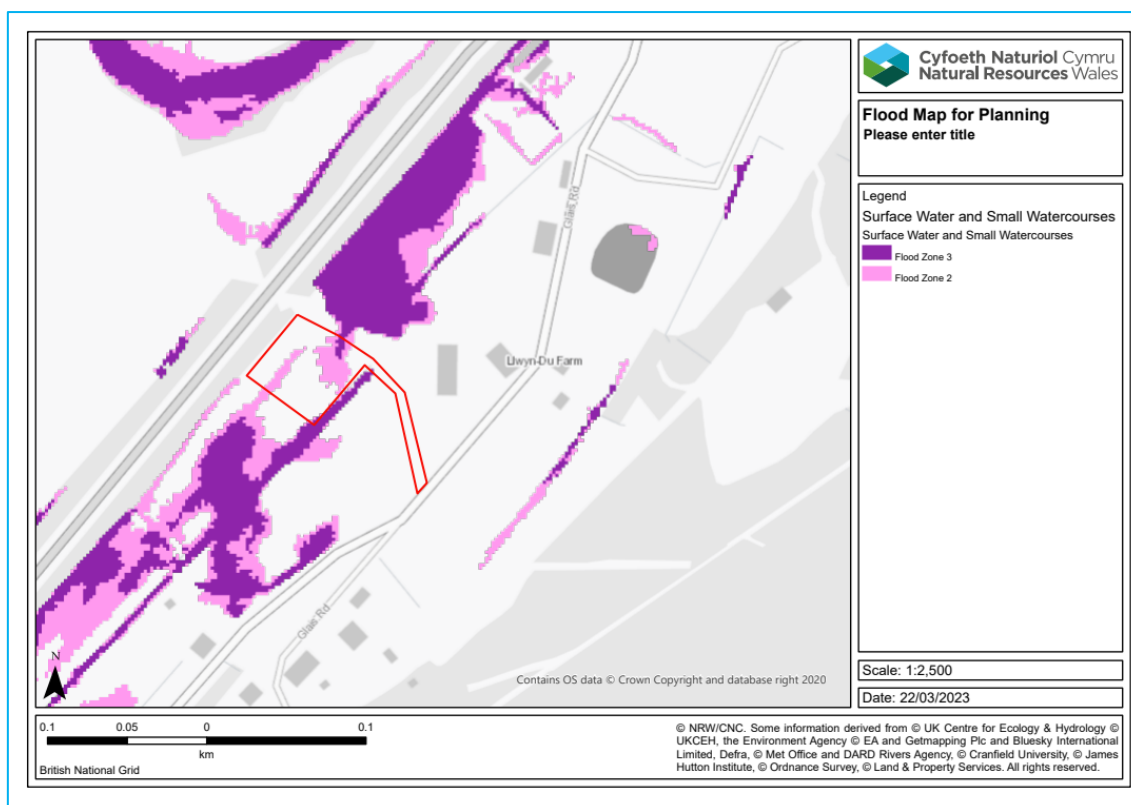


Figure 8 - Flood Map for Planning: Surface Water and Small Watercourses: Temporary Laydown Area

4.8 Flood Vulnerability

The different categories of development according to their vulnerability from TAN15 are described in Table 4. TAN15 categorises development according to its vulnerability to flooding. There are three categories: emergency services; highly vulnerable development; and less vulnerable development. All residential premises are categorised as highly vulnerable development. Commercial, retail and general industrial development are categorised as less vulnerable development.

TAN15 does not explicitly define the flood risk vulnerability of renewable energy developments such as solar parks. However, Table 4 confirms that less vulnerable development describes development, such as the case with the proposed development for a solar farm, where the ability of occupants to decide on whether they wish to accept such risk is greater than in the highly vulnerable category, such as residential uses.

Furthermore, the proposed development will not have permanent staff located on the site, the solar arrays are lifted off the ground and any sensitive equipment can be located with respect to flooding. The proposed development is not especially vulnerable to flooding and the proposed development would be considered as utilities infrastructure.

Recent planning applications for solar parks some of which have also been assessed by the Planning Inspectorate have been classified as 'less vulnerable' such as Rhyd Y Groes, Anglesey (ref: 20C310B/EIA/RE), Gwent Farmers' Community Solar Scheme, Llanwern, Newport, NP26 3D (ref: 18/0129) and Mamhilad Solar Park on land south of Little Mill Brickworks, Little Mill near Pontypool in Torfaen (ref: 15/P/00436). The Isle of Anglesey County Council confirmed that the planning application for a solar park at Rhyd Y Groes, Anglesey (ref: 20C310B/EIA/RE) was classified as 'less vulnerable'.

The temporary laydown area will be used for approximately 9 months for the storage of equipment and materials, will have modular cabins, accommodate parked vehicles, and will be reinstated to a grass field. The temporary laydown area will be used for storage of materials for a short period of time and the items stored will be transient in nature and will pass through the site briefly. The materials stored will not be vulnerable to flooding and will include the solar panels, cabling and stockpiles.

Solar farms are therefore, considered 'less vulnerable' development. Therefore, it has been considered, that the proposed development is classified as 'less vulnerable'. The DAM and the FMfP therefore indicates that the site is suitable for the proposed use.

Table 4 - Flood Risk Vulnerability

Development Category	Type
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.
Highly 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 <u>utilities infrastructure</u> , car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites.

4.9 Fluvial (river) Flooding

The primary flood risk is from the River Tawe and is posed to the temporary laydown area rather than the location of the solar farm which is shown to not be at risk of fluvial flooding. The fluvial flood risk can be considered to be limited due to the difference in elevations between the site and the identified watercourses.

The FMfP indicates that the solar farm is located within Flood Zone 1 with less than a chance of flooding of 1 in 1000 (0.1%) years of flooding from rivers in a given year, including the effects of climate change. However, the temporary laydown area is located with Flood Zone 2 with a chance of flooding of 1 in 1000 to 1 in 100 (0.1% to 1%) year in a given year, including the effects of climate change. The temporary laydown area is located on the very edge of Flood Zone 2. The FMfP represents better and more up-to-date information on areas at flood risk compared to the DAM and has therefore, been used instead of the DAM to assess the flood risk to the laydown area in detail. By comparing the Flood Zone 2 and 3 outlines to the topographical survey a modelled water level for the temporary laydown areas can be determined, as shown in Table 5.

The temporary laydown area is shown not to be inundated with floodwater for all events up to and including the fluvial 1 in 100 year (plus climate change) and 1 in 1000 year events. The site will be flood free during the 1 in 100 year (plus climate change) and 1 in 1000 year events. The temporary laydown area would only be inundated with floodwater during the 1 in 1000 year (plus climate change) event.

The River Tawe is located approximately 400m to the west of the temporary laydown area, between the site and the temporary laydown area is the embanked A4067 which reduces the floodwater which reaches the temporary laydown area directly from the west. During the 1 in 1000 year (plus climate change) event a small volume of floodwater is shown to pass underneath the road within a culvert.

The River Tawe is also located approximately 900m to the south west of the laydown area. The FMfP shows that flooding inundates the temporary laydown area from a small tributary of the River Tawe and drainage ditches adjacent to the temporary laydown area.

Table 5 shows that during the 1 in 1000 year (plus climate change) event a water level of 22.50mAOD may be experienced. This would result in a maximum water depths of 0.68m which would occur on the very southern boundary of the temporary laydown area.

The water depths over the majority of the temporary laydown area would be less than 0.50m as the ground levels rise to the north with a maximum of 22.70mAOD and the majority of the ground levels are above 22.10mAOD.

The water depths which would be experienced during the 1 in 1000 year (plus climate change) event at the location of the storage cabins would be <0.55m, at the location of the office and welfare cabin would be <0.35m and at the car/van parking spaces would be <0.51m.

An explanation of how the predicted flood water levels have been calculated is provided within the Addendum to the FCA (see Appendix 3).

Table 5 - Water Levels and Depths

Event (yrs)	Maximum Water Level (mAOD)	Water Depth (m)			
		Maximum ¹	Storage Cabins ²	Office/Welfare Cabin ³	Car/Van Parking Spaces ⁴
100 (plus climate change)	21.80	0.00	0.00	0.00	0.00
1000 (plus climate change)	22.50	<0.68	<0.55	<0.35	<0.51

Notes:

1 - Based on a ground level of 21.82mAOD

2 - Based on ground levels of 21.95 to 22mAOD.

3 - Based on ground levels of 22.15 to 22.25mAOD.

4 - Based on ground levels of 21.99 to 22.15mAOD.

The ground levels of the site temporary laydown area considerably above the normal water level of the watercourses. Flood risk to the site from the watercourse can also be considered to be limited, since the watercourses are located away temporary laydown area. Any overbank flow would follow the contours of the surrounding area and would flow directly away from the temporary laydown area rather than flowing towards the site.

Furthermore, the typical rainfall profile for this region, in common with much of Wales, is a low intensity, long duration event commensurate with frontal weather systems. The mechanism for river flooding is generally prolonged episodes of heavy rainfall, which affords good time for flood warnings to be issued.

The likelihood of a rapid river level rise within the rivers and possible rapid inundation of urban areas posing a risk to life is considered to be minimal. This is primarily due to the large river system and its substantial upper contributing catchment area which is 227.70km² at the gauging station Tawe at Ynystanglws⁷ (ref : 59001) just downstream of the site.

⁷ <https://nrfa.ceh.ac.uk/data/station/info/59001>

The site is located within a low risk area where the onset of flooding is very gradual (many hours) as per Flood Risk Assessment Guidance for New Development Phase 2, R&D Technical Report FD2320/TR2. The Time to Peak (Tp) is over 5 hours for the catchment at the gauging station Tawe at Ynystanglws (ref : 59001) just downstream of the site.

Given the scale and nature of the proposed development and the size and location of the fluvial flooding sources it has been concluded that fluvial flooding poses a low flood risk to the site and the risk of fluvial flooding is considered to be of **low significance**.

4.10 Tidal (coastal) Flooding

A review of the FMfP indicates that the site is located within Flood Zone 1 and is not at risk of tidal flooding as shown in Figures 5 and 7, with less than a 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year. Therefore, the risk of fluvial flooding is considered to be **not significant**.

4.11 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

Site conditions suggest a low probability of groundwater flooding. The local geology is not considered to yield significant volumes of groundwater. No below surface infrastructure and buildings are located or are proposed for the plot. The risk of flooding from groundwater flooding is considered to be **not significant**.

4.12 Surface Water (pluvial) Flooding

The site is not situated near to large areas of poor permeability or areas with the geology and/or topography which may result in surface water flooding. The soil conditions at the plot and within the vicinity of the site do not indicate that the plot may be at risk of surface water flooding.

A review of the FMfP indicates that the site is located within Flood Zone 1 and is not at risk of surface water flooding as shown in Figure 6, with less than a 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year. However, the temporary laydown area is located within Flood Zone 2 and 3 with a 1 in 1000 to more than 1 in 100 (1%) chance of flooding in a given year, including the effects of climate change (see Figure 8). This is shown to only impact a very small proportion of the temporary laydown area. The entrance to the temporary laydown area is shown to be located within Flood Zone 1. The risk of flooding from surface water flooding is considered to be of **low significance**.

4.13 Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

Flood flows could also be generated by burst water mains, but these would tend to be of a restricted and much lower volume than weather generated events and so can be discounted for the purposes

of this assessment. Therefore, the risk of flooding from sewer flooding is considered to be **not significant**.

4.14 Flooding from Artificial Drainage Systems/Infrastructure Failure

There are no other nearby artificial water bodies, water channels and artificial drainage systems that could be considered a flood risk to the plot. The Natural Resources Wales Reservoir flood map shows that the plots are not at risk of reservoir flooding (see Figure 9). The risk of flooding from artificial water bodies, water channels and artificial drainage systems is considered to be **not significant**.

