Document Reference	Appendix No.	Title
4.01.10	10.1	Flood Consequences Assessment

Oaklands Solar Farm and Battery Energy Storage System

TAN15: Flood Consequence Assessment

For Sirius Planning

KRS.0297.037.R.001.B

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Oaklands Solar Farm

Project	TAN15: Flood Consequence Assessment
Client	Sirius Planning
Status	Final
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Date	August 2022

CONTENTS

TABLES & FIGURES

EXECUTIVE SUMMARY

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.

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 solar farm and Battery Energy Storage System (BESS) to the south of the village of Bonvilston.

This FCA has been carried out in accordance with guidance contained in Technical Advice Note 15 Development and Flood Risk (TAN15) and associated Development Advice Maps. 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 discuss planning & flood risk:
- Section 4 outlines the flood risk posed to the existing and proposed development;
- Section 5 outlines mitigation measures used to reduce the overall level of flood risk;
- Section 6 details the Justification Test;
- Section 7 provides for the management of surface water runoff; and
- Section 8 presents a summary and conclusions.

2.0 LOCATION & DEVELOPMENT DESCRIPTION

2.1 Site Location

The proposal site covers an area of approximately 127 hectares (ha) of farmland situated at circa 0.70km to the south of the village of Bonvilston in the Vale of Glamorgan (see Figure 1).

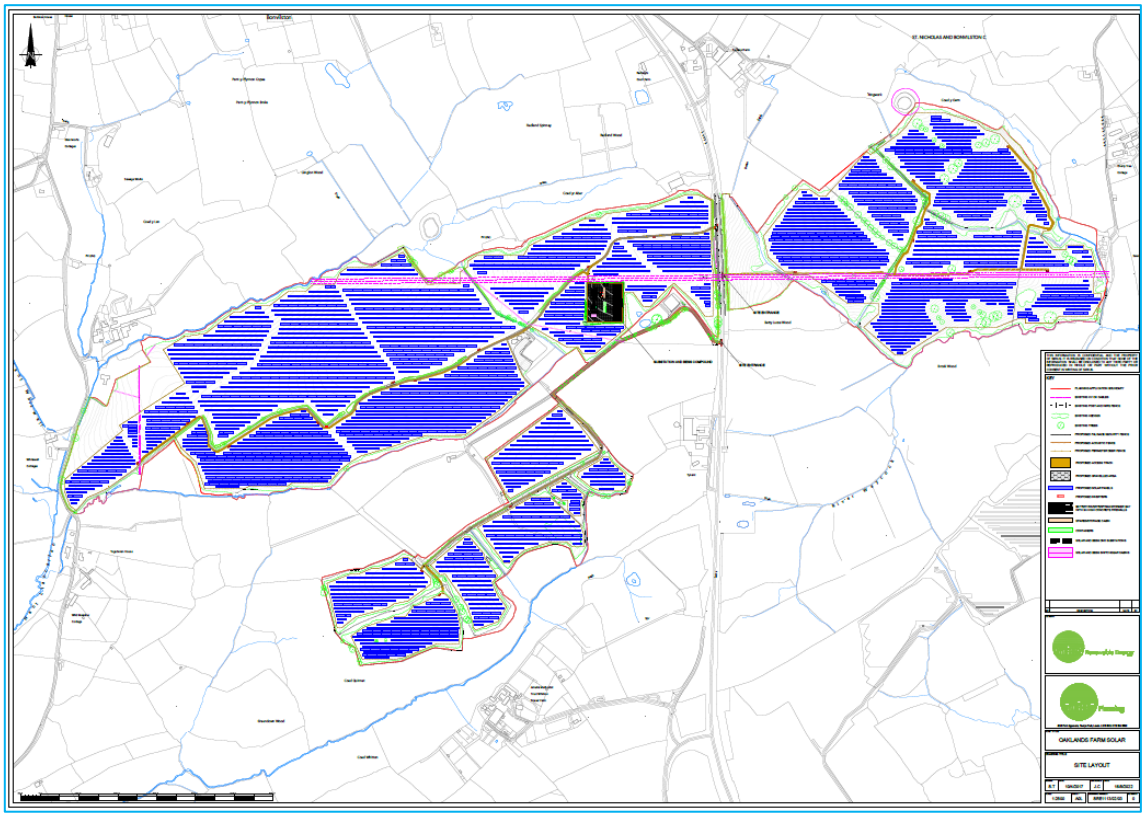


Figure 1 - Site Location

2.2 Existing Development

The site is currently 127 hectares of farmland with a number of trees and hedgerows forming field boundaries on the site. 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.

2.3 Proposed Development

The proposals are for construction of a ground-mounted photovoltaic solar farm and associated battery energy system, together with associated landscaping, works, infrastructure and access (see Appendix 1). The proposal will comprise the following:

- Photovoltaic (PV) panels
- Battery Energy Storage System
- Mounting frames - matt finished small section metal structure
- Scheme of landscaping and biodiversity enhancement

- Inverters and transformers and associated cabling (largely below ground)
- 132kV Distribution Network Operator (DNO) substation, DNO meter point, customer substation.
- Deer fencing and infra-red CCTV (CCTV cameras would operate using motion sensors and would be positioned inward only to ensure privacy to neighbouring land and property)
- Temporary set down areas
- Internal service roads, and
- Use of existing site access for the construction and operational phases.

The panels will be arranged in rows in an east-west alignment across the site and will be angled between 10° and 35° to the horizontal and orientated south. All panels will be mounted on frames with a maximum height of circa 3m above ground level; the lowest part of the panel will measure approximately 1m above ground level. The rows of panels will be set between 4m and 6m apart to avoid overshadowing and to allow access for scheduled maintenance. Transformer and substations are typically 3m in height.

The batteries will store electricity and provide instant power to the grid when demand is required and when the solar farm is not generating power such as at night-time. The batteries will be accommodated in containers located in a secured compound within the site boundary preferably located close to the point of connection to the local distribution network.

