Woodwalton 2 Solar Farm

Flood Risk Assessment and Surface Water Drainage Strategy

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Basis of Report

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Table of Contents

Basis of Report ..... **i**
1.0 Introduction **1**
1.1 Administrative Context 1
1.2 Site Location 2
2.0 Project Description **3**
3.0 Site Details **4**
3.1 Topography 4
3.2 Hydrology 5
3.3 Geology and Hydrogeology 6
3.3.1 Soils 6
3.3.2 Geology 6
3.3.3 Hydrogeology 6
3.4 Existing Site Drainage 6
3.4.1 Site survey observations 6
4.0 Policy Status for Proposed Development **8**
4.1 Development Proposals 8
4.2 Flood Zone Classification 8
4.3 Planning Policy 9
4.3.1 Local Planning Policy 9
4.3.2 Flood Risk Compatibility 12
4.3.3 Sequential Test 12
4.3.4 Exception Test 12
4.4 Climate Change 13
4.4.1 Anticipated Lifetime of Development 13
4.4.2 Climate Change Allowances 13
4.4.3 Allowances for Peak River Flows 13
4.4.4 Allowances for Extreme Rainfall 14
5.0 Potential Sources of Flooding **15**
5.1 Methodology & Best Practice 15
5.2 Screening Study 15
5.2.1 Flooding from the Sea or Tidal Flooding 15
5.2.2 Flooding from Rivers or Fluvial Flooding 15
5.2.3 Flooding from Surface Water and Overland Flow 15
5.2.4 Flooding from Groundwater 17
5.2.5 Flooding from Sewers and Water Mains 17

5.2.6 Flooding from Reservoirs, Canals, and other Artificial Sources 17
5.2.7 Flooding from Infrastructure Failure 18
5.3 Summary of Flood Screening 18
6.0 Detailed Assessment of Flood Risk 19
6.1 Historic Flood Records 19
6.2 Flood Defences 19
6.3 Fluvial Modelling 19
6.3.1 JFLOW Model Results 19
6.4 Design Datum 21
7.0 Flood Risk Management Measures 23
7.1 Design Flood Levels 23
7.2 Surface Water Drainage 23
7.3 Risk to Human Health 23
8.0 Surface Water Drainage Strategy 24
8.1 Context 24
8.2 Key Principles of Surface Water Management 24
8.2.1 Overview 24
8.2.2 National Policy Context 25
8.2.3 Local Policy Context 25
8.3 Existing Surface Water Drainage Regime 25
8.3.1 Pre-Development Runoff Rates (Greenfield) 25
8.4 Constraints on the use of SuDS 26
8.4.1 Geology 26
8.4.2 Topography 26
8.4.3 Hydrology and Flooding 26
8.4.4 Site Constraints 26
8.5 Proposed Discharge Arrangements 26
8.6 Conceptual Surface Water Drainage Strategy 27
8.7 SuDS Attenuation Storage 27
8.7.1 Swale 28
8.8 SuDS Performance: Water Levels 28
8.9 SuDS Attenuation Performance: Discharge 28
8.10 SuDS Performance Assessment: Water Quality 28
8.11 SuDS Operation Maintenance Requirements 30
8.11.1 Swale 30
8.12 Exceedance 31
9.0 Conclusion 32

9.1 Flood Risk 32
9.2 Surface Water Drainage Strategy 32
9.3 Emergency Planning 32

Tables in Text

Table 4-1: Flood Risk Vulnerability and Flood Zone 'compatibility' 12
Table 4-2: Peak River Flow Allowances by River Basin District (based on a 1961 to 1990 baseline) 13
Table 4-3: Peak Rainfall Intensity Allowance in Small and Urban Catchments 14
Table 5-1: Potential Risk Posed by Flooding Sources 18
Table 8-1: Greenfield Runoff Rates Analysis 26
Table 8-2: Suitability of Surface Water Disposal Methods 27
Table 8-3: Summary of SuDS Performance Attenuation Volumes 28
Table 8-4: Pollution Hazard Potential for the Proposed Development 29
Table 8-5: SuDS Mitigation Indices for Discharges to Surface Water for the Proposed Development 29
Table 8-6: SuDS Performance: Water Quality Indices Assessment – Swale 30
Table 8-7: Typical Swale Maintenance Requirements 30