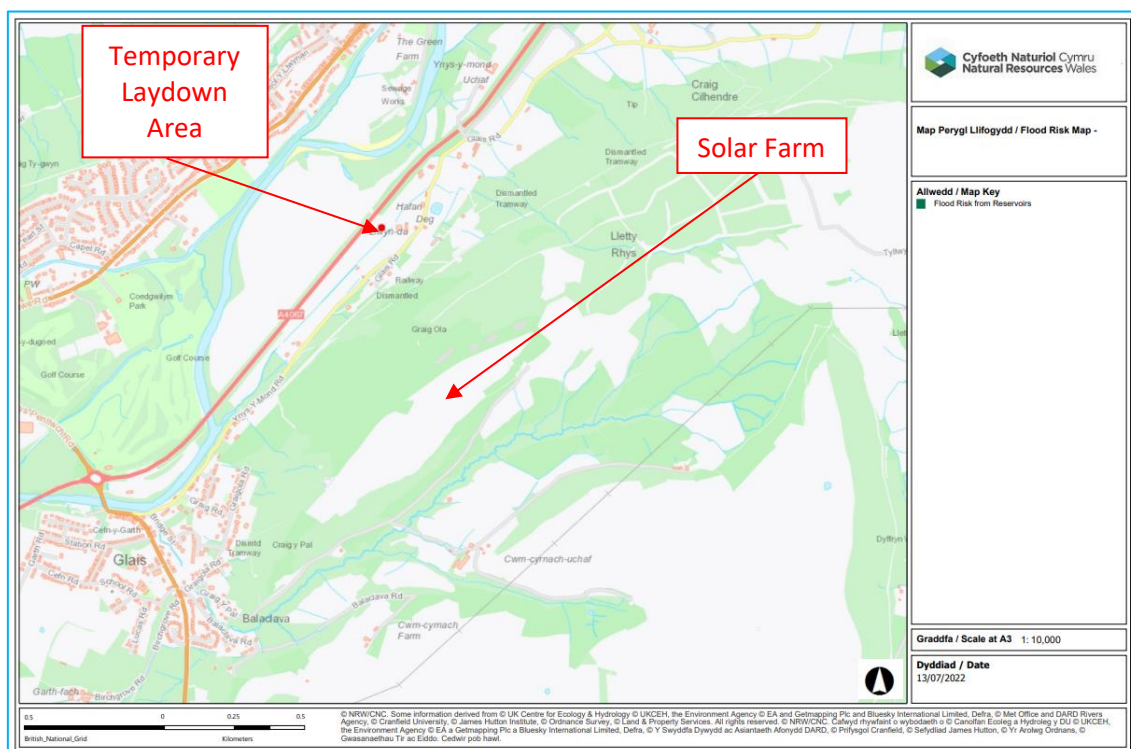


Figure 9 - Natural Resources Wales Reservoir Flood Map

4.15 Effect of the Development on Flood Risk

The site is located outside of Flood Zone 3 for rivers and will therefore, not be inundated with floodwater for all events up to and including the 1 in 100 year (plus climate change) event. The temporary laydown area is located within Flood Zone 3 for rivers with a chance of flooding of 1 in 1000 years (plus climate change).

To ensure there will be no detriment to the flood storage capacity and the movement of floodwater across the site will not be impacted, flood voids will be constructed under the modular cabins. The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar. The finished floor levels of the modular cabins will be raised to a minimum of 22.60m AOD, this will provide a freeboard of 0.10m above the 1 in 1000 year (plus climate change) event.

The flood voids will be open on all sides, the openings will be a minimum of 1m in width, the height of the void will be from ground level to 22.50m AOD (i.e. above the 1 in 1000 year (plus climate change) event). If the void opening represents a security risk, vertical bars at 100mm centres can be installed.

A suitable worded planning condition and agreements will be used to ensure the voids are maintained free of obstructions and that any entrance grilles are kept free of obstruction. Regular inspections and maintenance of the voids and grilles will be undertaken.

Therefore, the proposed development will have no impact on floodwater levels. The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed. There will be no increase in the flood risk due to the proposed development.

4.16 Summary of Site Specific Flood Risk

A summary of the sources of flooding and a review of the risk posed by each source at the site is shown in Table 6.

Table 6 - Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial Flooding	Yes	River Tawe	Low
Tidal Flooding	No	None Reported	None
Groundwater Flooding	No	None Reported	None
Surface Water Flooding	Yes	Poor Permeability	Low
Sewer Flooding	No	None Reported	None
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported	None

The primary flood risk posed to the site is from fluvial flooding. The site of the proposed solar farm is located within DAM Zone A and FMfP Flood Zone 1 and is not at risk of fluvial or tidal flooding, with less than a chance of flooding of 1 in 1000 (plus climate change) years. The site of the proposed temporary laydown area is located within DAM Zone C2 and FMfP Flood Zone 2 with a chance of river flooding of 1 in 1000 years (plus climate change). The FMfP represents better and more up-to-date information on areas at flood risk than the DAM and has therefore, been used within this FCA to assess the flood risk in detail.

It should be noted that the temporary laydown area will only to be used on a temporary basis for approximately 9 months and will then revert back to grazing land. The proposed development is classified as 'less vulnerable', 'less vulnerable' uses are appropriate within DAM Zone A, C2, FMfP Flood Zone 1 and 2.

During the 1 in 1000 year (plus climate change) event a water level of 22.50mAOD may be experienced. This would result in a maximum water depths of 0.68m which would occur on the very southern boundary of the temporary laydown area.

The water depths over the majority of the temporary laydown area would be less than 0.50m as the ground levels rise to the north with a maximum of 22.70mAOD and the majority of the ground levels are above 22.10mAOD.

The water depths which would be experienced during the 1 in 1000 year (plus climate change) event at the location of the storage cabins would be <0.55m, at the location of the office and welfare cabin would be <0.35m and at the car/van parking spaces would be <0.51m.

Given the scale and nature of the proposed development and the size and location of the fluvial flooding sources it has been concluded that fluvial flooding poses a low flood risk to the site and the risk of fluvial flooding is considered to be of **low significance**. A secondary flooding source has been identified which may pose a **low significant** risk to the site. This is:

- Surface Water Flooding

The risk from these sources will be further mitigated by using a number of mitigation measures to manage and reduce the overall flood risk at the site. The application is for a new, suitable flood-resilient design. The exposure of people and property will be reduced and minimised compared to existing site conditions. The chance of flooding each year is low each year. This takes into account the effect of any flood defences that may be located within the vicinity of the site as well property level protection measures.

To ensure there will be no detriment to the flood storage capacity and the movement of floodwater across the site will not be impacted, flood voids will be constructed under the modular cabins. The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar. The finished floor levels of the modular cabins will be raised to a minimum of 22.60mAOD, this will provide a freeboard of 0.10m above the 1 in 1000 year (plus climate change) event.

The flood voids will be open on all sides, the openings will be a minimum of 1m in width, the height of the void will be from ground level to 22.50mAOD (i.e. above the 1 in 1000 year (plus climate change) event). If the void opening represents a security risk, vertical bars at 100mm centres can be installed.

There will be no net loss in flood storage capacity or impact on movement of floodwater across the site. The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed.

In conclusion, the flood risk to the site can be considered to be limited; the site is situated in DAM Zone A and FMfP Flood Zone 1, with only the temporary laydown area being located in Zone C2 and FMfP Flood Zone 2, with a low annual probability of flooding and from all sources.

5.0 RISK MANAGEMENT

5.1 Introduction

In these flood zones, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development and the use of flood mitigation measures. The flooding sources will be mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site. These will be used to ensure the development will be safe and there is:

- Minimal risk to life;
- Minimal disruption to people living and working in the area;
- Minimal potential damage to property;
- Minimal impact of the proposed development on flood risk generally; and;

5.2 Finished Floor Levels

The finished floor levels of the modular cabins will be raised to a minimum of 22.60mAOD, this will provide a more than adequate freeboard above the flood events (see Table 7). The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar.

Table 7 - Water Levels and Freeboards

Finished Floor Level (mAOD)	Event (yrs)	Water Level (mAOD)	Freeboard (m)
22.60	100 (plus climate change)	21.80	0.70
	1000 (plus climate change)	22.50	0.10

5.3 Design

The solar arrays and vulnerable infrastructure will be located above the ground level. The modules are raised off the ground such that the leading edge of each panel will be approximately 0.80m off the ground and the top edge up to 3m in height off the ground. Consequently, the panels will be unaffected by floodwater depths.

The frame supporting the solar panels should not impede overland flow or reduce flood storage capacity, as it would only be the legs which would be within the path of overland flow or floodwaters. The legs are of narrow dimension (60mm) and well-spaced (minimum of 3m apart).

The panels are designed so that they have minimal foundations this limits disturbance of soils/loss of resource and reduces the volume of concrete required. This would also therefore limit the potential for disruption of surface and groundwater flows.

The ancillary structures: substation, transformers etc are also small structures and therefore only require shallow foundations, limiting ground disturbance and disruption to overland flow routes. The proposals are based on maintaining the existing drainage, the structures associated with the solar farm will introduce only small areas of impermeable surfacing. It is not proposed to install new drainage infrastructure but maintain existing Greenfield runoff rates.

Where possible existing farm access tracks will be used, and the position of new access tracks will avoid the necessity for watercourse crossings to avoid changes to in-channel flow and disturbance of the riparian habitat.

5.4 Flood Resilience and Resistance

Flood risk can be mitigated through the design of the building. Flood resistant/resilient measures will be used, including:

- All electrical wiring, switches, sockets, socket outlets, electrical, and gas meters etc. will be located a minimum of 450mm above the finished floor level.

5.5 Safe Access and Egress

The entrance to the temporary laydown area and surrounding areas are located within DAM Zone A and FMfP Flood Zone 1 therefore a permanently safe and dry access can be maintained.

5.6 Buffer Strip/Easement

A buffer strip adjacent to the top of any small watercourse will need to be retained for maintenance purposes. This will be free of built development and is required by the Local Planning Authority/Lead Local Flood Authority. The buffer strip will also mitigate the impact of flooding.

6.0 SURFACE WATER DRAINAGE

6.1 Surface Water Management Overview

It is recognised that consideration of flood issues should not be confined to the floodplain. The alteration of natural surface water flow patterns through developments can lead to problems elsewhere in the catchment, particularly flooding downstream. For example, replacing vegetated areas with roofs, roads and other paved areas can increase both the total and the peak flow of surface water runoff from the site. Changes of land use on previously developed land can also have significant downstream impacts where the existing drainage system may not have sufficient capacity for the additional drainage.

An assessment of the surface water runoff rates has been undertaken, in order to determine the surface water options and attenuation requirements for the site. The assessment considers the impact of the proposals compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.

The requirement for managing surface water runoff from developments depends on the pre-developed nature of the site. If it is an undeveloped greenfield site, then the impact of the proposals will need to be mitigated so that the runoff from the site replicates the natural drainage characteristics of the pre-developed site.

The surface water drainage arrangements for any site should be such that the volumes and peak flow rates of surface water leaving a site are no greater than the rates prior to the proposals unless specific off-site arrangements are made and result in the same net effect.

It should be acknowledged that the satisfactory collection, control and discharge of surface water runoff are now a principle planning and design consideration. This is reflected in the 'Statutory Standards for Sustainable Drainage Systems – Designing, constructing, operating and maintaining surface water drainage systems'. It is necessary to demonstrate that the surface water from the proposals can be discharged safely and sustainably.

6.2 Surface Water Runoff Rate/Volume

The proposed access tracks that will be used to service the inverter units will be constructed from permeable material. This will ensure that the access tracks remain permeable allowing surface water to infiltrate into the soil substrate therefore, the access tracks will not result in an increase in the impermeable area.

The proposed transformers, grid connection and substation structures will be constructed from impermeable surfaces however, these will stand on an area of permeable surfaces. The inverter are positioned on legs raised above the base. The cabin plinths will be founded on concrete pads surrounded by permeable surfaces.

The proposed PV modules will consist of an aluminium frame, with stainless steel supports and concrete shoes. Greenfield conditions will be retained as alluded to in the BRE Planning Guidance for the Development of Large Scale Ground Mounted Solar PV Systems⁸. Although the solar panels will divert the downward path of falling rain, being raised off the ground on frames, they will not reduce the permeable area where they are sited. Any rainfall that does fall onto the site will, as now, infiltrates into the soil substrate. The flow path over the PV modules is shown in Figure 10.

⁸ BRE (2013) Planning Guidance for the development of large-scale ground mounted solar PV systems: https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf

It is anticipated that rain falling on each of the solar PV modules will fall underneath the down-slope of the panels. A gap of approximately 20mm will allow water to drain off each PV module (the 20mm gap surrounds all sides of the panels) (see Figure 11). The erection of the solar panels will require the use of light machinery; however, it is anticipated that this would not lead to irreversible compaction of soils on the site. Therefore, infiltration should not be limited by compaction of soils. The land on the site can continue to be used for agricultural purposes (sheep grazing or similar) or for biodiversity enhancement following installation of the panels.