The developer has accepted a grid offer from the Distribution Network Operator (Western Power) to connect into the local distribution network at one of existing tower pylons located on site.

The construction phase will last approximately 6 months after which the solar farm and battery units will operate for 40 years. Temporary set down areas and vehicle parking area will be provided for the construction phase within the site boundary. As part of decommissioning, all equipment will be removed from site and the land will continue to be used for agriculture.

The deployment areas will be secured by a 2m high deer fence or similar with wooden posts, or an alternative to suit ecological requirements. Further details with regard to the proposed development can be found in the accompanying information submitted with the planning application.

2.4 Catchment Hydrology / Drainage

The River Waycock is located to the south east of the site. Nant Llancarfan is located to the west of the site boundary and Nant Whitton in located to the south. There are a number of open drains located within and around the site boundary.

2.5 Ground Conditions

The British Geological Survey (BGS) map shows that the superficial deposits consist of Glacial Sand and Gravel. The bedrock deposits vary across the site and consist of:

- Dinantian Rocks (undifferentiated) – limestone with subordinate sandstone and argillaceous rocks.
- Triassic Rocks (undifferentiated) – sandstone and conglomerate, interbedded.
- Triassic Rocks (undifferentiated) – mudstone, siltstone and sandstone.

- Lias Group – mudstone, siltstone, limestone and sandstone.

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 is due to be implemented in June 2023. This will be supported by the new Flood Map for Planning, 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.

3.4 The Vale of Glamorgan Local Development Plan

The Vale of Glamorgan Local Development Plan 2011 - 2026 (LDP) was adopted by the Council on the 28th June 2017. The LDP sets out the Council's planning policy framework for the development and use of land in the Vale of Glamorgan and forms the basis for consistent and rational decision-making and ensures the most efficient use of land and other limited resources.

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 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 and peak river flows are outlined in the CL-03-16 - Climate change allowances for Planning purposes.

Table 1 show the peak river flow allowances by river catchment. There is reasonable level of certainty that the future impacts of climate change will lie somewhere between the central and upper allowances. The 9th 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 (i.e. 2095).

However, the proposals are seeking a time limited consent for 40 years, it would be unreasonable to consider a longer life span. 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

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

4.3 Historic Flooding

Natural Resources Wales has no recorded history of flooding for this area, see Figure 2. There are no records of anecdotal information of flooding at the site including within the British Hydrological Society "Chronology of British Hydrological Events". No other historical records of flooding for the site have been recorded. Therefore, it has been concluded that the site has not flooded within the recent past. However, it is understood that the village of Llancarfan has been subject to a number of historic flooding events.

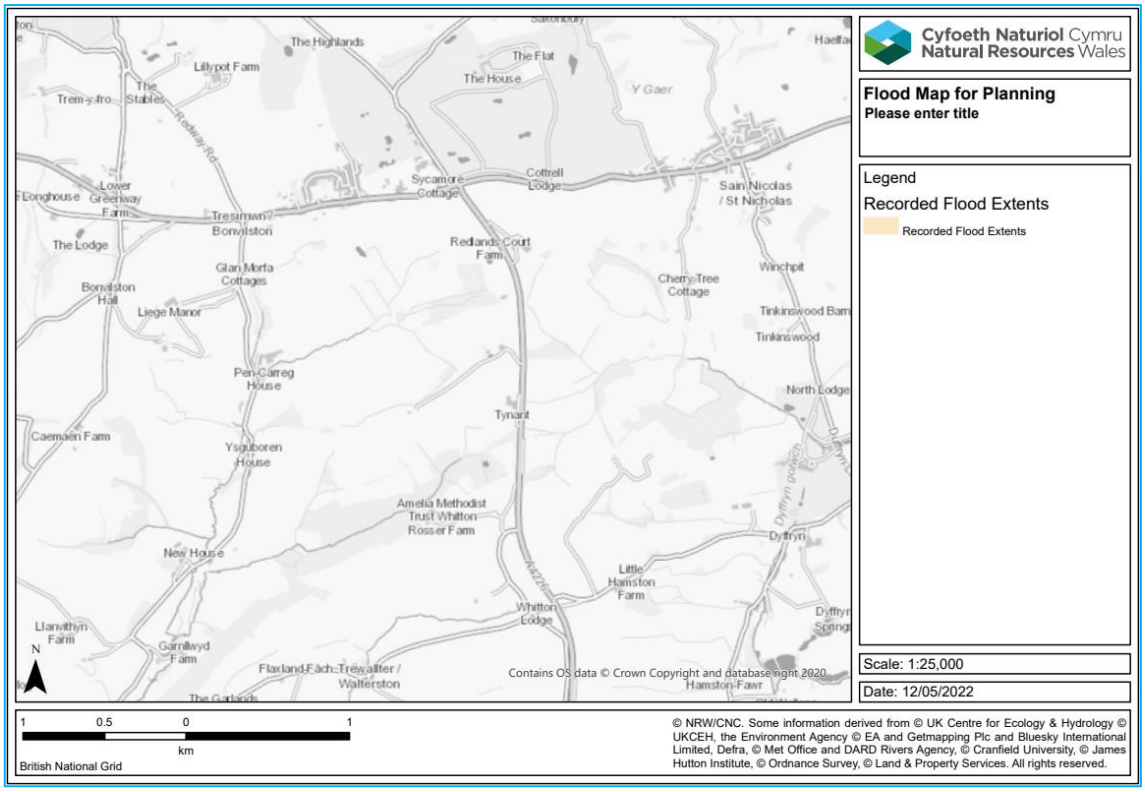


Figure 2 - Natural Resources Wales Historic Flood Outline

4.4 Existing and Planned Flood Defence Measures

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

4.5 Development Advice Map

The DAM which accompanies TAN15 shows that the majority of the site is located within Zone A - Considered to be at little or no risk of fluvial or tidal/coastal flooding (see Figure 3). Used to indicate that the justification test is not applicable and there is no need to consider flood risk further.

However, there is a very small proportion of the site, to the west and east which is located within Zone B - Areas known to have been flooded in the past evidenced by sedimentary deposits. 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. However, as noted above the site has not historically flooded.

