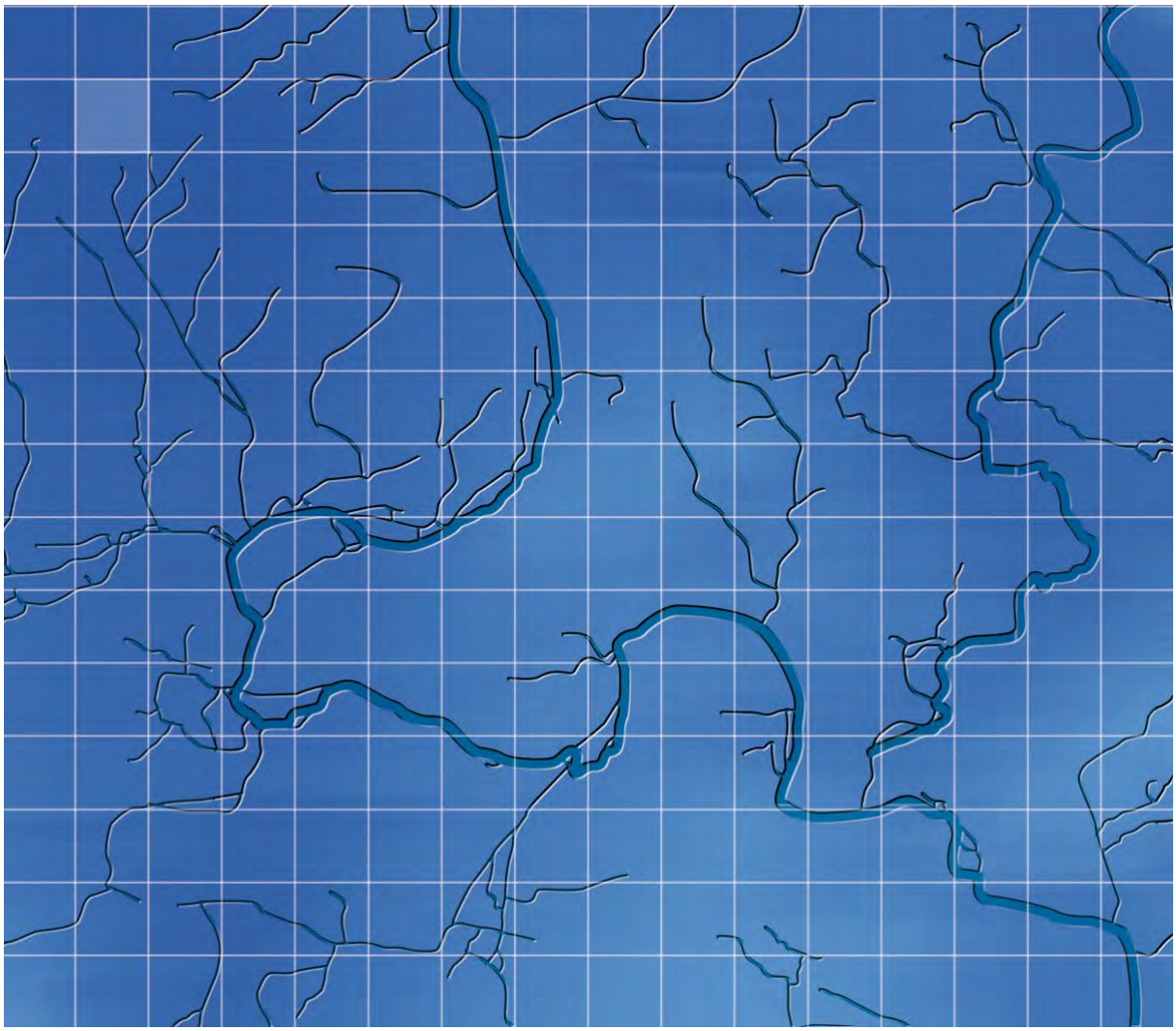
Dulas

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Hafod Road Solar FCA and Drainage Strategy



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For and on behalf of Wallingford HydroSolutions Ltd.

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1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd has been commissioned by Dulas to undertake a Flood Consequence Assessment (FCA) and outline drainage strategy in accordance with Planning Policy Wales (PPW)[1] and Technical Advice Note 15[2] (TAN 15). The proposed development is a solar farm located at a 2.9 ha site adjacent to the A483, to the east of Johnstown, near Wrexham (NGR: 331314, 345869).

Natural Resources Wales's (NRW) Flood Map for Planning, indicates that the site lies outside of Flood Zone 2 and 3 for fluvial and tidal flooding. The Surface Water and Small Watercourses flood map, shows the site to be partially within Flood Zones 2 and 3 along the eastern and southern boundaries.