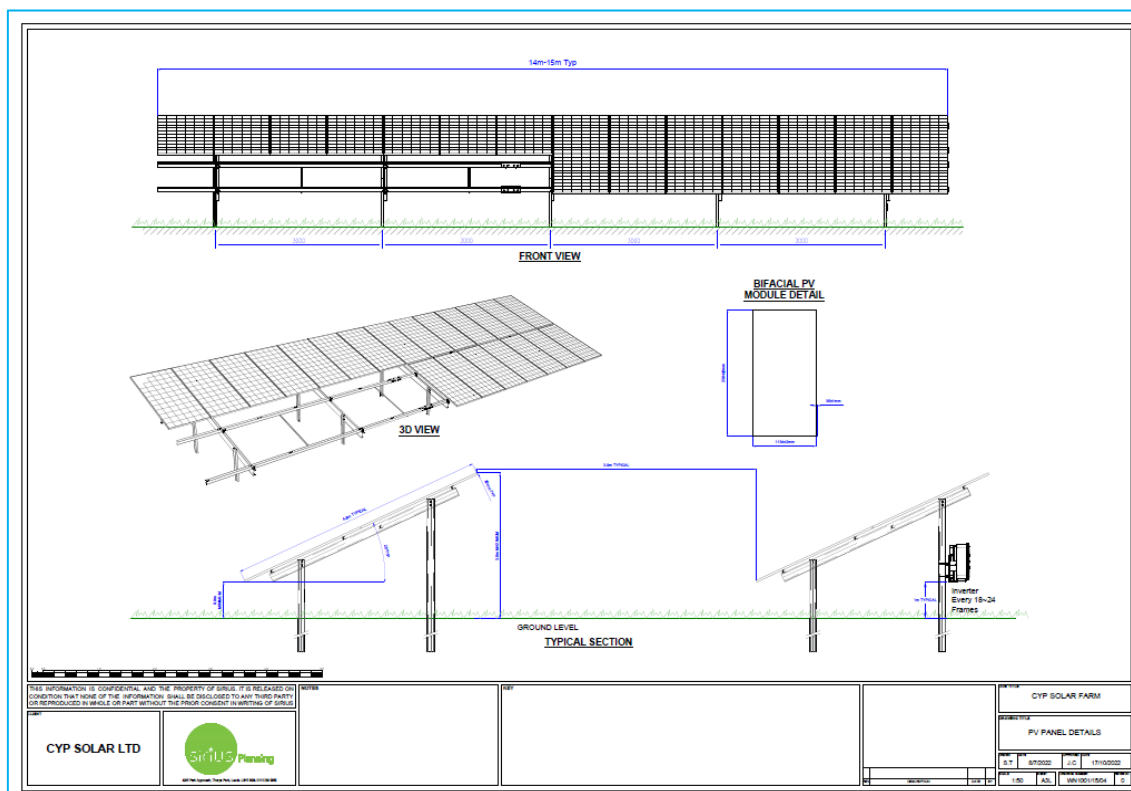


Figure 10 - Flow Paths over PV modules



Figure 11 - Typical View of Arrays with Joints which Distribute Runoff

It is generally accepted that the presence of solar panels on a site may slightly change the pattern of runoff with the potential for minor erosion at the base of the panels. There is empirical evidence of the effect of solar development, a recent research paper⁹ found that, with well-maintained grass underneath the panels, the solar panels themselves did not have a significant impact on the runoff volumes, peaks or time to peak. Their analysis did find that, with bare ground or gravel cover beneath the panels as a result of design decisions or lack of maintenance, peak discharge may increase resulting in the need for stormwater management.

Natural England (although this is English guidance the research is still applicable to Wales) has provided guidance on solar parks in the form of Technical Information Note 101 (TIN 101)¹⁰. This guidance provides an overview of the potential effects and possible mitigation measures for soil erosion and increased runoff, amongst others. TIN101 states that *“The key to avoiding increased run-off and soil into watercourses is to maintain soil permeability and vegetative cover. Permeable land surfaces underneath and between panels should be able to absorb rainfall as long as they are not compacted and there is some vegetation to bind the soil surface.”*

TIN101 concludes that *“the risks of run-off and soil erosion are lowest on low gradient land with cohesive soils and highest on dry, sandy and steeply sloping soil surfaces”*; this highlights the effect of slope on runoff rates and soil erosion. Furthermore, the slope aspect of the land can also have an effect on runoff rates and soil erosion. The aspect of the solar panels will always be south-facing (in the UK) and, therefore, north or south facing slopes will result in runoff flowing in a parallel direction to that of the runoff from the panels thereby remaining relatively diffuse and unlikely to result in concentrated flows that could cause soil erosion, apart from where very steep slopes occur.

The proposed development is considered to have a relatively low gradient, with south-facing slope. A grassed surface will be maintained at the site to reduce the likelihood of overland flow or soil erosion occurring which, based on this assessment, is considered to be low.

Any local erosion which might result from this trend will be mitigated by the thick sward of tussocky grass germinated both beneath and between the panels and its regime of regular maintenance and therefore, there will be no increase in flood risk off the site.

As there is no history of surface water flooding at the site it is likely that the current drainage system is sufficient for the current and proposed site use. The surface water runoff will not increase post-application compared to pre-application and there will be no increase in surface water flood risk to the site and off-site locations. No changes to the current surface water network are proposed. Following development, surface water flows from the site will continue to discharge to the ground and/or the nearby watercourses.

6.3 Surface Water Runoff During Construction

Recent experience has shown that vegetation clearing and soil compaction caused by construction traffic during solar farm construction typically results in larger peak runoff rates and volumes than rates and volumes flowing completion of the construction and site stabilisation.

6.4 Surface Water Management During Construction

The surface water management during construction will include the following measures:

⁹ Cook and McCuen (2013) Hydrologic Response to Solar Farms, pg 536-541, Journal of Hydrologic Engineering, ACSE, May 2013: <https://ascelibrary.org/doi/abs/10.1061/%28ASCE%29HE.1943-5584.0000530>

¹⁰ <https://webarchive.nationalarchives.gov.uk/ukgwa/20150902172007/http://publications.naturalengland.org.uk/publication/32027>

- Soil management practices to reduce runoff
- Erosion and sediment control
- Spillage – Emergency Action.

During construction (and decommissioning) it is anticipated that a temporary compound will be established to allow the materials to be off-loaded from HGVs, and then transferred to the site using smaller vehicles. The construction compound will have a temporary surfacing of hardcore; the compound is to be restored to its former condition on completion of the construction works. Any rainfall on the temporary compound will runoff to adjacent grassed permeable areas.

6.4.1 Soil Management

The limits of topsoil stripping will be minimised at the site to reduce site runoff volumes. Preserving the quantity and quality of the site topsoil is critical to preserving the site runoff rates both during and after construction and to promote stabilisation vegetation establishment. Topsoil stripping will be limited to the areas necessary for access road and construction and for the creation of temporary laydown areas, as required. All stripped topsoil must remain on the site and be reused for landscaping or restoration.

All access tracks and the compound area will be constructed using permeable granular materials. Vehicular movements will be restricted to the access tracks and designated areas where possible to avoid or limit soil compaction, which could have a detrimental impact on infiltration rates.

6.4.2 Erosion and Sediment Control Measures

The various construction activities required to construct the Proposed Development include minor grading activities and general construction traffic. If left unmitigated, these activities will result in impacts ranging from disturbance of soils to potential erosion and sediment transport to offsite locations.

Erosion control will be achieved primarily by:

- Managing disturbed soils using soil conservation practices to reduce runoff and sediment transport during construction.
- Constructing barriers to filter runoff.
- Erosion and sediment control measures will be implemented prior to any grading or servicing works commencing and include, but are not necessarily limited to, the following measures:
- A perimeter silt fence will be installed at the downstream side of the work limits.
- A 5m wide vegetated buffer will be provided on the downstream side of all disturbed areas. The vegetated buffer will consist of undisturbed native vegetation and any areas of sparse vegetation will be seeded.
- A construction entrance feature (“mud mat”) will be provided at the site entrance to minimise the offsite transport of sediment via construction vehicles.
- The access road will be cleaned of any sediment deposited by site construction traffic.
- Stabilise topsoil stockpiles expected to be left in place longer than 30 days with vegetative cover (i.e., hydroseeding) or a rolled erosion control product in the event of unfavourable growing conditions (i.e., during the winter).

- Re-vegetate all disturbed areas where construction is not expected for 30 days with a minimum 50mm of topsoil and hydro-seeding or other stabilizing vegetation / erosion protection measures. If vegetation establishment is not possible, given seasonal restriction or other revegetation limiting factors, the disturbed area should be stabilised against erosion impacts by non-vegetated means such as erosion control blankets.
- In the event of inclement weather or unfavourable terrain for construction, construction best practices, such as temporary rig-mats may be used to prevent disruption of surface soils and vegetative cover by construction vehicles and equipment.

The erosion and sediment control measures shall be maintained in good repair during the entire construction period and removed as contributing drainage areas are restored and stabilised. In addition, the condition of erosion control works, their overall performance, and any repairs, replacement, or modifications to the installed item shall be noted in logbooks to be kept on-site.

Erosion and Sediment Control Contingency Plan

The purpose of the Erosion and Sediment Control contingency plan is to help minimise the risk or consequence of failure of the erosion and sediment control works. Failure could result from insufficient measures, lack of maintenance, or severe weather conditions. The contingency plan includes two areas of consideration: the contingency measures that will be implemented where there is potential for failure; and the procedures that will be followed where a failure has occurred.

The Contractor shall be responsible for following the Erosion and Sediment Control contingency plan, and will prepare the following items:

- Workers shall be on call for emergency situations for all aspects of the emergency from design to construction of emergency sediment and erosion control measures. Any associated health and safety issues are the responsibility of the Contractor.
- Heavy duty silt fence, pumps, double-net straw matting erosion control blankets, straw bales and stakes, sandbags, appropriately sized rip-rap, and clean gravel fill shall be available on-site for emergency installation.
- Heavy equipment shall be on standby for emergency works.
- A contact list for any further required equipment or materials shall be prepared and made available for emergency use.

Contingency Measures where there is a High Risk of Failure

Conditions that may potentially cause failures can be identified through two methods:

1. High Risk Identified Through Monitoring

Where monitoring has identified a high potential for failure, steps shall be immediately taken to reduce the risk. These measures may include repair to existing measures, modification of existing measures, and the addition of new measures.

2. Severe Weather Anticipated

In cases where the weather forecast indicates that significant rainfall (>10mm) is expected within a 24-hour period, the Contractor shall immediately complete the following:

- Verify that all erosion and sediment control measures are secure and that there is no exposed soil that could erode and be deposited downstream.

- Verify that all other measures are in good working order.
- Monitor all measures during the rainfall event, and where a potential for failure is identified, take corrective measures.

If unforeseen events cause the strategies set out in the contingency plan to be insufficient or inappropriate to meet the objective of containing sediment within the work limits, the Contractor will respond in a timely manner with all reasonable measures consistent with safety, to prevent, counteract or remedy any negative effects on the natural environment or adjacent properties.

Contingency Measures in Case of Failure

In the event of a failure, the Contractor will cease all construction related work and focus on erosion and sediment control as required to effectively stabilise the site where a failure has occurred or is imminent.

If significant long-term damage to downstream habitat or property is suspected, the Contractor will immediately assess and document the situation and report the incident to Natural Resources Wales. Development of the initial restoration plan will begin within 24 hours of the discovery of failure, and will be implemented as soon as possible. The plan will address:

- Removal and disposal of sediment from outside the work limits.
- Restoration of the affected area.
- Restoration of any areas disturbed through deposition or removal.

Erosion and Sediment Control Monitoring Programme

To ensure the effectiveness of the various erosion and sediment control measures, a routine programme should be implemented which includes the inspection of the erosion and sediment controls daily and after each significant rainfall event (10mm), and immediate repair of any deficiencies. Non-urgent repairs (i.e. no immediate risk of sediment discharges to the downstream environment) will be completed within 48 hours of identifying the deficiency, or prior to the next anticipated rainfall event, whichever is less. This program will consist of the following activities:

- Visual inspection of the measures to ensure discharged flows are generally free of sediment and turbidity.
- Inspection of vegetation protection, erosion control blankets and silt fencing to ensure that they are maintained in good repair.
- Removal of construction debris that may accumulate.
- Implementation of remedial measures including erosion stabilisation, repair of damaged measures and any other remediation where required.