Table 2 describes the composition and use of the DAM Zones to control and manage development.

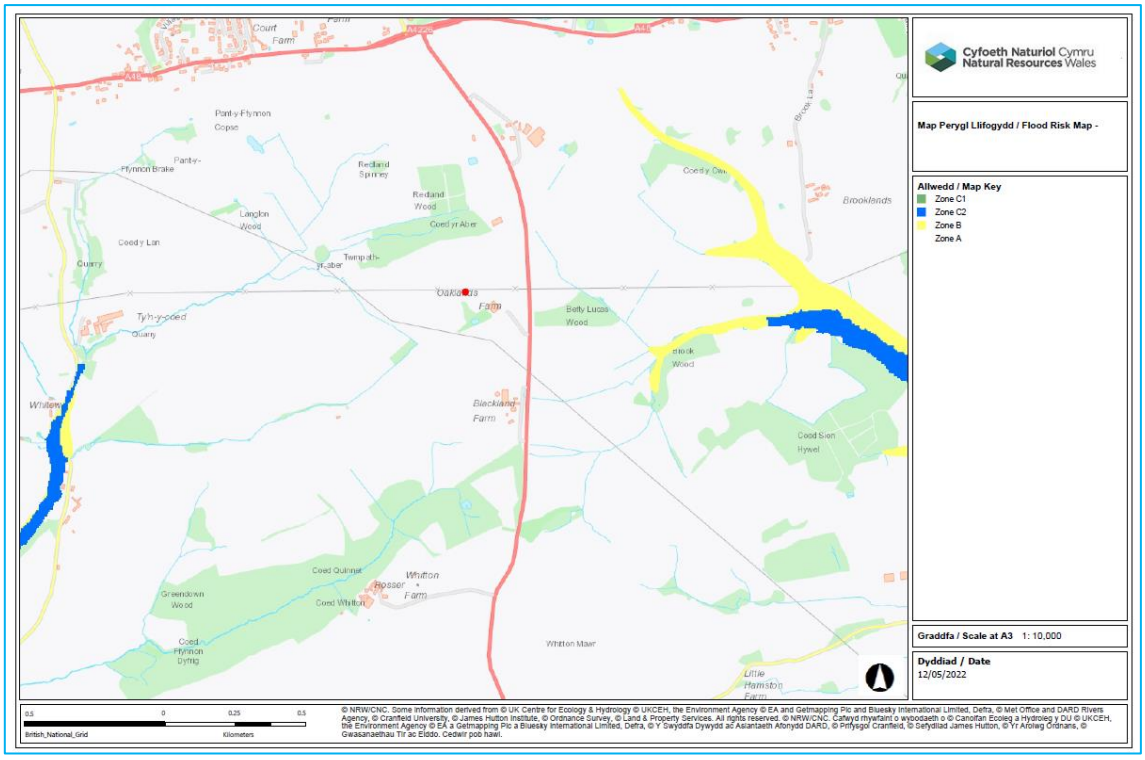


Figure 3 - DAM Zones

Table 2 - DAM 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.

4.6 Flood Map for Planning

The Flood Map for Planning (FMfP) shows the following:

- Rivers: Flood Zone 1, with less than a 1 in 1000 year (0.1%) chance of flooding from rivers in a given year, including the effects of climate change (see Figure 4).
- Sea: Flood Zone 1, with less than a 1 in 1000 year (0.1%) chance of flooding from the sea in a given year, including the effects of climate change (see Figure 5).
- Surface Water and Small Watercourses: The majority of the site is located within Flood Zone 1, with less than a 1 in 1000 year (0.1%) chance of flooding in a given year, including the effects of climate change however, a small proportion of the site is located within Flood Zone 3 with more than a 1 in 100 (1%) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. This is associated with small watercourses and it should be noted that the proposed built development will be located within Flood Zone 1. The floodwater is shown to be retained within the channel of the watercourses (see Figure 6).

Table 3 provides details of the FMfP Flood Zones.