This FCA seeks to demonstrate that the proposed development can remain compliant with TAN15 for the lifetime of development and that the risk of flooding can be managed to an acceptable level.

1.2 Scope

This FCA and drainage strategy will identify all sources of flood risk to the site and where applicable identify any mitigation measures and safe access/egress routes to reduce risk to the development and ensure that it can remain safe for its lifetime. This FCA will demonstrate that the flood risk to the site can be appropriately managed in line with Technical Advice Note 15 (TAN 15) guidance to secure planning approval.

In summary, this FCA will:

- Introduce the Site in terms of its location, topography and the proposed development.
- Provide a comprehensive review of all publicly available flood risk data assessing the risk to the development site.
- Provide a surface water drainage strategy for the Site.

1.3 Data Sources

- Planning Policy Wales[1]
- Technical Advice Note 15[2]
- NRW Flood Map[3]
- LiDAR (1m) data[4]
- British Geological Survey (BGS) Geology of Britain viewer[5]
- Landis Soilscapes Map[6]
- Ciria SuDS Manual[7]
- BGS SuDS GeoReport

[1] Welsh Government. February 2024. Planning Policy Wales Edition 12.
[2] Welsh Government. March 2025. Technical Advice Note 15: development, flooding and coastal erosion.
[3] NRW. Natural Resources Wales Flood Risk Map Viewer. Available at: https://datamap.gov.wales/layergroups/inspire-nrw:FloodRiskAssessmentWales Accessed: March 2025.
[4] NRW. LiDAR Viewer. https://datamap.gov.wales/maps/lidar-viewer/view#/ Accessed: March 2025
[5] British Geological Survey. Geology of Britain Viewer. https://geologyviewer.bgs.ac.uk/ Available: March 2025.
[6] Landis. LandIS Soilscapes. https://www.landis.org.uk/soilscapes/ Accessed: March 2025.
[7] CIRIA SuDS Manual 2015. C753

2 The Site

2.1 Location

The Site is located approximately 550 m east of Johnstown, Rhosllanerchrugog between Haford Rd to the west and the A483 to the east. Settlements in the wider area include Wrexham approximately 3.5 km northeast of the Site and Ruabon approximately 1 km southwest. The Site is currently a 2.9 ha greenfield agricultural site. Figure 1 shows the location of the Site within the local area.

The nearest watercourse is a ditch that runs eastwards from the northeastern corner of the site to its confluence with Black Brook 700 m from the Site. Another small watercourse (Aberderfyn) is present close to the southwestern corner of the site boundary. A pond is also present in the field north of the site boundary, approximately 40 m from the Site at its closest point.



Figure 1 - Site Location

2.2 Topography

LiDAR data[4] indicates a west to east slope across the whole site, see Figure 2. The highest ground levels occur along the furthest western section of the site boundary with an estimated peak of 102.7 m AOD. Conversely, the lowest ground levels occur along the furthest eastern boundary of the site, with an estimated lowest level of 96.5 m AOD.