Figures in Text

Figure 1-1: Site Location Plan 1
Figure 3-1: Satellite Imagery of the Site 4
Figure 3-2: LiDAR Data 5
Figure 4-1: Environment Agency Flood Map for Planning 9
Figure 5-1: Surface Water Flood Map 16
Figure 6-1: JFLOW Model Results -1% AEP 20
Figure 6-2: JFLOW Model Results-0.1% AEP 21
Figure 6-3: Adopted Design Datum for the Site 22
Figure 8-1: Four Pillars of SuDS (extract from CIRIA Report C753) 24

Appendices

Appendix A **Site Masterplan**
Appendix B **Topographic Survey**
Appendix C **Sawtry IDB District Plan**
Appendix D **Environment Agency Response**
Appendix E **Conceptual Drainage Strategy**
Appendix F **Post-Development Runoff Calculations**

1.0 Introduction

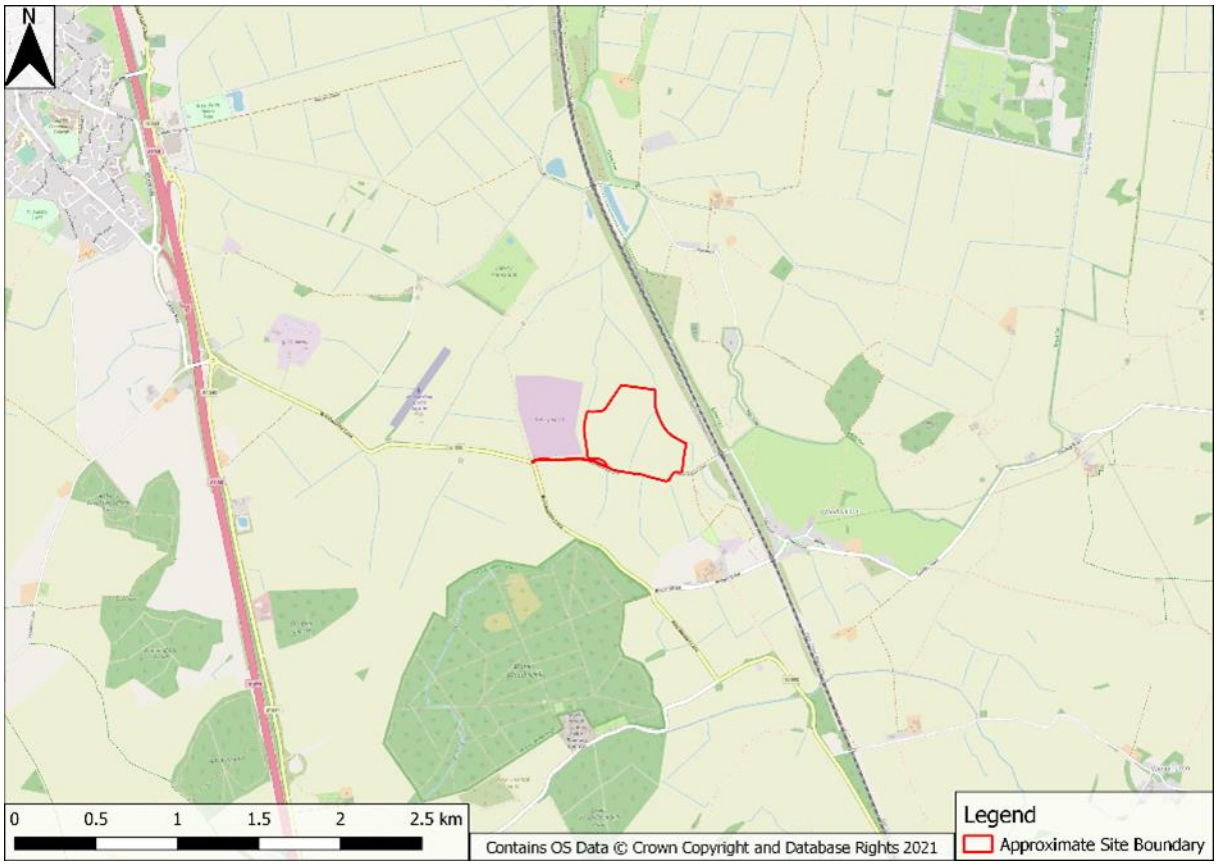
SLR Consulting Limited (SLR) has been appointed by Anesco Ltd (Anesco) to produce a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) for a proposed Solar Farm at Woodwalton, on land north of Double Bank Lane, PE28 5YL (the Site).