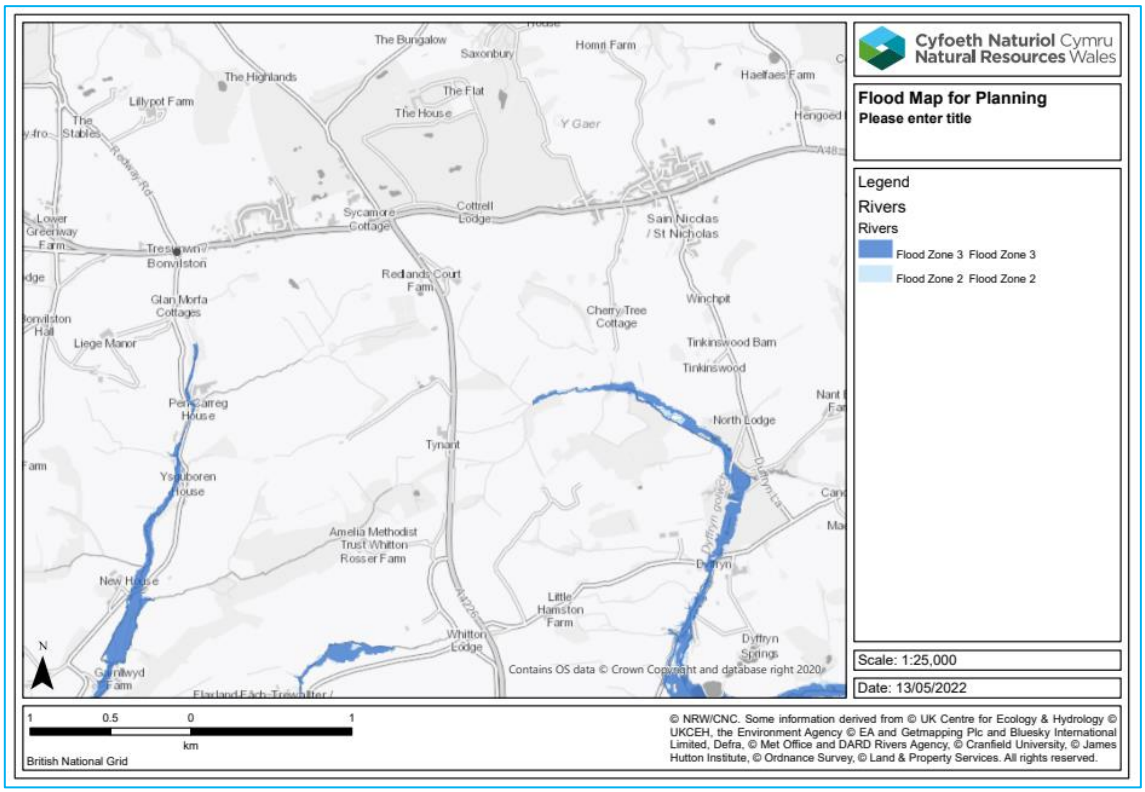


Figure 4 - Flood Map for Planning: Rivers

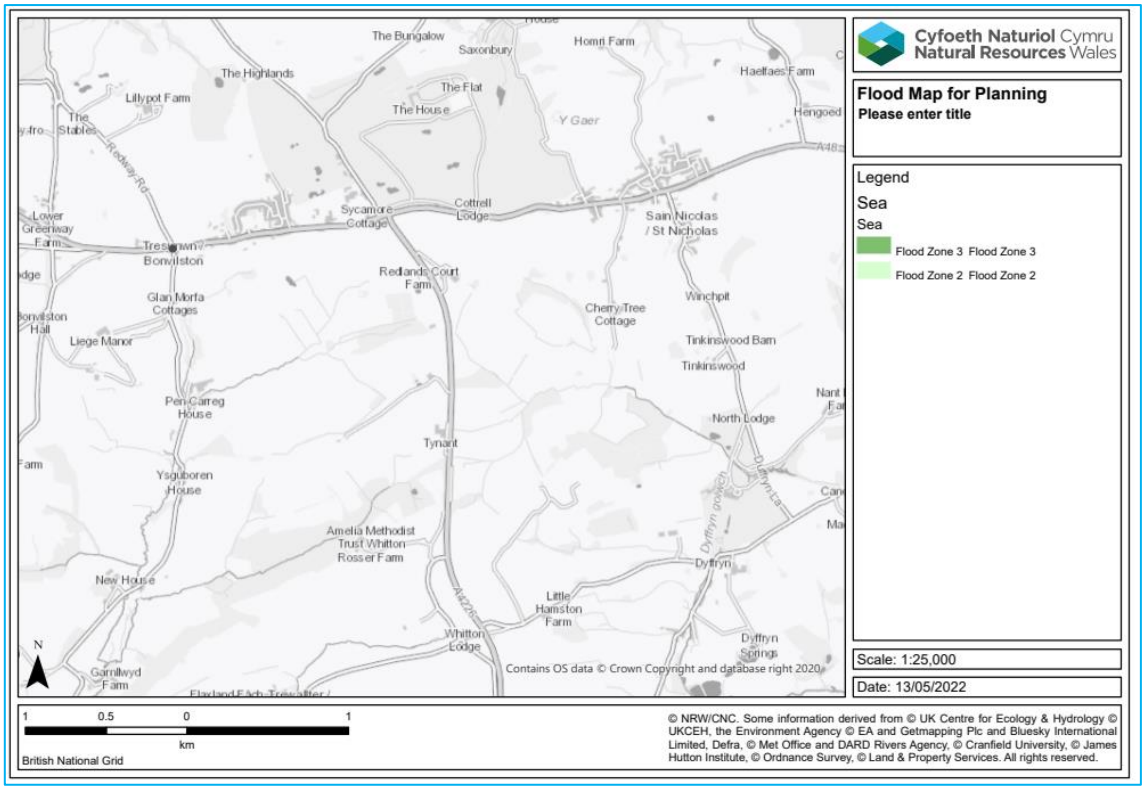


Figure 5 - Flood Map for Planning: Sea

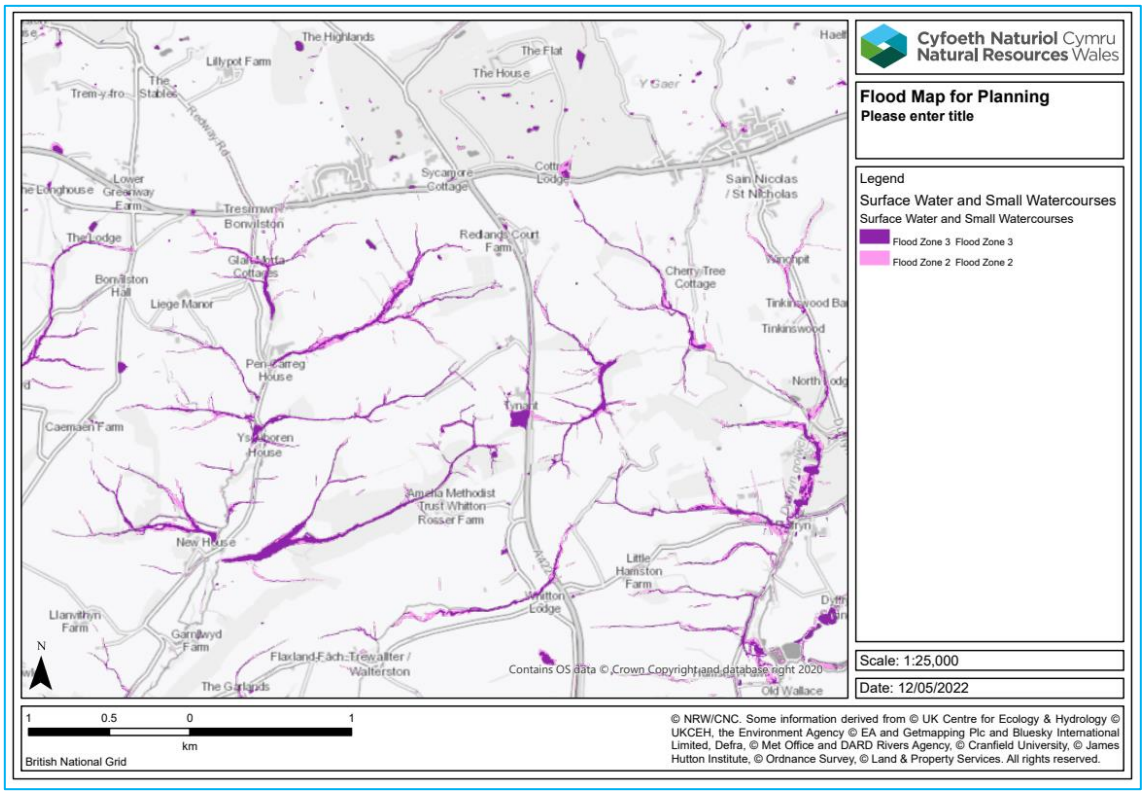


Figure 6 - Flood Map for Planning: Surface Water and Small Watercourses

Table 3 - FMfP Flood Zones

Flood Zone	Explanation
Rivers - Flood Zone 2	Areas with 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 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 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 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 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 1% (1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change.

4.7 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 and energy storage development. However, Table 4 confirms that less vulnerable development describes development, such as the case with the proposed development for a solar farm and energy storage development, 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).

Solar farms are considered 'less vulnerable' development. Therefore, it has been considered, that the proposed development is classified as 'less vulnerable'. The DAM classification 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 utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites.