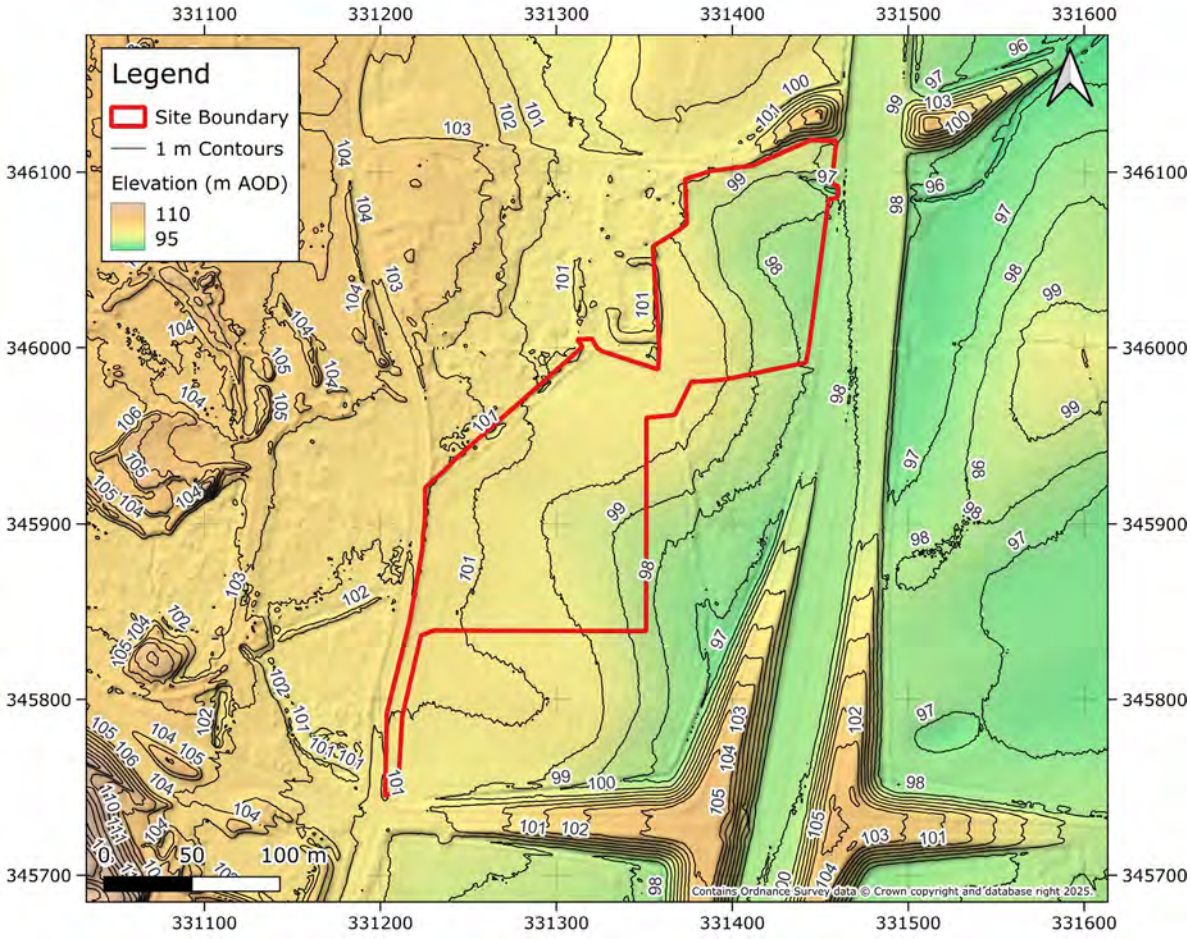


Figure 2 – Site Topography

2.3 Proposed Development

The proposed development includes a 4575.4 m^2 solar panel array, a customer substation, DCO substation, and an access track. An additional temporary compound will also be present in the north of the site during the construction phase. Figure 3 indicates the locations of this infrastructure within the Site.