6.4.3 Spillage – Emergency Action

All materials and equipment used for site preparation and construction will be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, silt, etc.) from migrating to offsite receivers:

- Refuelling and maintenance of construction equipment should occur in designated areas, a minimum of 30m from a water body, wetland, or other sensitive receiver.

Most spillages on development are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommended by Natural Resources Wales, with residual spillage allowed to bioremediate in the drainage system.

In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chamber(s) downstream of the spillage with a bung(s), (A bung for blocking pipes may be made by wrapping soil or turf in a plastic sheet or closely woven fabric.)

Contact Natural Resources Wales immediately Tel: 0300 065 3000.

6.5 Surface Water Management Post Construction

The following design features will reduce the risks from surface water runoff from solar panels by promoting dispersion and infiltration:

- The gap between panels will be sufficient (typically 20 mm) to allow drainage to ground rather than onto adjacent panels.
- The ground surface around and between the frames will be maintained as grass to ensure that bare soil areas are minimised.
- The vegetated gap between rows of frames will be of greater width than that of each row of solar panels.
- Groundcover vegetation will be maintained in good condition in those areas receiving runoff from solar panels.
- Regular inspections and maintenance of the site will be undertaken to ensure that vegetation cover is adequate and no rivulets are generated.

Runoff is expected to remain dispersed and unlikely to form channels. Broad grass strips around the edge of the array will also act to impede drainage of surface water to field margins. The proposed transformers will be sufficiently small so that measures to attenuate surface water will not be required. The runoff will shed onto the surrounding ground where it will naturally disperse.

Post-development, the land will become managed pasture without seasonal ploughing. Runoff will therefore contain lower silt loads than currently and perimeter grass strips around fields will reduce runoff to drainage ditches. Managed grassland will offer equivalent or better runoff management than the current situation. Over the long-term, runoff from the area occupied by the solar array is likely to be an improvement on present conditions

The proposed PV modules will consist of an aluminium frame, with stainless steel supports and concrete shoes. Greenfield conditions will be retained as alluded to in the BRE Planning Guidance for the Development of Large Scale Ground Mounted Solar PV Systems . Although the solar panels will divert the downward path of falling rain, being raised off the ground on frames, they will not reduce the permeable area where they are sited. Any rainfall that does fall onto the site will, as now, infiltrates into the soil substrate.

It is anticipated that rain falling on each of the solar PV modules will fall underneath the down-slope of the panels. A gap of approximately 20mm will allow water to drain off each PV module (the 20mm gap surrounds all sides of the panels). The land on the site can continue to be used for agricultural purposes (sheep grazing or similar) or for biodiversity enhancement following installation of the panels.

TIN101 encourages existing land drainage to be maintained. Existing onsite features will therefore be retained in their existing state, and will continue to intercept overland flows from the site.

6.5.1 Vegetated Buffers

Vegetation can be used to provide water quality benefits, this is achieved by the runoff/vegetation interaction which reduces the velocity of runoff, thereby promoting the sedimentation of particulate matter. The vegetation also provides nutrient uptake benefits to help reduce biological pollutants such as nitrogen and phosphorous. Where required the vegetated will be re-instated and replanted to improve the current situation.

6.5.2 Stabilisation Vegetation

All permeable surfaces within the Site will be stabilised with a restoration seed mix that will provide year-round surface cover. The stabilisation vegetation will improve the Site hydrologic characteristics, reducing both the peak flows and volumes.

Prior to restoration seeding, the work limits will be scarified to a minimum depth of 150mm, to mitigate soil compaction caused by construction traffic and to promote seed establishment. In accordance with the guidance presented, scarification will be performed with a chisel plough to retain as much vegetation residue on the soil surface as possible.

6.5.3 Long Term Erosion and Sediment Control

Approximately one (1) year after completion of construction, the Owner will complete a site inspection to ensure that long-term erosion control measures have been effective. Seeded or replanted areas will be inspected to ensure that vegetation measures were successful and reseeding or replanting will occur where necessary.

If erosion control measures are found to be less than fully effective during this survey, reseeding or replanting of problem areas will take place. Should there be residual effects noted during post-construction monitoring, advice on contingency measures will be sought and applied.

6.6 Monitoring and Maintenance

The proposals incorporate passive and simple surface water runoff management practices, with operational and maintenance requirements to match. The site Owner's inspection, operational, and maintenance activities generally consist of:

- A semi-annual walking inspection of the entire site should be completed during the spring and autumn to identify areas of bare soil and/or erosion. Remediation efforts would typically involve re-grading the affected area and/or re-vegetating with sod or appropriate seed mix, with fertilizer and water applied as necessary to ensure germination and stabilisation.
- Concurrent with the walking inspections, a visual assessment of any areas of persistent sediment build-up should be identified. Excessive sedimentation is an issue requiring attention if it remains in a non-vegetated condition and is, therefore, prone to re-suspension and transport downstream. If any such condition occurs, the sediment should be removed and the area re-stabilised.
- The walking inspections will also include a review of the ground surface conditions along the entire downstream site perimeter to identify any areas of erosion or concentrated surface water discharge. Downstream impacts will be identified, and the Owner will develop a remediation plan to address them.

- The density and health of vegetation should be evaluated during the walking inspections. Deficiencies in this regard could be indicative of poor species selection or poor growth, and replanting should be undertaken to ensure sufficient vegetation densities.
- Driving on the site should be avoided during wet periods to reduce the possibility of excessive rutting.

6.7 Conclusion

There should be no perceivable changes to the upstream or downstream hydrology and to flood risk as a result of the proposals. In terms of surface water runoff, the proposals will not increase the impermeable area on the site, as the size of the inverter house and PV modules are considered to be negligible in the context of the site areas.

Research into the impact of solar farm panels on runoff rates and volumes indicates that solar panels do not have a significant impact on runoff volumes, peak rates or time to peak rates when the ground below the panels is vegetated. Therefore, with well-maintained grass underneath the panels, the solar panels themselves will not have a significant impact on the runoff volumes, peaks or time to peak.

7.0 JUSTIFYING THE LOCATION OF THE DEVELOPMENT

7.1 Justification Test

The Justification Test sets out the details required to justify siting a new development in an area believed to be at risk of flooding and is defined in Section 6 of TAN15. The required criteria a site / development must fulfil are:

- i) its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or
 - ii) its location in zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;
- and
- iii) it concurs with the aims of PPW and meets the definition of previously developed land; and,
 - iv) the potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.

The proposed development has been assessed against the requirements of the Justification Test:

Solar Farm

The proposed solar farm will be located within FMfP Flood Zone 1 and DAM Zone A - Considered to be at little or no risk of fluvial or tidal/coastal flooding. Used to indicate that the justification test is not applicable and there is no need to consider flood risk further. For developments in Zone A TAN15 guidance states that the '*justification test is not applicable and there is no need to consider flood risk further*'.

Temporary Laydown Area

The temporary laydown area is located within Flood Zone C2 - Areas of the floodplain without significant flood defence infrastructure. Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences.

However, the FMfP shows that the site of the proposed temporary laydown area is located within Flood Zone 2 for rivers with a chance of flooding of 1 in 1000 to 1 in 100 (0.1% to 1%) year from rivers in a given year, including the effects of climate change.

The entrance to the temporary laydown area is located within Flood Zone 1 with a chance of flooding of less than 1 in 1000 (0.1%) years from rivers, the sea or surface water and small watercourses in a given year, including the effects of climate change.

The FMfP data is the 'best available information' on flood risk to inform their planning advice, the FMfP represents better and more up-to-date information on areas at flood risk than the DAM and has therefore, been used within this FCA to assess the flood risk in detail.

It should also be noted that the temporary laydown area will only to be used on a temporary basis for approximately 9 months and will then revert back to grazing land. The proposed development is classified as 'less vulnerable', 'less vulnerable' uses are appropriate within DAM Zone C2 and Flood Zone 2.

The proposed development will make a significant contribution to meet 'net zero', a target the Local Authority are actively seeking to achieve. The Council's objectives are to sustain and enhance the vitality and viability of the region, and to ensure a wide range of employment uses. This is underpinned by the quality of the physical environment, social well-being and economic and environmental improvements. The Council seeks to grant permission for developments that add to the vitality and viability of the region.

This site will help to regenerate the region and will help to deliver these objectives. This site will help encourage economic impetus that will in turn help deliver a stronger service function and mix of employment uses.

Whilst the application site is not previously developed land there is a clear and reasoned argument as to why such a requirement is onerous. However, the proposal does reflect the objectives of PPW11 in providing renewable energy generation as part of decarbonising the Welsh economy, also the proposal will provide economic, social and environmental enhancements.

The site layout has been strategically planned to ensure flood risk to the site and users are managed together with the flood risk of neighbouring third parties. The potential consequences of a flooding event for the particular type of development have been considered within this FCA. This FCA details the potential consequences of flooding from all sources taking into account the proposed development type has been considered and has been found to be acceptable.

Further information on the Justification Test is included within Appendix 4.

In summary, the development proposals should be considered by the LPA to satisfy the Justification Test as set out in TAN15.

7.2 Assessment of Acceptability Criteria

New development should be directed away from Zone C and towards suitable land in Zone A, otherwise to Zone B, where river or coastal flooding will be less of an issue. However, in some areas where developable land is in short supply, there can be an overriding need to build in areas that are at risk of flooding.

A1.14 Criteria

There is an indicative frequency threshold of flooding below which flooding of developed may not be allowed, Table A1.14 of TAN15 provides indicative guidance as to what that frequency threshold could be for different types of development described in terms of annual probability of occurrence (see Table 8).

Table 8 - Frequency Threshold of Flooding

Type of Development	Threshold of Frequency (yrs)	
	Fluvial	Tidal
Residential	1% or 100 years	0.5% or 200 years
Commercial/Retail	1% or 100 years	0.5% or 200 years
Industrial	1% or 100 years	0.5% or 200 years

Emergency Services	0.1% or 1000 years	0.1% or 1000 years
General Infrastructure	1% or 100 years	0.5% or 200 years

The FMfP shows that site including the temporary laydown area will not be inundated with floodwater for all events up to and including the 1 in 100 year (plus climate change) event. The site will be flood free during the 1 in 100 year (plus climate change) event. The FMfP data is the 'best available information' on flood risk to inform their planning advice, the FMfP represents better and more up-to-date information on areas at flood risk than the DAM.

Therefore, the site proposals have been deemed to pass the indicative frequency threshold of flooding, as per Table A1.14 of TAN15.

A1.15 Criteria

An assessment of the flood consequences to the site in an extreme flood has been undertaken, as given within Table A1.15 of TAN15 (see Table 9). An assessment of the flood consequences to the site in an extreme flood has been undertaken. TAN15 makes it clear that the figures in TAN15 are indicative and reflect conditions in which, given the presence of adequate warnings and preparation, appropriately equipped personnel could undertake emergency activities. However, they are not definitive. Each site must therefore be considered individually and a judgement taken in the context of the particular circumstances which could prevail at that site.

During the 1 in 1000 year (plus climate change) event the maximum water depths to be experienced During the 1 in 1000 year (plus climate change) event a water level of 22.50mAOD may be experienced. This would result in a maximum water depths of 0.68m which would occur on the very southern boundary of the temporary laydown area.

The water depths over the majority of the temporary laydown area would be less than 0.50m as the ground levels rise to the north with a maximum of 22.70mAOD and the majority of the ground levels are above 22.10mAOD.

The water depths which would be experienced during the 1 in 1000 year (plus climate change) event at the location of the storage cabins would be <0.55m, at the location of the office and welfare cabin would be <0.35m and at the car/van parking spaces would be <0.51m.

Furthermore, the typical rainfall profile for this region, in common with much of Wales, is a low intensity, long duration event commensurate with frontal weather systems. The mechanism for river flooding is generally prolonged episodes of heavy rainfall, which affords good time for flood warnings to be issued.

The likelihood of a rapid river level rise within the rivers and possible rapid inundation of urban areas posing a risk to life is considered to be minimal. This is primarily due to the large river system and its substantial upper contributing catchment area which is 227.70km² at the gauging station Tawe at Ynystanglws (ref : 59001) just downstream of the site.