4.8 Fluvial (river) 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 ground levels of the site are 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 on the boundaries of the site well away from the proposed development. Any overbank flow would follow the contours of the surrounding area and would flow directly away from the site rather than flowing towards the site.

The FMfP shows that the site is located within Flood Zone 1 for flooding from rivers with less than a 1 in 1000 year (0.1%) chance of flooding from rivers in a given year, including the effects of climate change (see Figures 4 and 7).

For flooding from surface water and small watercourses, as shown within the FMfP, the majority of the site is located within Flood Zone 1, with less than a 1 in 1000 year (0.1%) chance of flooding in a given year, including the effects of climate change however, a small proportion of the site is located within Flood Zone 3 with more than a 1 in 100 (1%) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. This is associated with small watercourses and it should be noted that the proposed built development will be located within Flood Zone 1. The floodwater is shown to be retained within the channel of the watercourses, this is also confirmed within Figure 8. Therefore, the risk of fluvial flooding is considered to be **not significant**.

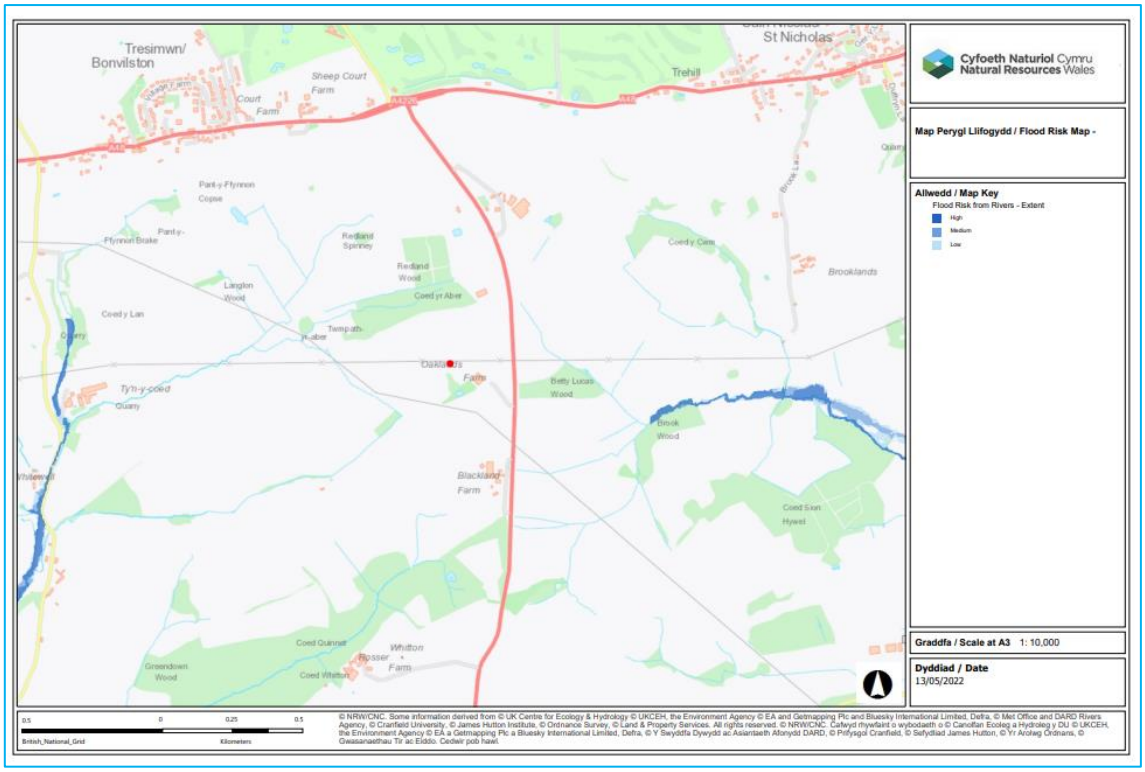


Figure 7 - Fluvial Natural Resources Wales Flood Risk Assessment Wales Map for Rivers