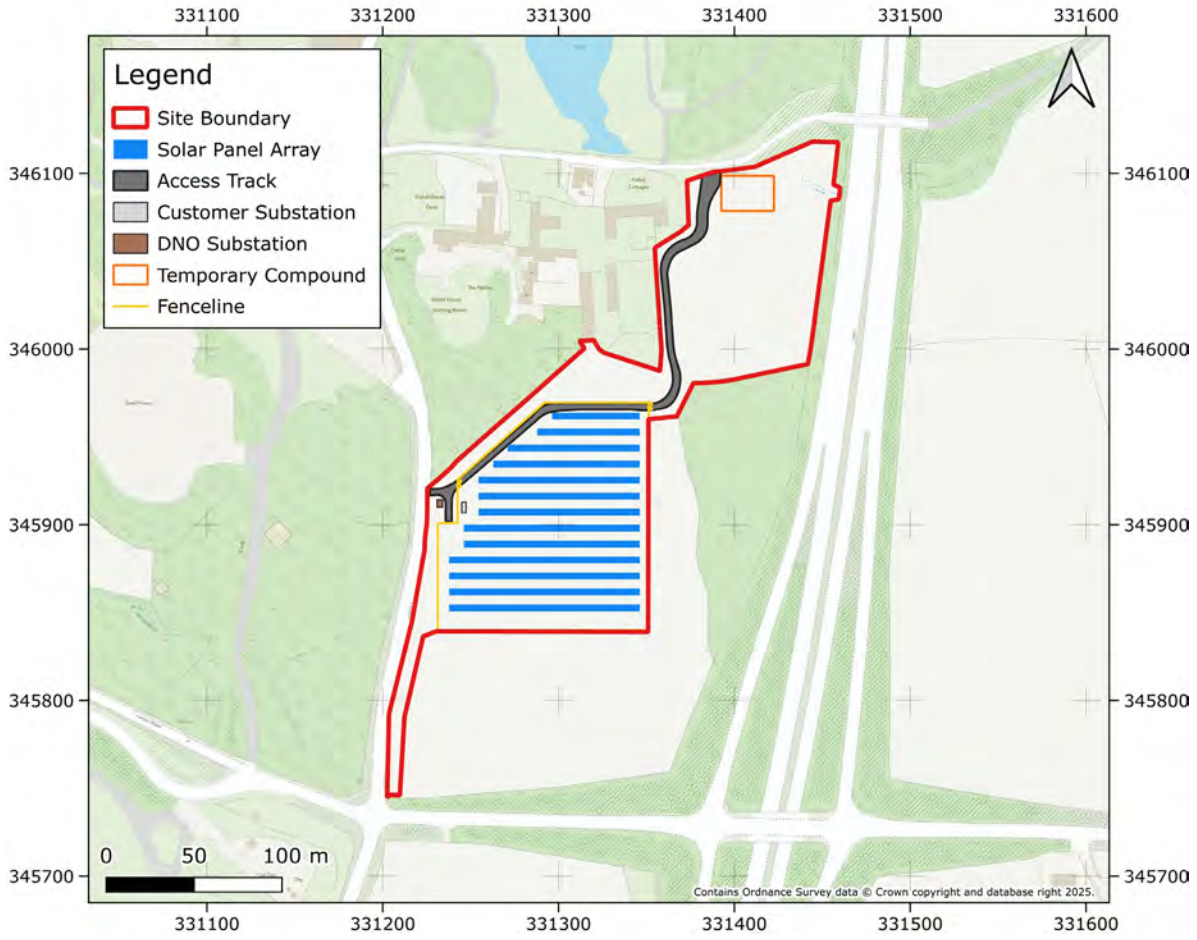


Figure 3 - Proposed Development Layout

3 Sources of Flood Risk

3.1 Flood Map for Planning Wales – Rivers and Seas

A revised Tan 15 has been implemented by the Welsh Government and is supported by the Flood Map for Planning. This shows how climate change will affect flood risk extents. The map shows the potential extent of flooding assuming no defences are in place.

Figure 4 shows the Site is located outside of any fluvial flood zones, (areas with a less than 0.1% annual probability of fluvial flooding, including the effects of climate change).