The site is located within a low risk area where the onset of flooding is very gradual (many hours) as per Flood Risk Assessment Guidance for New Development Phase 2, R&D Technical Report FD2320/TR2. The Time to Peak (Tp) is over 5 hours for the catchment at the gauging station Tawe at Ynystanglws (ref : 59001) just downstream of the site.

This would result in the maximum rate of rise of floodwaters being less than 0.30m/hr, the maximum speed of inundation would be more than 2 hours and the maximum velocity of floodwaters would be less than 0.30 metres/sec.

In conclusion, the site proposals are in accordance with A1.15 of TAN15. The consequences of flooding can be acceptably managed for the lifetime of the development recognising the small scale proposal on the edge of floodplain. The development proposals should therefore be considered by the LPA to satisfy the Acceptability Criteria as set out in TAN15.

Table 9 - Indicative Guidance on Tolerable Conditions

Type of Development	Maximum Depth of Flooding (mm)	Maximum rate of Rise of Floodwaters (m/hr)	Maximum Speed of Inundation (hrs)	Maximum Velocity of Floodwaters (m/s)
	Property Access			Property Access
Residential (habitable rooms)	600 600	0.10	4	0.15 0.30
Commercial & Retail	600 600	0.30	2	0.15 0.30
Industrial	1000 1000	0.30	2	0.30 0.45
Emergency Services	450 600	0.10	4	0.15 0.30
General Infrastructure	600 600	0.30	2	0.30 0.30

8.0 SUMMARY AND CONCLUSIONS

8.1 Introduction

This report presents an FCA in accordance with TAN15 for the proposed development of CYP Solar Farm.

This FCA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

8.2 Flood Risk

The primary flood risk posed to the site is from fluvial flooding. The site of the proposed solar farm is located within DAM Zone A and FMfP Flood Zone 1 and is not at risk of fluvial or tidal flooding, with less than a chance of flooding of 1 in 1000 (plus climate change) years. The site of the proposed temporary laydown area is located within DAM Zone C2 and FMfP Flood Zone 2 with a chance of river flooding of 1 in 1000 years (plus climate change). The FMfP represents better and more up-to-date information on areas at flood risk than the DAM and has therefore, been used within this FCA to assess the flood risk in detail.

It should be noted that the temporary laydown area will only to be used on a temporary basis for approximately 9 months and will then revert back to grazing land. The proposed development is classified as 'less vulnerable', 'less vulnerable' uses are appropriate within DAM Zone A, C2, FMfP Flood Zone 1 and 2.

During the 1 in 1000 year (plus climate change) event a water level of 22.50mAOD may be experienced. This would result in a maximum water depths of 0.68m which would occur on the very southern boundary of the temporary laydown area.

The water depths over the majority of the temporary laydown area would be less than 0.50m as the ground levels rise to the north with a maximum of 22.70mAOD and the majority of the ground levels are above 22.10mAOD.

The water depths which would be experienced during the 1 in 1000 year (plus climate change) event at the location of the storage cabins would be <0.55m, at the location of the office and welfare cabin would be <0.35m and at the car/van parking spaces would be <0.51m.

Given the scale and nature of the proposed development and the size and location of the fluvial flooding sources it has been concluded that fluvial flooding poses a low flood risk to the site and the risk of fluvial flooding is considered to be of **low significance**. A secondary flooding source has been identified which may pose a **low significant** risk to the site. This is:

- Surface Water Flooding

The risk from these sources will be further mitigated by using a number of mitigation measures to manage and reduce the overall flood risk at the site. The application is for a new, suitable flood-resilient design. The exposure of people and property will be reduced and minimised compared to existing site conditions. The chance of flooding each year is low each year. This takes into account the effect of any flood defences that may be located within the vicinity of the site as well property level protection measures.

To ensure there will be no detriment to the flood storage capacity and the movement of floodwater across the site will not be impacted, flood voids will be constructed under the modular cabins. The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar. The finished floor levels of the modular cabins will be raised to a minimum of 22.60mAOD, this will provide a freeboard of 0.10m above the 1 in 1000 year (plus climate change) event.

The flood voids will be open on all sides, the openings will be a minimum of 1m in width, the height of the void will be from ground level to 22.50mAOD (i.e. above the 1 in 1000 year (plus climate change) event). If the void opening represents a security risk, vertical bars at 100mm centres can be installed.

There will be no net loss in flood storage capacity or impact on movement of floodwater across the site. The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed.

In conclusion, the flood risk to the site can be considered to be limited; the site is situated in DAM Zone A and FMfP Flood Zone 1, with only the temporary laydown area being located in Zone C2 and FMfP Flood Zone 2, with a low annual probability of flooding and from all sources.

8.3 Risk Management

The flooding sources will be mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site:

Finished Floor Levels: The finished floor levels of the modular cabins will be raised to a minimum of 22.60mAOD, this will provide a more than adequate freeboard above the flood events (see Table 6). The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar.

Design: The solar arrays and vulnerable infrastructure will be located above the ground level. The modules are raised off the ground such that the leading edge of each panel will be approximately 0.80m off the ground and the top edge up to 3m in height off the ground. Consequently, the panels will be unaffected by floodwater depths.

The frame supporting the solar panels should not impede overland flow or reduce flood storage capacity, as it would only be the legs which would be within the path of overland flow or floodwaters. The legs are of narrow dimension (60mm) and well-spaced (minimum of 3m apart).

The panels are designed so that they have minimal foundations this limits disturbance of soils/loss of resource and reduces the volume of concrete required. This would also therefore limit the potential for disruption of surface and groundwater flows.

The ancillary structures: substation, transformers etc are also small structures and therefore only require shallow foundations, limiting ground disturbance and disruption to overland flow routes. The proposals are based on maintaining the existing drainage, the structures associated with the solar farm will introduce only small areas of impermeable surfacing. It is not proposed to install new drainage infrastructure but maintain existing greenfield runoff rates.

Where possible existing farm access tracks will be used, and the position of new access tracks will avoid the necessity for watercourse crossings to avoid changes to in-channel flow and disturbance of the riparian habitat.

Flood Resilience and Resistance: Flood risk can be mitigated through the design of the building. Flood resistant/resilient measures will be used, including:

- All electrical wiring, switches, sockets, socket outlets, electrical, and gas meters etc. will be located a minimum of 450mm above the finished floor level.

Safe Access and Egress: The entrance to the temporary laydown area and surrounding areas are located within DAM Zone A and FMfP Flood Zone 1 therefore a permanently safe and dry access can be maintained.

Buffer Strip/Easement: A buffer strip adjacent to the top of any small watercourse will need to be retained for maintenance purposes. This will be free of built development and is required by the Local Planning Authority/Lead Local Flood Authority. The buffer strip will also mitigate the impact of flooding.

8.4 Surface Water Drainage

The surface water runoff from the developed site will be no different pre and post-application. There will be no increase in surface water runoff or exacerbation of off-site risk as a result of the development.

There should be no perceivable changes to the upstream or downstream hydrology and to flood risk as a result of the proposals. In terms of surface water runoff, the proposals will not increase the impermeable area on the site, as the size of the inverter house and PV modules are considered to be negligible in the context of the site areas.

Research into the impact of solar farm panels on runoff rates and volumes indicates that solar panels do not have a significant impact on runoff volumes, peak rates or time to peak rates when the ground below the panels is vegetated. Therefore, with well-maintained grass underneath the panels, the solar panels themselves will not have a significant impact on the runoff volumes, peaks or time to peak.

8.5 Justification Test

The development proposals should be considered by the LPA to satisfy the Justification Test and the Assessment of Acceptability Criteria as set out in TAN15.

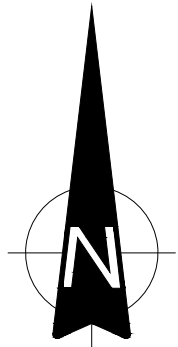
8.6 Conclusion

In conclusion, the proposed development, would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FCA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable, and the development would be in accordance with the requirements of TAN15.

This FCA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of TAN15. The development should not therefore be precluded on the grounds of flood risk.

APPENDICES

APPENDIX 1 – Proposed Site Layout



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KEY

PLANNING APPLICATION BOUNDARY

REV	DESCRIPTION	DATE	BY
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CLIENT