This FRA has been prepared by SLR, under the direction of a Technical Director of SLR who specialises in flood risk and associated planning matters. Reporting has been completed in accordance with guidance presented within the National Planning Policy Framework[1] (NPPF) and its associated Planning Practice Guidance[2] (PPG), taking due account of current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533[3].

1.1 Administrative Context

The proposed development falls within the planning jurisdiction of Cambridgeshire County Council and Huntingdonshire District Council. Cambridgeshire County Council additionally acts as the Lead Local Flood Authority (LLFA) for the area. The Middle Level Commissioners and Sawtry Internal Drainage Board (IDB) have a duty to co-operate with the LLFA regarding local flood risk strategies.

Figure 1-1: Site Location Plan



1 National Planning Policy Framework: Communities and Local Government (Updated July 2021)
2 Planning Practice Guidance: Communities and Local Government (Updated August 2022)
3 BS8533:2017, Assessing and managing flood risk in development: Code of Practice (December 2017)

1.2 Site Location

The Site is centred on National Grid Reference (NGR) TL 20529 81515, covering an area of approximately 24ha. The Site is located to the north west of Woodwalton village, adjacent to the established Double Bank solar farm development, immediately west of the Site. The southern boundary of the Site is defined by Double Bank Lane, a track that runs from the B1090 Woodwalton Lane in the west to New Road in the east, with agricultural land further south. Agricultural fields bound the Site to the north and east, with the East Coast Main Line further east, running north west to south east.

A number of field boundary drainage ditches are mapped around the Site and were observed during the Site survey. Ditches are evident along or immediately adjacent to all boundaries, with the ditch defining the southern end of the western boundary and the ditch defining the north eastern boundary managed by Sawtry IDB. A further unnamed drain runs in a north east to south west direction through the Site, referred to as ‘the central drain’ in this report.

2.0 Project Description

This FRA has been prepared in support of the proposal for a solar farm for solar energy generation on the Site.

The proposed development involves the installation of solar photovoltaic (PV) panels and construction of associated infrastructure, including a DNO[4] substation, customer substation, and ancillary equipment including security fencing.

An indicative Site layout is shown in Appendix A. The Site boundary has been determined following preliminary environmental studies of the wider area that included adjoining fields, with the proposed development being restricted to those areas of land that are not considered likely to affect sensitive environmental assets.

The PV panels would be arranged in a series of arrays running west to east across the Site. The panels would be angled to maximise the capture of solar energy, facing south. The PV panels would be bolt anchored to a metal frame (‘table’), which would be mounted on steel posts driven or screwed into the ground, to a depth of 1-2m depending on ground conditions. Cables would be routed around the Site on cable ladders, raised off the ground.

4 Distribution Network Operator

3.0 Site Details

A Site walkover survey was carried out on 20/04/2021 to supplement the findings of this report.

The Site is undeveloped and is currently comprised of arable/ grassland with some vegetated areas along the drainage channels. Satellite imagery detailing the current Site land use is provided in Figure 3-1.