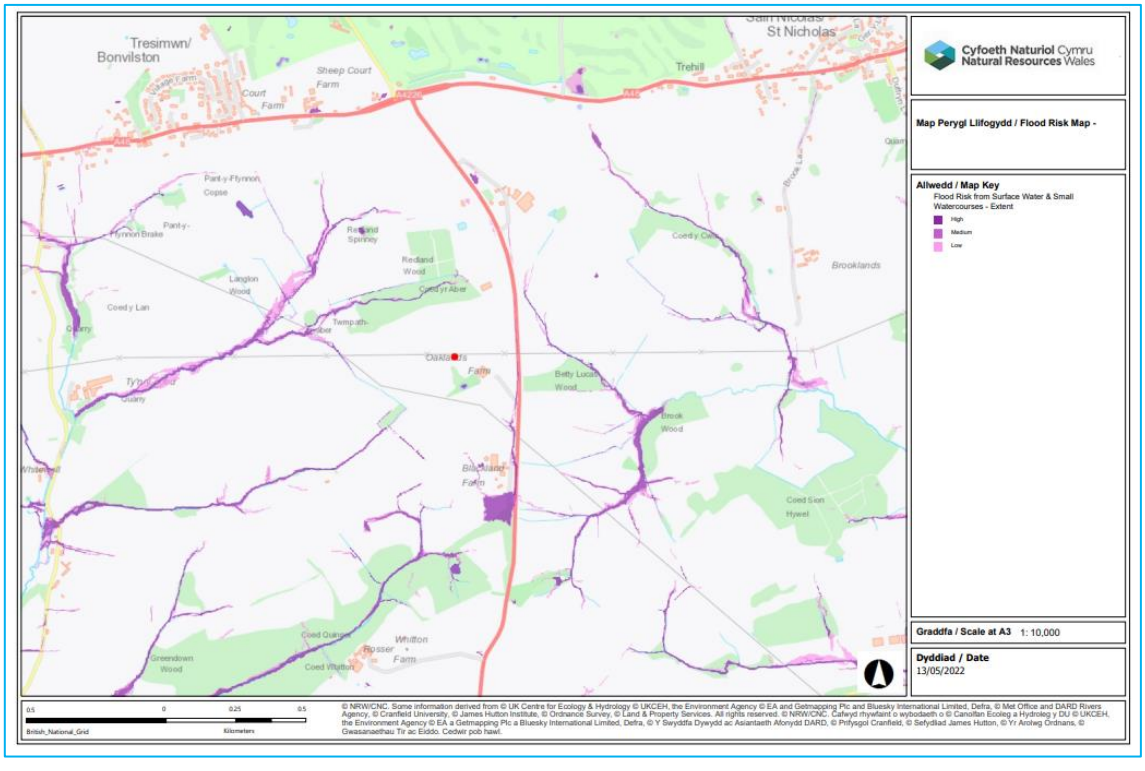


Figure 8 - Fluvial Natural Resources Wales Flood Risk Assessment Wales Map for Surface Water and Small Watercourses

4.9 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 Figure 5, 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**.

4.10 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**.

4.11 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 and do not indicate that the plot may be at risk of surface water flooding.

The Natural Resources Wales Surface Water flood map shows that the site has a very low risk of surface water flooding (see Figure 7) with a chance of surface water flooding of less than 1 in 1000 (0.1%) years. A review of the FMfP the majority of the site is located within Flood Zone 1, with less than a 1 in 1000 year (0.1%) chance of flooding in a given year, including the effects of climate change however, a small proportion of the site is located within Flood Zone 3 with more than a 1 in 100 (1%) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. This is associated with small watercourses and it should be noted that the proposed built development will be located within Flood Zone 1. The floodwater is shown to be retained within the channel of the watercourses. Therefore, the risk of surface water flooding is considered to be **not significant**.

4.12 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**.

4.13 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**.

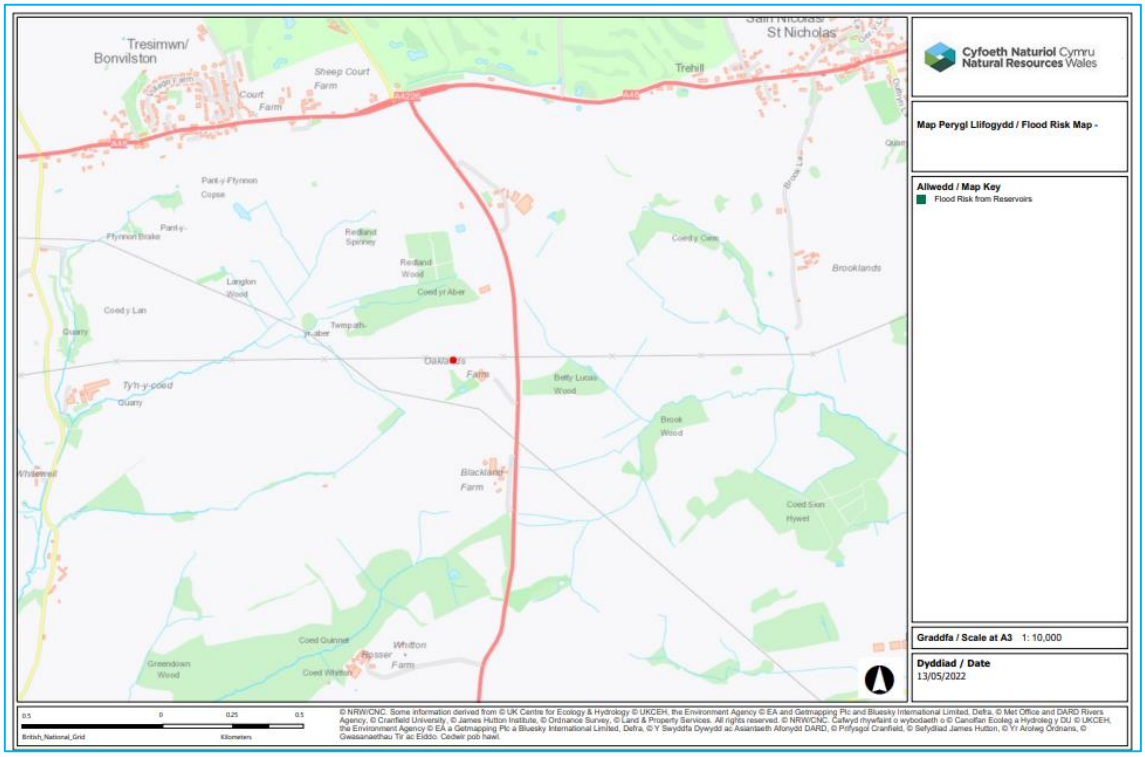


Figure 9 - Natural Resources Wales Reservoir Flood Map

4.14 Effect of the Development on Flood Risk

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 floodwater levels due to the proposed development.