CYP SOLAR LTD



4245 Park Approach, Thorpe Park, Leeds. LS15 8GB. 0113 264 9960

JOB TITLE

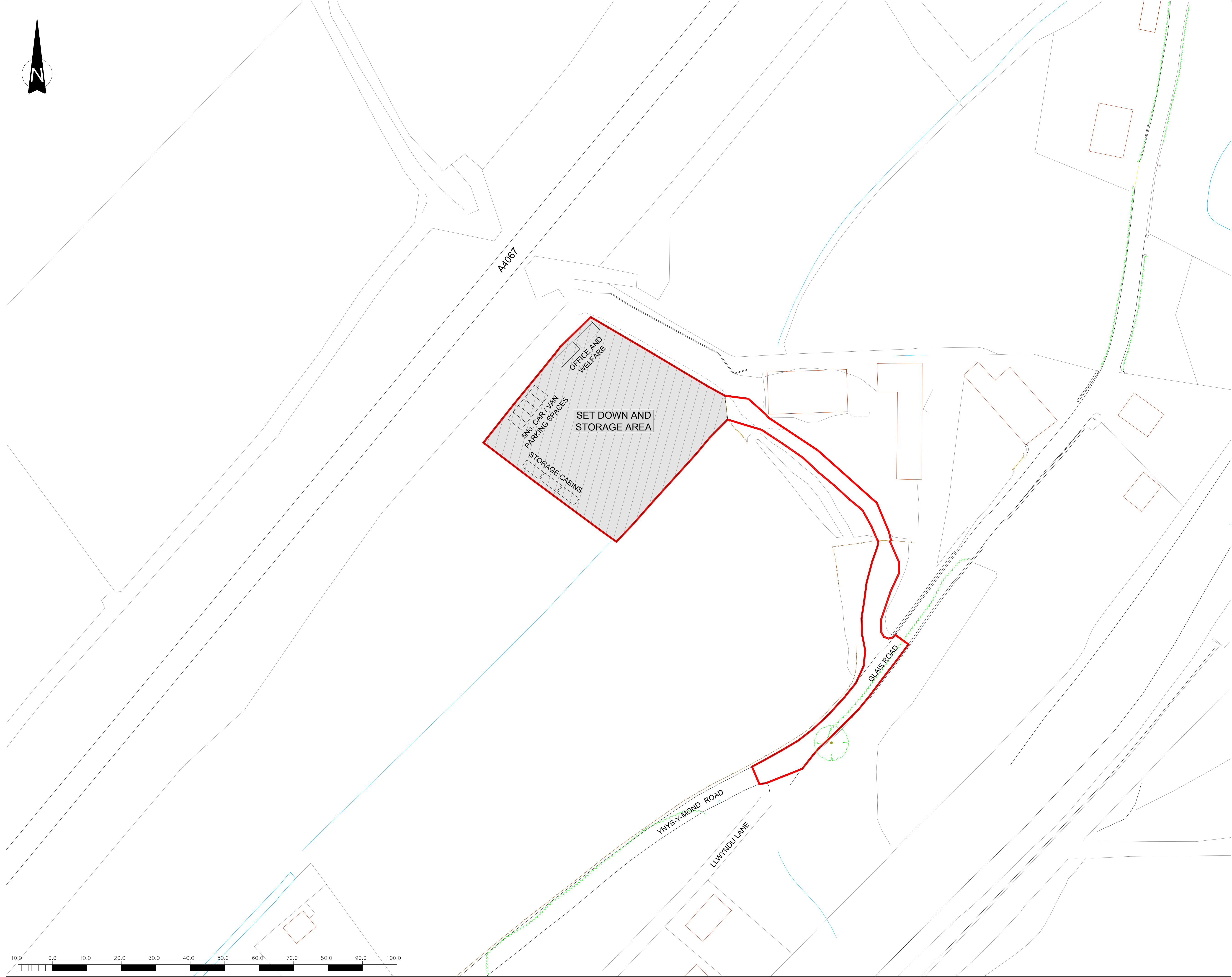
CYP SOLAR FARM

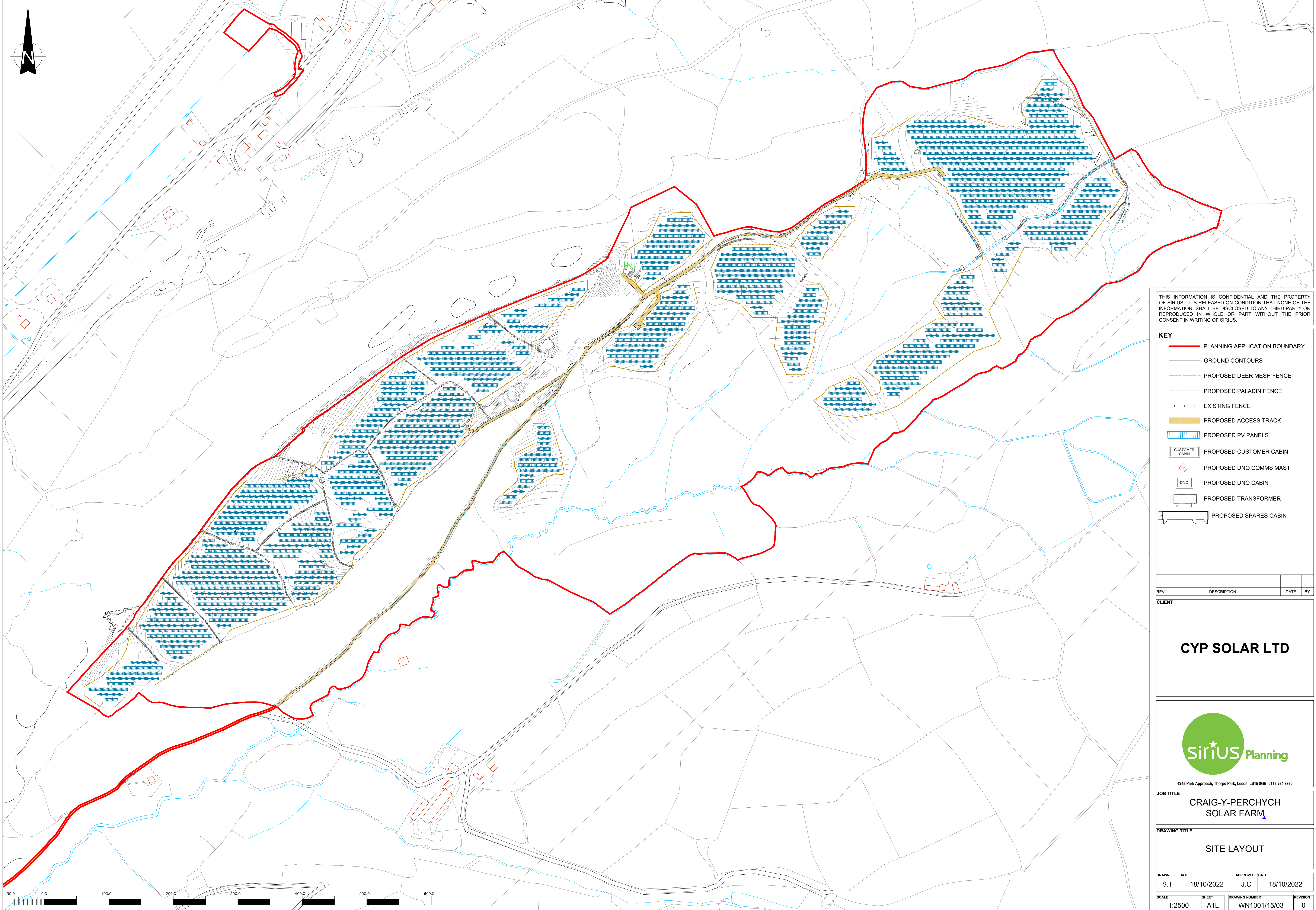
DRAWING TITLE

REMOTE SET DOWN
AREA DETAILS

DRAWN	DATE	APPROVED	DATE
S.T	8/12/2022	J.C	8/12/2022

SCALE	SHEET	DRAWING NUMBER	REVISION
1:500	A1L	WN1001/15/14	0





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- KEY**
- PLANNING APPLICATION BOUNDARY
 - GROUND CONTOURS
 - PROPOSED DEER MESH FENCE
 - PROPOSED PALADIN FENCE
 - EXISTING FENCE
 - PROPOSED ACCESS TRACK
 - PROPOSED PV PANELS
 - CUSTOMER CABIN
 - PROPOSED CUSTOMER CABIN
 - PROPOSED DNO COMMS MAST
 - DNO
 - PROPOSED DNO CABIN
 - PROPOSED TRANSFORMER
 - PROPOSED SPARES CABIN

REV	DESCRIPTION	DATE	BY
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CLIENT

CYP SOLAR LTD



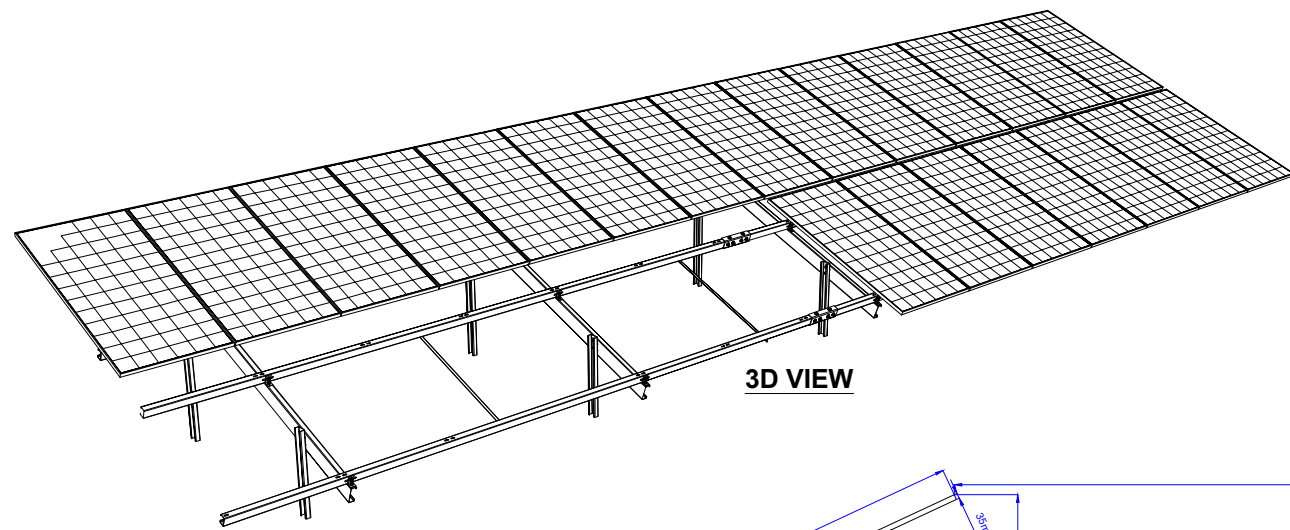
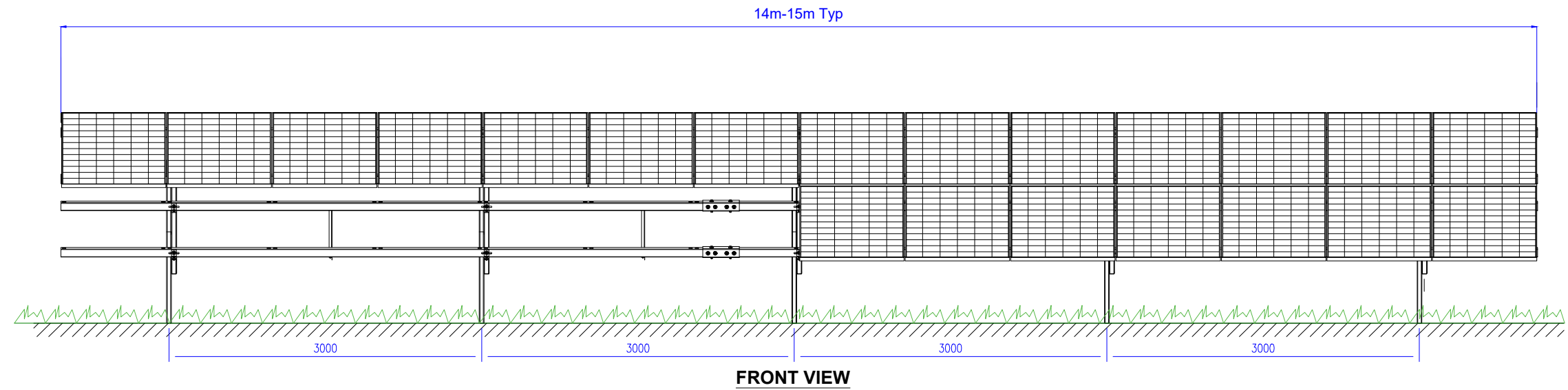
JOB TITLE

CRAIG-Y-PERCHYCH SOLAR FARM

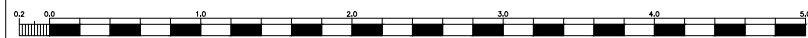
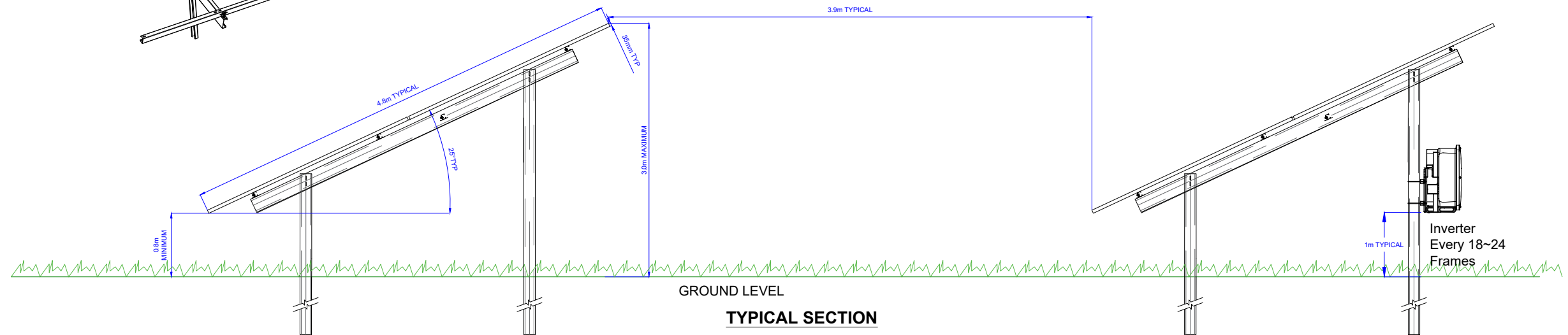
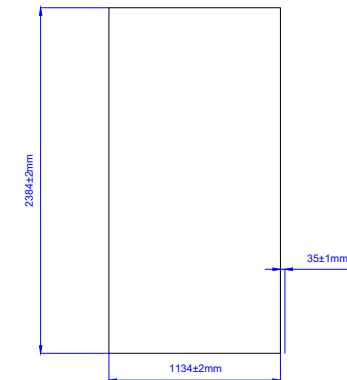
DRAWING TITLE