Figure 3-1: Satellite Imagery of the Site



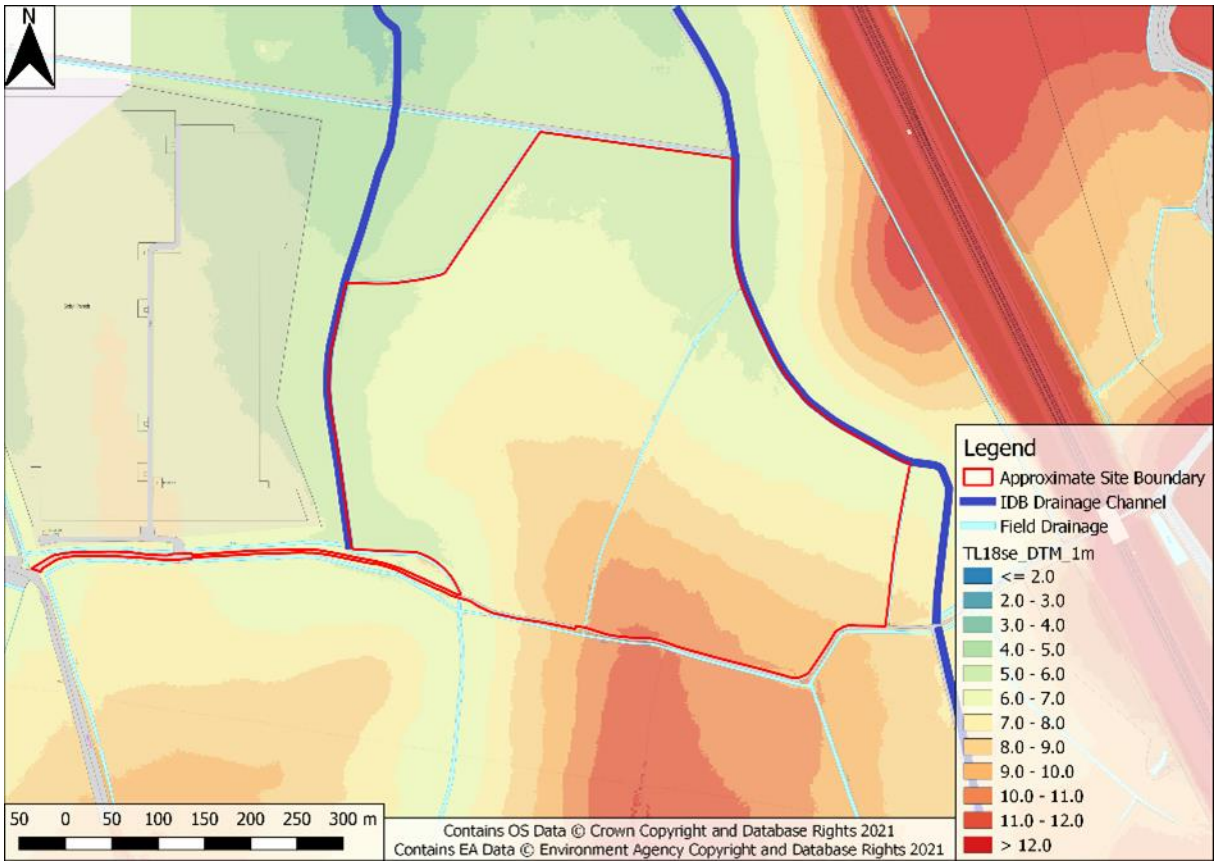
3.1 Topography

LiDAR topographic data for the Site and immediate locality has been downloaded from the Environment Agency (EA) open data website[5] and is contained in Figure 3-2 which shows bare earth elevation data using a Digital Terrain Model (DTM), excluding built features and vegetation.

LiDAR analysis indicates the Site is situated on a steady south to north downslope towards Woodwalton Fen National Nature Reserve, around 2.5km to the north east of the Site. Topography across the Site falls from a topographic high of about 11.0m above Ordnance Datum (aOD) in the south, to a low of approximately 5.0m aOD in the north and west. Topography falls from the centre of the southern Site boundary, sloping to the north, north east and north west towards the boundary drainage ditches.