4.15 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 5.

Table 5 - Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial Flooding	Yes	Small Watercourses	None
Tidal Flooding	No	None Reported	None
Groundwater Flooding	No	None Reported	None
Surface Water Flooding	Yes	Small Watercourses	None
Sewer Flooding	No	None Reported	None
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported	None

The site is not at risk of flooding from a major source (e.g. fluvial and/or tidal). The majority of the site is located within Zone A with very small proportion of the site, to the west and east which is located within Zone B. However, it has been concluded that the site has not historically flooded.

The FMfP shows that the site is located within Flood Zone 1 for rivers and sea flooding. The majority of the site is located within Flood Zone 1 for surface water and/or small watercourses however, a small proportion of the site is located within Flood Zone 3 with more than a 1 in 100 (1%) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. This is associated with small watercourses and it should be noted that the proposed built development will be located within Flood Zone 1. The floodwater is shown to be retained within the channel of the watercourses.

The proposed development is classified as 'less vulnerable', 'less vulnerable' uses are appropriate within DAM Zones A and B. There are no constraints relating to flooding from rivers or the sea, other than to avoid increasing risk elsewhere. The justification test is not applicable.

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 Zones A and B with a very 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;
- Minimal disruption to natural heritage.

5.2 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 approximately 2.86m 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 proposal 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.

5.3 Safe Access and Egress

The site and surrounding area are located within DAM Zone A therefore a permanently safe and dry access can be maintained. Furthermore, solar farms are controlled remotely and attendance at the site in adverse weather conditions is not conducive to maintenance activities etc. If the weather is inclement, or a warning of flooding is issued, the solar farm will not be visited.

5.4 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 JUSTIFYING THE LOCATION OF THE DEVELOPMENT

6.1 Justification Test

New development should be directed away from Zone C and towards suitable land in Zone A 1, otherwise to Zone B, where river or coastal flooding will be less of an issue. The DAM which accompanies TAN15 shows that the site is located within Zone A and B. For developments in Zones A and B TAN15 guidance states that the *'justification test is not applicable and there is no need to consider flood risk further'*.

7.0 SURFACE WATER DRAINAGE

7.1 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 safety and sustainably.

7.2 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 inverter/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 Systems[1]. 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.

[1] 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.

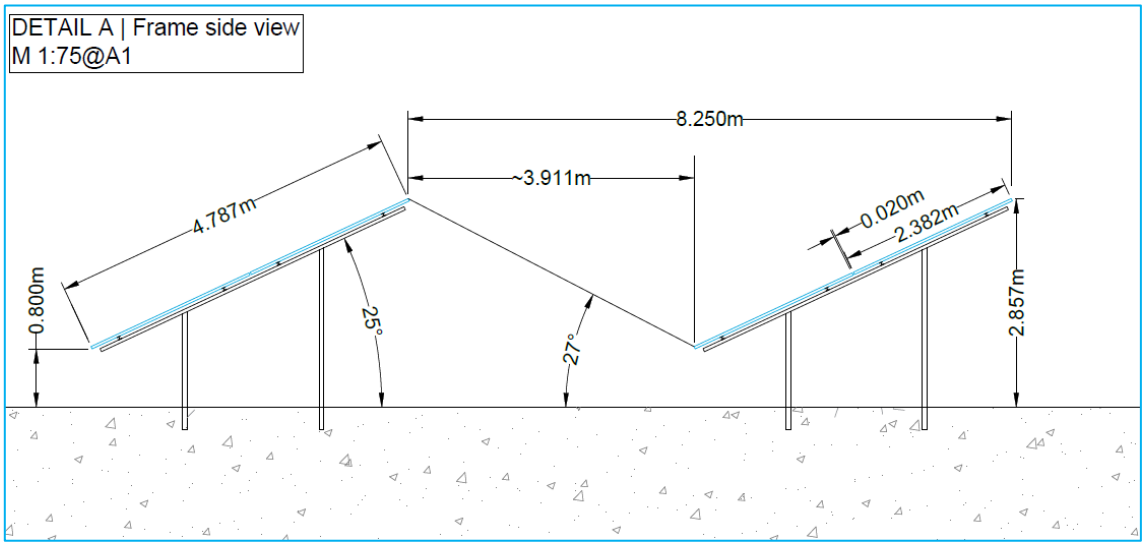


Figure 10 - Flow Paths over PV modules

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 paper[2] 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.

[2] 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

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)[3]. 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.

7.3 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.

7.4 Surface Water Management During Construction

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

- 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

[3] https://webarchive.nationalarchives.gov.uk/ukgwa/20150902172007/http://publications.naturalengland.org.uk/publication/32027

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.

7.4.1 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.

7.4.2 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.

7.4.3 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.

7.5 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.

7.5.1 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.

7.5.2 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 plow to retain as much vegetation residue on the soil surface as possible.

7.5.3 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.

7.6 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.

7.7 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.

8.0 SUMMARY AND CONCLUSIONS

8.1 Introduction

This report presents an FCA in accordance with TAN15 for the proposed development of Oaklands Solar Farm and Battery Energy Storage System.

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 site is not at risk of flooding from a major source (e.g. fluvial and/or tidal). The majority of the site is located within Zone A with very small proportion of the site, to the west and east which is located within Zone B. However, it has been concluded that the site has not historically flooded.

The FMfP shows that the site is located within Flood Zone 1 for rivers and sea flooding. The majority of the site is located within Flood Zone 1 for surface water and/or small watercourses however, a small proportion of the site is located within Flood Zone 3 with more than a 1 in 100 (1%) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change. This is associated with small watercourses and it should be noted that the proposed built development will be located within Flood Zone 1. The floodwater is shown to be retained within the channel of the watercourses.