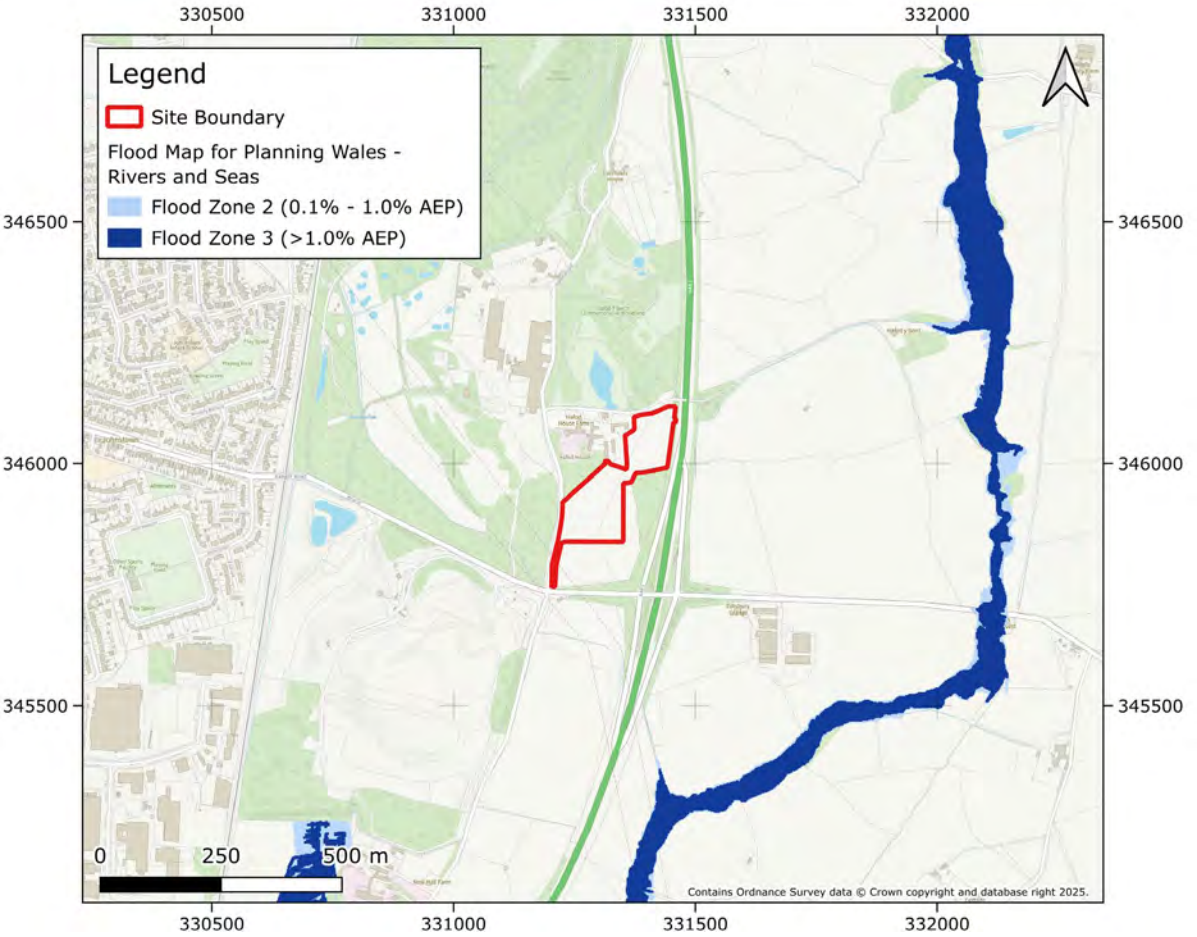


Figure 4 - Flood Map for Planning Wales – Rivers and Seas

3.2 Flood Map for Planning Wales – Surface Water and Small Watercourses

The Surface Water and Small Watercourses Flood Map indicates parts of the site are located within Flood Zones 2 and 3, see Figure 5. Flood Zone 2 is defined as areas with a 0.1 to 1% annual probability of flooding from surface water and/or small watercourses, including the effects of climate change. Flood Zone 3 is defined as areas with a greater than 1% annual probability of flooding from surface water and/or small watercourses, including the effects of climate change.

The greatest risk of flooding occurs along the northeastern boundary of the Site, as surface water can accumulate in the topographic depression caused by the raised road level of the adjacent A483, see Figure 2 and Figure 5. A small area below Hafod House is also located within Flood Zone 3 and is likely to be attributed to surface water pooling. Flood risk associated with the small watercourse close to the southwestern corner of the site is the likely cause for the designation of Flood Zone 2 in this region. All infrastructure including panels, fences and temporary compound have been located outside of the at-risk areas.



Figure 5 - Flood Map for Planning Wales - Surface Water and Small Watercourses

3.3 Historic Flooding

The Flood Map for Planning Recorded Flood Extents have been reviewed to understand the history of flooding at the development site. Online mapping indicates there have been no historic flood events recorded by NRW at or near the development site. The closest recorded extent is approximately 1 km southwest of the site boundary.

3.4 Reservoir Flood Risk

The Flood Map for Planning Wales reservoir flood risk map indicates the Site is not at risk from reservoir flooding.

3.5 Groundwater Flood Risk

Groundwater flooding is defined as the emergence of groundwater at ground level. A review of Soilscapes online mapping service has indicated that the soils underlying the site are slowly permeable and seasonally wet with impeded drainage. BGS mapping indicates that the site is underlain by mudstones with superficial till deposits and borehole records in the vicinity of the site report groundwater levels at depths between 2.5 and 6 m, below the layer of glacial till. Therefore, groundwater flood risk is not considered to be significant.

4 Flood Consequence Assessment

4.1 Planning Policy

This FCA is required to fulfil the guidance outlined in section A1.17 of TAN15[2].

4.2 Justification for Development

The Proposed Development will result in a change of vulnerability classification from less vulnerable to mixed vulnerability. The solar panel array is classed as less vulnerable; however, the two proposed substations are classed as highly vulnerable infrastructure.

The proposed infrastructure locations have been located to avoid all areas of surface water flooding identified within the Flood Map for Planning Wales - Surface Water and Small Watercourses flood map, see Figure 6.