5 Environment Agency open data website, http://environment.data.gov.uk

Figure 3-2: LiDAR Data



A topographic survey of the Site was undertaken by 3D Land Surveys Ltd in January 2021 and a copy of the survey plan is attached as Appendix B. The topographic survey data generally confirms the findings published in the LiDAR data, showing a fall in elevation away from the centre of the southern Site boundary at a high of 11.21m (AOD), sloping to the west, north and east from this point towards the boundary drains. The head of the central drain is also noted close to this high point, approximately 15m from the southern Site boundary. The low point of 4.70m lies at the vegetated extent of the Site, approximately halfway along the western boundary.

3.2 Hydrology

As stated in Section 1.1, the Site lies within the Sawtry IDB management district, with the IDB responsible for the channels local to the Site identified in Figure 3-1. These channels flow northwards along the western and north eastern site boundaries. A full District Plan of the Sawtry IDB management area is included at Appendix C.

Additional unnamed channels lie along the northern and north western Site boundary, adjacent to Double Bank Road which marks the southern Site boundary, the south eastern Site boundary, and along the central drain which cuts through the middle of the Site. These channels all connect into the IDB channels which drain to a common channel beyond the Site boundary to the north, before passing under the railway embankment and then discharging to the Middle Level Catchwater drainage network to the north east.

The corridor of the IDB drainage channel along the western boundary of the site is noted to be at high risk of fluvial flooding (Flood Zone 3), as defined by EA[6], this area corresponds to a measured low point of the Site discussed in Section 3.1.

3.3 Geology and Hydrogeology

3.3.1 Soils

The National Soils Resources Institute, Soilscapes website[7], indicates that soil composition across the Site comprises wholly of *'Lime-rich loamy and clayey soils with impeded drainage'*, further classified as *'slightly impeding drainage'*.

3.3.2 Geology

British Geology Survey (BGS) mapping[8] indicates that the area is completely underlain and surrounded by the Oxford Clay Formation – Mudstone. There are no superficial deposits present on Site nor any made ground.

3.3.3 Hydrogeology

Review of the online MAGIC mapping[9] indicates that bedrock at the Site is designated as an Unproductive Aquifer, defined as *'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'*.

The Site is not located within a Source Protection Zone (SPZ).

3.4 Existing Site Drainage

The Site is currently undeveloped and is not therefore expected to be served by a formal drainage system, other than the existing field drainage ditches. Incidental rainfall is expected to drain via a combination of evaporation, infiltration into the underlying soil and into the existing surface water drainage channels which are present across the Site. Any excess overland flow is likely to follow the topography and flow to the existing surface water drainage channels which bound the Site to the west, north and east.

3.4.1 Site survey observations

The Site walkover indicated that the IDB channels along the Site boundary and downstream of the Site to the north are generally well maintained and free of significant obstruction. The smaller drainage channels were less well defined and tended to be shallower channels with some vegetation noted within the channel profile.

The head of the IDB drain along the western boundary had some evidence of established vegetation within the channel and some shallow standing water was observed. The western IDB channel was approximately 1.5m in depth and 3.5m to 4.0m in width at the top of bank. Where the Site boundary breaks away from the IDB channel at the approximate mid-point of the western boundary, the channel passes through a concrete pipe culvert to facilitate a field access point. Further north, the IDB channel passes through another culverted track crossing. Evidence of recent (within the last 12 months) top of bank flow was visible along the reach of the drain downstream of the Site, from deposited vegetation debris at the high-water point.