The proposed development is classified as 'less vulnerable', 'less vulnerable' uses are appropriate within DAM Zones A and B. There are no constraints relating to flooding from rivers or the sea, other than to avoid increasing risk elsewhere. The justification test is not applicable.

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 Zones A and B with a very low annual probability of flooding and from all sources.

8.3 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.

8.4 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:

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 approximately 2.86m 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.

Safe Access and Egress: The site and surrounding area are located within DAM Zone A therefore a permanently safe and dry access can be maintained. Furthermore, solar farms are controlled remotely and attendance at the site in adverse weather conditions is not conducive to maintenance activities etc. If the weather is inclement, or a warning of flooding is issued, the solar farm will not be visited.

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.

8.5 Justification Test

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

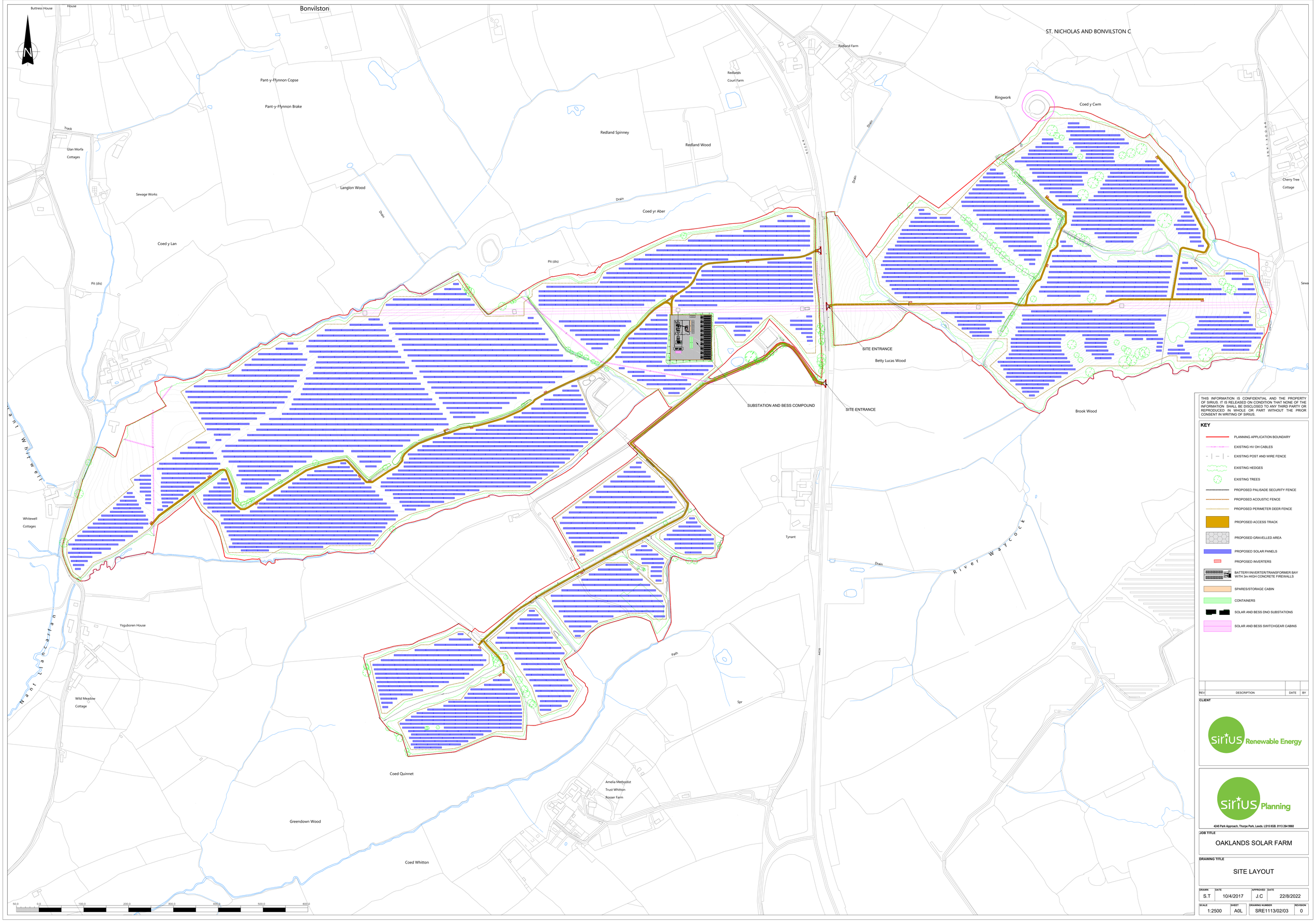
8.6 Conclusion

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



KEY

- PLANNING APPLICATION BOUNDARY
- EXISTING HV OH CABLES
- EXISTING POST AND WIRE FENCE
- EXISTING HEDGES
- EXISTING TREES
- PROPOSED PALISADE SECURITY FENCE
- PROPOSED ACOUSTIC FENCE
- PROPOSED PERIMETER DEER FENCE
- PROPOSED ACCESS TRACK
- PROPOSED GRAVELLED AREA
- PROPOSED SOLAR PANELS
- PROPOSED INVERTERS
- BATTERY/INVERTER/TRANSFORMER BAY WITH 3m HIGH CONCRETE FIREWALLS
- SPARES/STORAGE CABIN
- CONTAINERS
- SOLAR AND BESS DNO SUBSTATIONS
- SOLAR AND BESS SWITCHGEAR CABINS

REV	DESCRIPTION	DATE	BY

CLIENT

Sirius Renewable Energy

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

JOB TITLE

OAKLANDS SOLAR FARM

DRAWING TITLE

SITE LAYOUT

DRAWN	DATE	APPROVED	DATE
S.T	10/4/2017	J.C	22/8/2022

SCALE	SHEET	DRAWING NUMBER	REVISION
1:2500	A0L	SRE1113/02/03	0

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