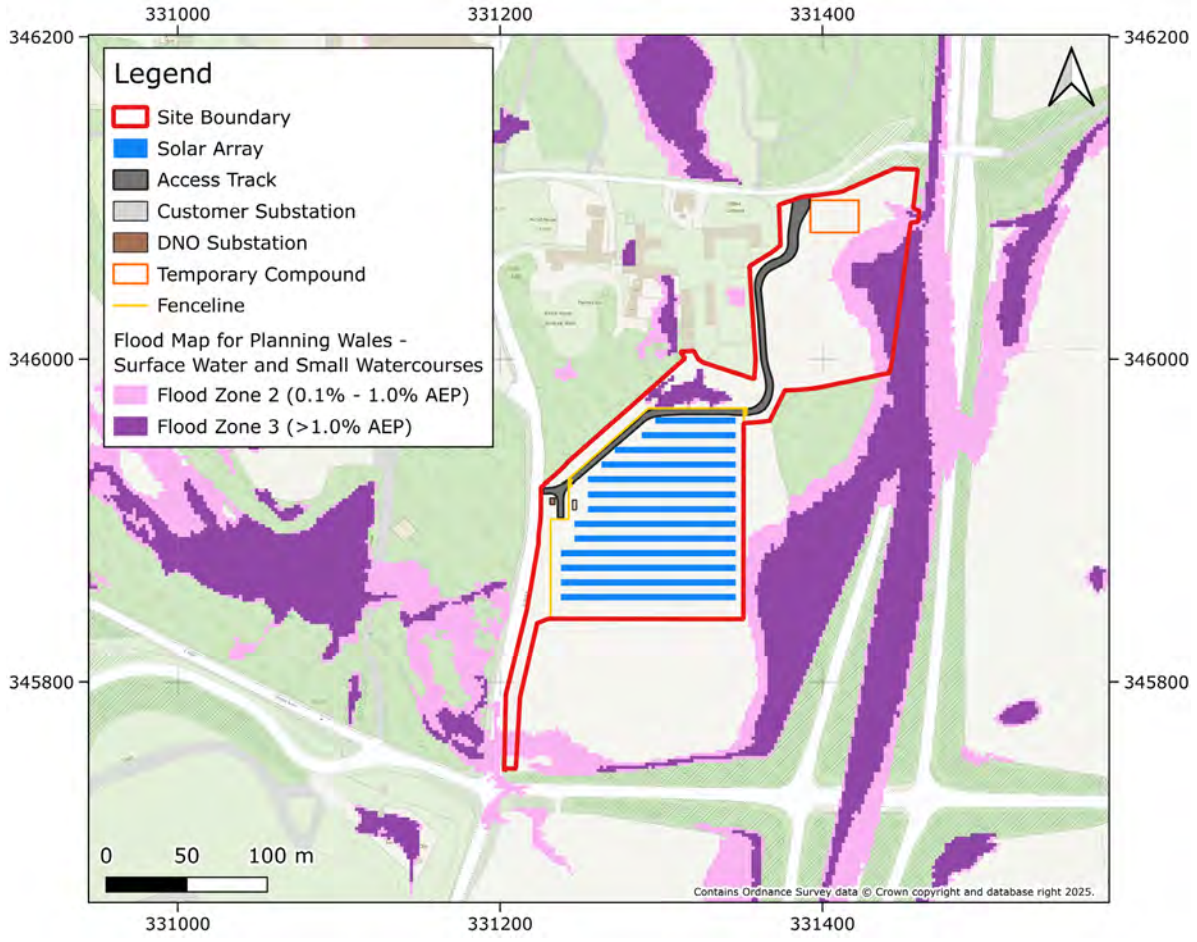


Figure 6 - Flood Map for Planning Wales - Surface Water and Small Watercourses Flood Zones and the Proposed Development

4.3 Third-Party Impacts

As no infrastructure has been proposed within the areas of flood risk, it is assumed the development will have no impact on the existing flood extents.

4.4 Access and Egress

Access to the site will only be required on a maintenance basis as no permanent or semi-permanent staff will be required for the development. Therefore, access and egress during a flood event is not required.

5 Management of Surface Water Runoff

5.1 Correspondence with SAB

A meeting with Wrexham SAB was held on 26th March 2025, during which principles of the drainage design for the development were discussed. The following points were agreed upon:

- Attenuation should be provided for tracks and substation areas, designed according to the 1 in 100yr plus 30% climate change (6hr) event.
- Solar panels will not have a significant impact upon runoff and therefore do not require any formal drainage provision.
- Infiltration testing should be carried out (will be set as a condition of approval of the SuDS) so as to provide evidence that infiltration methods are suitable at the Site.

5.2 Infiltration Potential

To assess the viability of the site for infiltration, a BGS SuDS GeoReport was acquired to provide a preliminary assessment of the ground conditions. This report details information on the suitability of the subsurface of the site for the installation of infiltration SuDS.

The BGS SuDS GeoReport indicates that very significant constraints are associated with the use of infiltration SuDS at the site. These constraints are noted as:

- Persistent or seasonally shallow groundwater;
- Groundwater depths likely less than 3 m; and
- Poorly draining bedrock deposits.