6 Flood Map for Planning, https://flood-map-for-planning.service.gov.uk/

7 Soilscapes online soil map, Cranfield Soil and Agrifood Institute, http://www.landis.org.uk/soilscapes/

8 BGS Geology of Britain Viewer, available at http://mapapps.bgs.ac.uk/geologyofbritain/home.html.

9 Magic Map, DEFRA, https://magic.defra.gov.uk/MagicMap.aspx

The north eastern IDB channel was estimated to be between 2.0m and 2.5m in depth with a top of bank width of approximately 4.5m. This is a well defined, steep sided, v-shaped channel and some limited flow was evident at the time of survey (<5.0 l/s). The upstream catchment for the channel includes field drains to the south east of the Site and flow from the west of the Site which passes under the railway embankment via a culvert and then flows into the IDB channel via pipe under the field adjacent to the Site.

The head of the central drain was situated on the higher ground close to the middle of the southern Site boundary. The channel at this point was dry and relatively shallow. The smaller drainage channels along the north west Site boundary and the south east Site boundary were noted to be dry. The ditch adjacent to the southern Site boundary was dry apart from at the western extent of the Site where standing water was noted.

Evidence of boggy ground within the field was noted at the south east extent of the Site, with some standing water visible and some improvised field drainage evident connecting to the adjacent field ditch.

4.0 Policy Status for Proposed Development

4.1 Development Proposals

The development proposals are for a solar farm comprising solar energy generation.

Annex 3: Flood risk vulnerability classification within the PPG (Flood Risk and Coastal Change), '*infrastructure for electricity supply including generation, storage and distribution systems*' (which it is assumed also covers solar power generation) are classified as '*Essential Infrastructure*'.

4.2 Flood Zone Classification

The definition of EA Flood Zones is provided in PPG *Table 1: Flood Zones*:

- *Zone 1 - Low Probability* (Flood Zone 1) is defined as land which could be at risk of flooding from fluvial or tidal flood events with less than 0.1% annual probability of occurrence i.e. considered to be at 'low probability' of flooding.
- *Zone 2 - Medium Probability* (Flood Zone 2) is defined as land which could be at risk of flooding with an annual probability of occurrence between 1% and 0.1% from fluvial sources and between 0.5% and 0.1% from tidal sources i.e. considered to be at 'medium probability' of flooding.
- *Zone 3a - High Probability* (Flood Zone 3a) is defined as land which could be at risk of flooding with an annual probability of occurrence greater than 1% from fluvial sources and greater than 0.5% from tidal sources i.e. considered to be at 'high probability' of flooding.
- *Zone 3b - the Functional Floodplain* (Flood Zone 3b) is defined as land where water has to flow or be stored in times of flood. Local Planning Authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain in agreement with the EA. In the absence of definitive information, it is often defined as land that would flood with an annual probability of occurrence of 5% or greater.

Based upon the EA Flood Map for Planning[10] the Site lies mostly in Flood Zone 1 apart from the corridor of the IDB drainage channel along the western boundary which is in Flood Zone 3 as shown in Figure 4-1. The Strategic Flood Risk Assessment (SFRA) prepared by Huntingdonshire District Council[11] confirms that the Flood Zone 3 mapped along the western boundary is Flood Zone 3a and is not part of the functional floodplain.

10 Flood Map for Planning, https://flood-map-for-planning.service.gov.uk/

11 Huntingdonshire District Council Level 1 and Level 2 Strategic Flood Risk Assessment, JBA Consulting, June 2017

Figure 4-1: Environment Agency Flood Map for Planning



4.3 Planning Policy

This FRA report has been completed in accordance with the guidance presented in the NPPF[1] and with reference to PPG[2]. The NPPF states that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and develop policies to manage flood risk from all sources taking account of advice from the EA. It is crucial that Local Planning Authorities consider the risks posed by flooding within their boundary when determining planning applications.

4.3.1 Local Planning Policy

The Site lies under the jurisdiction of Huntingdonshire District Council. The Huntingdonshire Local Plan[12] was adopted in May 2019, setting out visions and policies for future development until 2036.