SITE LAYOUT

DRAWN	DATE	APPROVED	DATE
S.T	18/10/2022	J.C	18/10/2022
SCALE	SHEET	DRAWING NUMBER	REVISION
1:2500	A1L	WN1001/15/03	0



**BIFACIAL PV
MODULE DETAIL**



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CLIENT

CYP SOLAR LTD



4245 Park Approach, Thorpe Park, Leeds. LS15 8GB. 0113 264 9960

NOTES

KEY

JOB TITLE

CYP SOLAR FARM

DRAWING TITLE

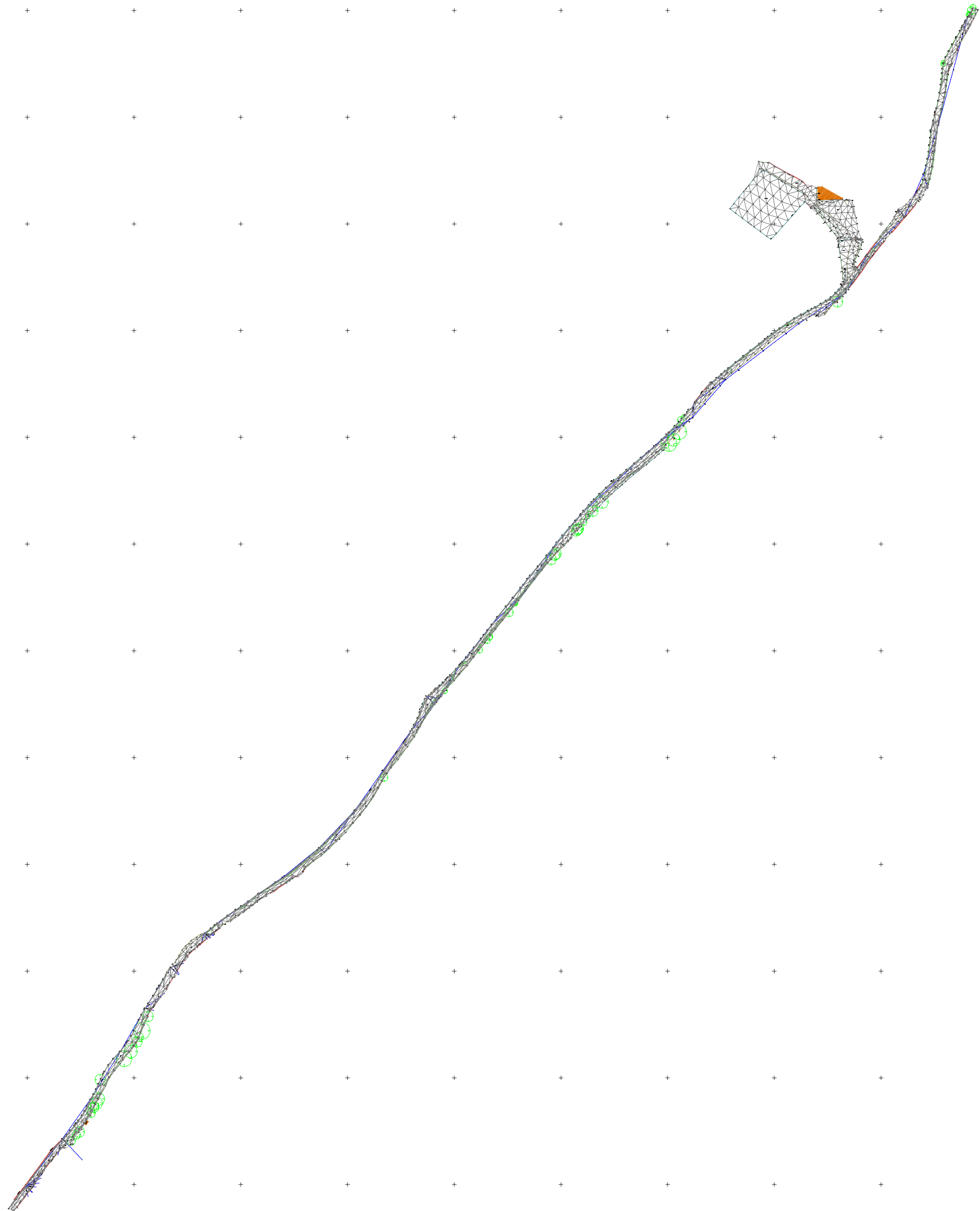
PV PANEL DETAILS

DRAWN	DATE	APPROVED	DATE
S.T	8/7/2022	J.C	17/10/2022

SCALE	SHEET	DRAWING NUMBER	REVISION
1:50	A3L	WN1001/15/04	0

REV	DESCRIPTION	DATE	BY

APPENDIX 2 – Topographical Survey



APPENDIX 3 – Addendum to Flood Consequence Assessment

Our Ref: KRS.0297.040.R.002.A**Date:** 26th April 2023**RE: CYP SOLAR FARM****Introduction**

This short note forms an addendum to the Flood Consequence Assessment (FCA)¹ and provides clarification with regards to the flood risk at the site. Natural Resources Wales have raised the following query:

“We would be grateful if you could provide a clear explanation of how the predicted flood water levels have been calculated, and how the figures in Table 5 of Section 4.9 have been arrived at. This will enable us to provide a complete response.”

Calculation of Flood Levels

The Flood Map for Planning (FMfP) represents better and more up-to-date information on areas at flood risk compared to the Development Advice Map (DAM) and has therefore, been used instead of the DAM to assess the flood risk to the laydown area in detail.

The temporary laydown area is located with Flood Zone 2 with a chance of flooding of 1 in 1000 to 1 in 100 (0.1% to 1%) year in a given year, including the effects of climate change (see Figure 1). The temporary laydown area is located on the very edge of Flood Zone 2.

Natural Resources Wales has confirmed that they do not hold modelling data for this location therefore, to calculate an approximate water level for the temporary laydown area, the Flood Zone 2 and 3 outlines have been compared to the topographical survey. Figure 1 shows that on the edge of the Flood Zone 3 outline the ground levels are approximately 21.80mAOD and the on the edge of the Flood Zone 2 outline the ground levels are approximately 22.50mAOD. An approximate water depth, for locations within the temporary laydown area, has then been calculated based on the water levels and the ground levels of the site.

The minimum ground level is 21.82mAOD which has been used to define the maximum water depth for the temporary laydown area, the ground level at the storage cabins is 21.95 to 22mAOD, the ground level at the office/welfare cabin is 22.15 to 22.25mAOD and the ground level at the car/van parking spaces is 21.99 to 22.15mAOD which have been used to define the water depths at these locations (see Table 5 of the FCA).

¹ KRS Environmental Ltd, CYP Solar Farm, TAN15: Flood Consequence Assessment, For Sirius Planning' KRS.0297.040.R.001.D, March 2023.

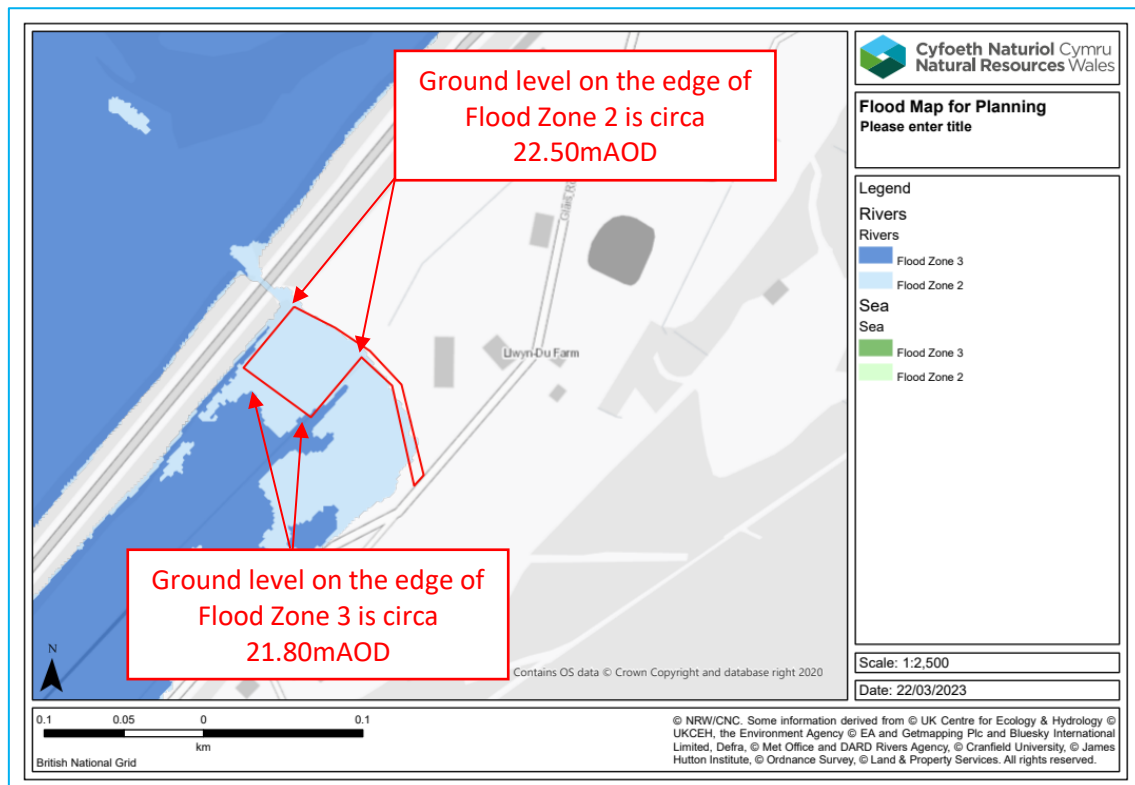


Figure 1 - Flood Map for Planning: Rivers and Sea: Temporary Laydown Area

When detailed modelling data is not available this is a recognised method for deriving a water level for use within FCA's and has been used many times by KRS Environmental Ltd in support of planning applications (e.g. Land at Llwyn Afon, Llanrhaeadr, Denbigh, LL16 4NG for the erection of 3 dwellings, Planning Reference 23/2022/0344 and Legends, Bradford Road, Batley, WF17 6HY, change of use from public house with residential accommodation above to ground floor cafe and first floor hostel with internal and external alterations, Planning Reference 2023/62/90372/E).

This method is appropriate for the proposed development when it is taken into account that the temporary laydown area will only be used for approximately 9 months for the storage of equipment and materials, will have modular cabins, accommodate parked vehicles, and will be reinstated to a grass field. The temporary laydown area will be used for storage of materials for a short period of time and the items stored will be transient in nature and will pass through the site briefly. The materials stored will not be vulnerable to flooding and will include the solar panels, cabling and stockpiles. Where possible to material will be stored on pallets and shrink wrapped for ease of transport and to protect the material. The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar with a minimum finished floor level of 22.60m AOD. The transformers will not be stored on the temporary laydown area and will be transported straight to the larger site area.

Conclusion

The clarification of the points will ensure that the site will be safe during a flood event without increasing flood risk elsewhere. We trust that the details presented herein are self-explanatory and clear. If, for any reason you should have any queries or comments, please do not hesitate to contact us.

Yours sincerely
KRS Environmental Ltd

A handwritten signature in blue ink, appearing to read 'K Serjeant', is positioned below the company name.

Keelan Serjeant BSc (Hons), MSc, MCIWEM
Director

APPENDIX 4 – TAN15 Justification Test

TAN 15 Justification Test

- 1.1. The FCA (Doc. Ref 4.5) confirmed that solar farms are considered less vulnerable development. Less vulnerable development can be accommodated in higher flood risk areas subject to meeting the requirements of the Justification Test as prescribed in Section 6 of Technical Advice Note 15.
- 1.2. The Justification Test sets out the details required to justify siting a new development in an area believed to be at risk of flooding and is defined in Section 6 of TAN15. The required criteria a site / development must fulfil are:
 - i) its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or*
 - ii) its location in zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;*
 - and*
 - iii) it concurs with the aims of PPW and meets the definition of previously developed land; and,*
 - iv) the potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.*
- 1.3. The following section appraises the temporary laydown area that forms part of the proposed solar farm development regarding the Justification Test criteria.

Necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement.
- 1.4. Future Wales 2040 has ambitions for Wales to become a world leader in renewable energy technologies. It acknowledges that the natural wind and tidal resources, potential for solar generation, together with the support for both large and community scaled projects and commitment to ensuring the planning system provides a strong lead for renewable energy development, equate to a well-supported renewables sector. This creates opportunity to attract new investment and reduce carbon emissions in Wales.
- 1.5. Future Wales 2040 identifies the energy sector as a key industry and recognises that decarbonisation commitments and renewable energy targets create an opportunity to build a more resilient and equitable low-carbon economy, develop clean and efficient transport infrastructure, improve public health and generate skilled jobs in new sectors.
- 1.6. Furthermore, in 2021 the four local authorities¹ of South-West Wales published a joint Regional Economic Delivery Plan. The Plan sets the ambitions for a resilient, broad-based and sustainable economy and outlines the focus of efforts over the next few years. To achieve these ambitions the Plan identifies three missions:
 - Establishing South West Wales as a UK leader in renewable energy and the development of a net zero economy
 - Building a strong, resilient and embedded business base

¹ Neath Port Talbot CBC, Swansea Council, Carmarthenshire County Council and Pembrokeshire County Council

- Growing and sustaining the 'experience' offer
- 1.7. Key Action Areas to achieve the first mission includes building capacity and expertise to maximise South West Wales' renewable energy and net zero potential, secure new investment in renewable energy infrastructure and deliver the South West Wales Regional Energy Strategy.
 - 1.8. The vision of South West Wales Regional Energy Strategy (updated in March 2022) is:

Harnessing the region's low carbon energy potential across its on and offshore locations, to deliver a prosperous and equitable net zero carbon economy which enhances the well-being of future generations and the region's ecosystems, at a pace which delivers against regional and national emissions reduction targets by 2035 and 2050.
 - 1.9. The vision is guided by three core principles:
 - Optimise the wide range of regional natural resources such as solar, wind (on and off-shore, including floating off-shore wind (FLOW)), biomass, hydro and marine (including wave, tidal stream and tidal range technologies), to maximise low carbon electricity generation and help achieve a de-carbonised economy.
 - The transition to a low carbon economy needs to improve lives for all and for benefits to be shared in an equitable way. The vision will support inward investment to the region; encourage the growth of sustainable local supply chains, including cutting edge research and development; the creation of resilient manufacturing, construction, operations and maintenance jobs; and affordable energy and energy efficient housing across the region.
 - Led by a proactive and effective regional delivery vehicle - Our vision will be achieved by an effective regional delivery mechanism able to convert the vision into action.
 - 1.10. At a local level, Swansea Local Development Plan (2019) sets out in the Plan's Strategy that there are opportunities for renewable energy generation and new energy infrastructure to help meet carbon reduction requirements, and that greater resilience needs to be built into the supply of energy, and energy efficiency promoted as a means of supporting the de-carbonisation of the energy supply chain.
 - 1.11. Policy ER 1: Climate Change seeks to reduce carbon emissions and provides against the impacts of climate change. The policy also states that development proposals should take account of promoting energy and resource efficiency and increasing the supply of renewable and low carbon energy.
 - 1.12. Objective 1 of Neath Port Talbot County Borough Council's Local Development Plan (2016) is "minimise the causes and consequences of climate change through reduced greenhouse gas emissions...". Policy SP 1: Climate Change is a strategic policy that is of fundamental importance that influences every aspect of the Plan's development.
 - 1.13. The proposal will make a significant contribution to achieving both National and Local Policy objectives in relation to renewable energy generation, economic opportunities and sustainable living. It is considered that the proposal is necessary to assist the local authorities' strategy to sustain Swansea and Neath Port Talbot particularly through the Regional Economic Delivery Plan and Regional Energy Strategy.

Concurs with the aims of PPW and meets the definition of previously developed land.

- 1.14. Planning Policy Wales 11 set out 5 Key Principles that represent a guiding vision. These principles support the culture change needed to embrace placemaking and ensure that planning facilitates the right development in the right place. One of the principles includes 'Making Best Use of Resources.' This principle requires:

"...making development resilient to climate change, decarbonising society and developing a circular economy for the benefit of both the built and natural environments and to contribute to the achievement of the well-being goals".

- 1.15. Chapter 5 (Productive and Enterprising Places) of the PPW sets out the Welsh Government's policies regarding Enterprising Placemaking and Well-being across Wales. One of the key aims in relation to energy is:

- For Wales to generate 70% of its electricity consumption from renewable generation by 2030;
- For one Gigawatt of renewable electricity capacity in Wales to be locally owned by 2030; and
- Actively managing the transition to a low carbon economy.

- 1.16. Chapter 5 of the PPW outlines the importance of the planning system to deliver these targets, paragraph 5.7.15 states:

"The planning system has an active role to help ensure the delivery of these targets, in terms of new renewable energy generating capacity and the promotion of energy efficiency measures in buildings.

- 1.17. Paragraph 5.9.19 states that:

"In determining applications for the range of renewable and low carbon energy technologies, planning authorities should take into account:

- *the contribution a proposal will make to meeting identified Welsh, UK and European targets;*
- *the contribution to cutting greenhouse gas emissions; and*
- *the wider environmental, social and economic benefits and opportunities from renewable and low carbon energy development.*

- 1.18. Renewable energy generation has an important role in achieving sustainable development. As part of decarbonising the Welsh economy, the proposal will provide economic, social and environmental enhancements. Economic benefits will be provided through the creation of temporary jobs and supporting local supply chains during the construction phase. Social benefits will be realised through decentralised energy generation and not relying on energy imports. Environmental gains would be secured through carbon reduction and local biodiversity enhancements.

- 1.19. As the proposal will have a maximum capacity of 20MW of renewable energy a significant contribution to achieving PPW's vision will be made.

- 1.20. The application site measures approximately 68ha, of which 67ha is in flood zone 1. The remote laydown area for the receipt of materials measures circa 0.3ha, but is in flood zone 2. The laydown area will be used for a period of 9 months as part of the construction phase.

- 1.21. In terms of using previously developed land the availability of grid capacity is a key factor that determines the location of PV schemes. If available grid is in a rural

location then it is unlikely there will be areas of previously developed land on which to develop. Chapter 5 of the Planning Statement provides a detailed breakdown of the site selection process and why the application site was chosen for the solar farm.

- 1.22. In identifying the remote set down area, the site was selected as being:
- as close as possible to the solar deployment area to minimise the distance travelled,
 - remote from large urban areas,
 - suitable access for HGVs,
 - level topography, and
 - available for a temporary period.
- 1.23. The identified set down area will be returned to grazing land on completion of the construction phase.
- 1.24. TAN15 was published in 2004 and it is unlikely that large-scale ground mounted solar schemes were given fair consideration as part of the previously developed land requirement. More specifically TAN15 does not consider short term, temporary uses in flood zone 2. As such it is considered to be an out-dated and onerous requirement.
- 1.25. To provide a context, the Inspector's Report on the Llanwern Solar proposal (ref. APP/G6935/A/16/3150137) from October 2018 considered the Justification Test associated with the defended C1 flood zone application site. The Inspector acknowledged that the site was not previously developed land, but paragraph 306 of the report stated:
- There are, however, robust reasons why the proposal needs to be located in this area. Foremost of these are the availability and proximity to a grid connection, and the high number of hours of sunshine. The former is not present in most other locations in the plan area or even nationally, and the highest and second highest average values for sunshine duration are nearly all in coastal locations. In the absence in TAN 15 of any consideration of renewable energy installations, I consider these circumstances to present an alternative and strong justification for the proposed development's location in this area. Where there are exceptions to the general rule TAN 15 states that these will not be subject to the first part of the justification test but subject to the acceptability of consequences part of the test.*
- 1.26. The Inspector's Report on the Wentlooge Solar DNS (ref DNS/3216558) from March 2021, came to the same conclusion in relation to the TAN15 tests for the proposed development within a C1 flood zone with the inspector noting:
- 'I consider that there are robust reasons for locating the development within this zone as an exception to the first 3 justification tests. The Llanwern decision also established the Cabinet Secretary's view that, in this context, solar farms should not be regarded as 'power stations' or as highly vulnerable development, and there is no reason not to follow that approach'.*
- 1.27. The Inspector's Report on the Parc Solar Traffwll DNS (ref: DNS/3217391) from October 2022 arrived at the same conclusion in relation to the TAN15 tests for the proposed development partially located within flood zones C2 and B.
- 'It is considered the proposed development meets the justification tests with the exception of being located on previously developed land. It will make a*

significant contribution to national and local policy objectives in relation to renewable energy generation, economic opportunities, and sustainable living.'

1.28. It is considered that if the above three Inspector recommendations confirm that solar deployment for a 40 year period passes the justification test, then allowing a 9-month operation to accommodate a materials laydown area (as part of a solar proposal) which has no fixed equipment should also be acceptable.

1.29. Furthermore, the business model for the development of subsidy free PV schemes is based on fine margins. Including land that has an increased of potential contamination (through previous uses) and subsequent requirement to clean the land prior to development could make the scheme unviable. Chapter 5 of the Planning Statement provides a full assessment of the site selection process and why using previously developed land was not an option.

Consequences of a flooding event for the particular type of development have been considered and found to be acceptable.

1.30. The flood risk to the temporary laydown area has been explored in detail in the FCA (Doc Ref. 4.5) and in summary the flood risks are outlined in **Table 1** below.

Table 1: Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability and Significance
Fluvial Flooding	Yes	River Tawe	Low
Tidal Flooding	No	None Reported	None
Groundwater Flooding	No	None Reported	None
Surface Water Flooding	Yes	Poor Permeability	Low
Sewer Flooding	No	None Reported	None
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported	None

1.31. From the above table it is clear the potential significance of flooding is at worst low; from fluvial and surface water sources.

1.32. In accordance with Section 6 of TAN15 and following the pre-application consultation response from NRW² the proposal has been designed to incorporate suitable mitigation to meet the criteria of which requires:

Minimal risk to life

1.33. The typical rainfall profile for this region, in common with much of Wales, is a low intensity, long duration event commensurate with frontal weather systems. The mechanism for river flooding is generally prolonged episodes of heavy rainfall, which affords good time for flood warnings to be issued.

1.34. The likelihood of a rapid river level rise within the rivers and possible rapid inundation of urban areas posing a risk to life is considered minimal. If the weather is inclement, or a warning of flooding is issued measures can be put in place to ensure risk to life is minimised.

Minimal disruption to people living and working in the area.

² Letter from NRW dated 17th Feb 2023.

- 1.35. During the 1 in 1000 year (plus climate change) event a water level of 22.50mAOD may be experienced. This would result in a maximum water depths of 0.68m which would occur on the very southern boundary of the temporary laydown area. The temporary laydown area will only to be used on a temporary basis for approximately 9 months and will then revert to grazing land.
- 1.36. The entrance to the temporary laydown area and surrounding areas are located within DAM Zone A and FMfP Flood Zone 1 therefore a permanently safe and dry access can be maintained.

Minimal potential damage to property.

- 1.37. The water depths over the majority of the temporary laydown area would be less than 0.50m as the ground levels rise to the north with a maximum of 22.70mAOD and the majority of the ground levels are above 22.10mAOD. The water depths which would be experienced during the 1 in 1000 year (plus climate change) event at the location of the storage cabins would be <0.55m, at the location of the office and welfare cabin would be <0.35m and at the car/van parking spaces would be <0.51m.

Minimal impact of the proposed development on flood risk generally.

- 1.38. To ensure there will be no detriment to the flood storage capacity and the movement of floodwater across the site will not be impacted, flood voids will be constructed under the modular cabins. The modular cabins will be raised above the existing ground levels by the use of sleepers and/or concrete blocks/plinths or similar. The finished floor levels of the modular cabins will be raised to a minimum of 22.60mAOD, this will provide a freeboard of 0.10m above the 1 in 1000 year (plus climate change) event.
- 1.39. The flood voids will be open on all sides, the openings will be a minimum of 1m in width, the height of the void will be from ground level to 22.50mAOD (i.e. above the 1 in 1000 year (plus climate change) event). If the void opening represents a security risk, vertical bars at 100mm centres can be installed.
- 1.40. There will be no net loss in flood storage capacity or impact on movement of floodwater across the site. The overall direction of the movement of water will be maintained within the developed site and surrounding area. The conveyance routes (flow paths) will not be blocked or obstructed.

Minimal disruption to natural heritage.

- 1.41. The temporary laydown area measures approximately 0.3ha and is currently used for grazing. The ecology survey confirmed the site had limited biodiversity value. On completion of the construction phase, the site would revert to grazing land.

Meeting the Justification Test - Conclusion

- 1.42. The Justification Test requires three of the four listed criteria need to be met. The above information demonstrates that the proposed solar farm would make a significant contribution to the objectives of National and Local policy and also regional and local programmes to improve local communities.
- 1.43. Whilst the application site, or more specifically the temporary laydown area, is not previously developed land, the proposal does reflect the objectives of PPW11 in providing renewable energy generation as part of decarbonising the Welsh economy, also the proposal will provide economic, social and environmental enhancements. It is noted from recent DNS decisions that the Inspectors take the view (and this was endorsed by the Minister's decision) that the locational requirements of the development, and the absence in TAN 15 of any consideration

of renewable energy installations, provide robust reasons why solar development only needs to be subject to the acceptability of consequences test in TAN15.

- 1.44. Lastly, the design of the temporary laydown area ensures flood risk to the site and users are managed together with the flood risk of neighbouring third parties. Furthermore, the FCA details the potential consequences of flooding from all sources taking into account the proposed development type has been considered and has been found to be acceptable.
- 1.45. Therefore, the proposed development meets the requirements of the Justification Test as set out in TAN15.



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