However, borehole records in the area indicate groundwater levels between 2.5 and 8m. Therefore, groundwater depths are more likely to be greater than 3 m. Furthermore, the permeability of the superficial deposits are described as “spatially variable, but likely to permit moderate infiltration”. As borehole records in the area indicate that topsoil thickness ranges from 0.2 to 0.4 m, the depths of infiltration SuDS will be kept within these limits. The presence of shallow groundwater and infiltration potential across the site will be confirmed through infiltration testing prior to construction.

5.3 Drainage Strategy

5.3.1 Solar Panels

The total area of the tables for the proposed solar array will cover 0.46 ha of the 2.9 ha site. As the panels are raised above the ground, leaving the natural surface below, they are not considered to contribute towards the total impermeable area of the site. To prevent water running off the panels being concentrated into a single drip line, intermediate gaps between panels will be included in the array to provide additional routes to reduce erosion below the lower point of the panels. Vegetation growing under and around the panels will intercept the water with some infiltrating to the soil beneath and some running off through the vegetation during more extreme events. Cook and McCuen (2011)[8] showed solar panels do not have a significant effect on hydrologic response (including runoff volumes), rather that ground cover is the most significant effect, more so than soil type, slope angle, and rainfall intensity.

Based on these factors, a suitable landscaping plan with a maintenance regime, is deemed to be sufficient to mitigate the impact of the panels. The land has already been planted with perennial

[8] Cook, L. M., & McCuen, R. H. (2011). Hydrologic response of solar farms, *Journal of Hydrologic Engineering,* 18(5), 536-541.

ryegrass from 'bare earth' maize crop, which will be maintained through the operational phase. The grass will be allowed to develop with occasional sheep grazing to minimise shading of panels from excessive growth. The grass under and adjacent to the panels will prevent erosion of topsoil and the maintenance plan will ensure its ongoing effectiveness. This will intercept and slow runoff to a greater degree than prior use of the land as arable farmland, as well as increasing the existing infiltration potential of the land. As a result of this landscaping, no significant increase in surface-water runoff is anticipated with the addition of solar panels on site.

5.3.2 Substations

Two substations are included within the proposed development with areas of 14.8 m^2 and 13.4 m^2. As the area of impermeable surfaces added by the substations is small relative to the area of the site, shallow crushed stone aprons around the perimeter of the buildings are anticipated to be sufficient. These will be 0.3 m deep and 0.75 m wide to create adequate runoff storage (2.55 m^3 combined assuming a porosity of 0.3)[7] and allow infiltration into the topsoil. Their locations are shown in Figure 7.

The use of the clean crushed stone surrounding the ancillary infrastructure is common practice for solar farm developments across the UK and deemed to be an appropriate measure to manage surface water run-off from small ancillary infrastructure at source. Consideration for the maintenance of these drainage features are given in Section 6.

5.3.3 Access Track

Approximately 1340 m^2 (0.134 ha) of access track are proposed within the development. These tracks are proposed to consist of two parallel gravel filled trenches with undisturbed earth between. Therefore, no additional impermeable areas will be created within the site as a result of the access track.

Given the nature of the access track construction, it is not considered necessary to provide any additional drainage features for this. To ensure the gravel trenches do not become preferential flow routes, impermeable barriers at appropriate intervals will be implemented where the gradient of the track is significant enough to potentially form preferential flow pathways.

5.4 Exceedance Flow Routes

If an event greater than the 100 yr + 30% climate change uplift occurs, the capacity of the SuDS features may be exceeded. Excess runoff will drain downslope towards the east of the site, away from the substations, see Figure 7. Due to the relative impermeability of the site, it is expected that the 0.02% increase in impermeable area is unlikely to have a significant effect on runoff volumes.

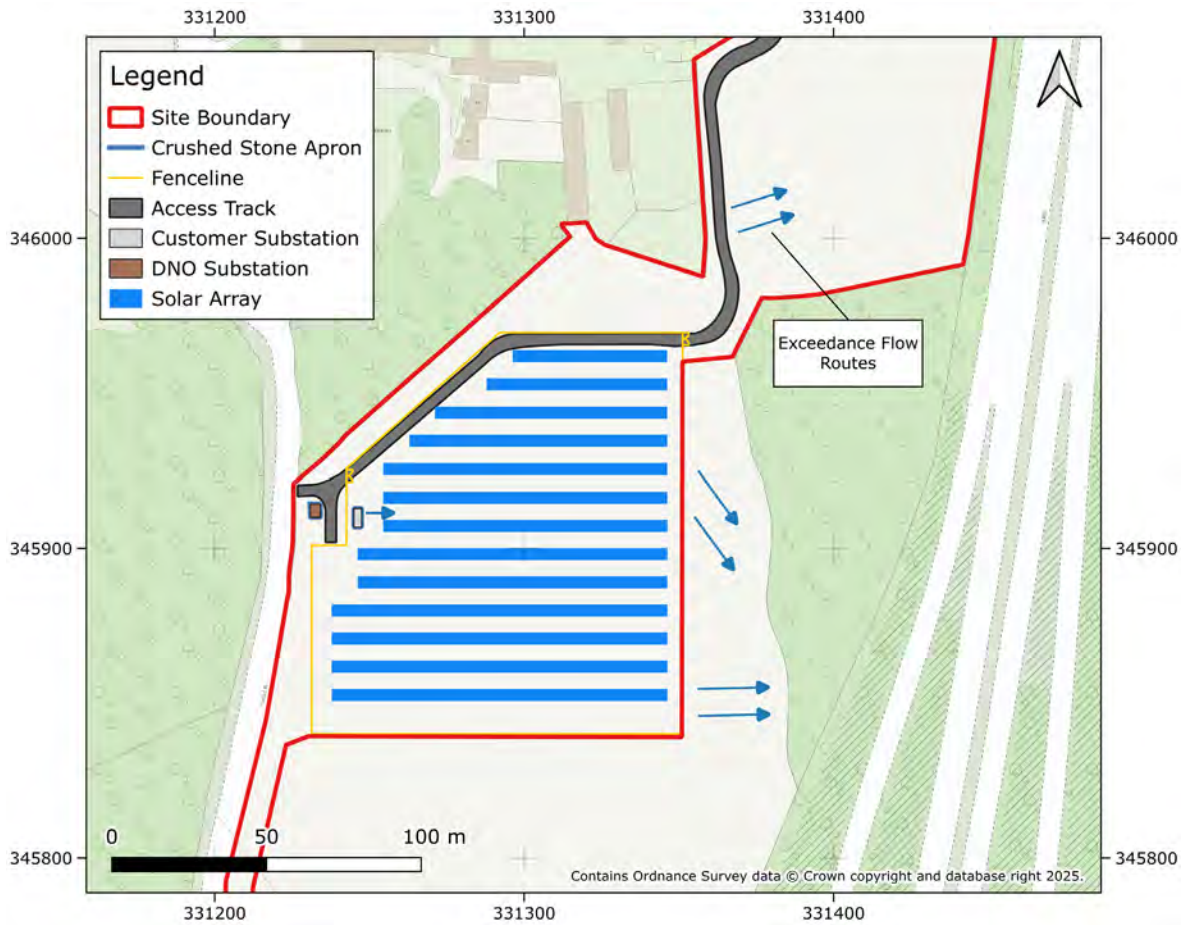


Figure 7 - Exceedance Flow Routes

6 Maintenance Plan

This section has been produced as per the guidance provided in the CIRIA SuDS manual[7].

Table 1 - SuDS Maintenance Plan

SuDS Feature	Maintenance Act	Frequency
Grass Under PV Panels	Inspect for problematic weeds and deal with them as required.	Annually or as required
	Inspect the ground at the toe of the panels and around structures for strips of bare soil (rilling). These areas will be scarified, the soil cultivated locally and reduced to a fine till and re-seeded with a grass/wildflower seed mix.	Annually
	Cut the grass to a minimum height of 50mm and remove cuttings from site.	Annually or as required
Crushed Stone Apron (Based off Table 16.1 in the CIRIA SuDS manual[7])	Remove litter (including leaves) and debris from the crushed stone apron surface, access chambers and pre-treatment devices.	Monthly or as required
	Inspect crushed stone apron surface for blockages, clogging, standing water and structural damage. Replace stone fill if performance deteriorates.	Monthly
	Inspect for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove or control tree roots where they are encroaching the sides of the crushed stone apron.	As required

7 Conclusions

This FCA and drainage strategy outlines how surface water will be managed during operational phases of the development and provides an overview maintenance plan for the SuDS features proposed. In summary:

- No infrastructure has been placed within the mapped flood zones.
- New landscaping will improve upon existing farmland by intercepting runoff and promoting sedimentation, filtration and infiltration.
- The substations will be surrounded by shallow crushed stone aprons to infiltrate and store any increases to runoff at the source.
- The track will be constructed of two gravel filled trenches which will promote good infiltration to the ground, therefore no additional SuDS features are proscribed for this feature. Impermeable barriers at appropriate intervals will be implemented within this feature to prevent it becoming a preferential flow pathway,
- No third-party impacts are anticipated as a result of this proposed development.
- As no permanent or semi-permanent staff are required at the site, access and egress during flood events is not required.