The following policies have been developed in order to manage sources of flooding and drainage:

LP 5 Flood Risk

1. *Location of development*

A proposal will only be supported where all forms of flood risk, including breaches of flood defences or other defence failures, have been addressed, as detailed in the National Planning Practice Guidance and with reference to the Cambridgeshire Flood and Water Supplementary Planning Document (SPD), such that:

12 Huntingdonshire Local Plan, adopted 2019, Huntingdonshire District Council

a. the sequential approach and sequential test are applied and passed, having regard to actual and residual flood risk and including consideration of the impact of climate change;

b. if necessary the exception test is applied and passed;

c. development has been sequentially located within the site to avoid flood risk;

d. all reasonable opportunities to reduce overall flood risk have been considered and where possible taken;

e. the integrity of existing flood defences is not adversely affected and any necessary flood mitigation and compensation measures have been agreed with relevant bodies and the Council; and

f. the requirements relating to flood risk set out in the Cambridgeshire Flood and Water SPD have been applied.

Any reliance on emergency services to make a proposal safe will not be acceptable. Safety risks will be determined with reference to the Defra guidance on flood risk safety FD2320 or successor guidance, on the basis that development should be 'safe for all' for a 1:1000 annual probability flood event, for the lifetime of the development.

2. *Previously developed land in defended areas*

   Where a proposal for redevelopment of Previously Developed Land (as defined in the 'Glossary') which benefits from flood defences is deemed appropriate following application of the sequential test and exception test it will be supported where:

   g. breach modelling has been completed to determine the residual risk in all instances for new vulnerable development; and

   h. safe access and egress can be provided with approval from the emergency planning authority that there is no additional reliance on their services as a result of the development.

3. *Managing flood water*

   Where a proposal is considered to be acceptable within the 1% annual probability flood extent (flood zone 3), including an allowance for climate change for the lifetime of the development, the development must not result in a loss of flood storage capacity, reduced flow performance, increase the rate of flooding onset or result in an unsustainable form of flood storage requiring on-going silt removal, maintenance or renewal.

   Where a proposal would occupy functional flood plain (flood zone 3b), the developer must ensure that it does not impact upon the ability of the floodplain to store or convey water, and seek opportunities to provide floodplain betterment. Development will only be support where it results in no loss of floodplain performance within the undefended floodplain.

   Where ground levels are proposed to be raised to bring the development out of the floodplain compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume and performance of floodplain storage is not reduced or vulnerability to climate change impacts increased.

4. *Site-specific flood risk assessments*

   On a site that is at risk of flooding from any form, where there are critical drainage problems or on sites of 1 hectare or more the proposal will only be supported where a site-specific flood risk assessment has been produced, appropriate to the scale and nature of the development and risks involved, including consideration of the impact of climate change, and is agreed with relevant bodies. Such assessments will need to demonstrate that they comply with the requirements set out:

   i. in the Cambridgeshire Flood and Water SPD or successor documents;

   j. by any applicable responsible authority, including but not limited to the Environment Agency and Cambridgeshire County Council, as Lead Local Flood Authority; and

   k. by the Middle Level Commissioners or internal drainage boards, as may be applicable.

LP 15 Surface Water

A proposal will only be supported where surface water has been considered from the outset as an integral part of the design process and:

a. the proposal incorporates sustainable drainage systems (SuDS) in accordance with the Cambridgeshire Flood and Water Supplementary Planning Document (SPD) or successor documents and advice from Cambridgeshire County Council as Lead Local Flood Authority, unless demonstrated to be inappropriate;

b. provisions are put in place to ensure that SuDS will be maintained;

c. if the drainage system would directly or indirectly involve discharge to a watercourse that the Environment Agency are responsible for the details of the discharge have been agreed with them;

d. if a road would be affected by the drainage system the details have been agreed with the relevant highway authority;

e. if the drainage system would discharge water to systems controlled by the Middle Level Commissioners or an internal drainage board their standing advice or guidance has been taken into account and the details of the discharge have been agreed with them;

f. if the drainage system would directly or indirectly involve discharge to the river Great Ouse the incorporation of water retaining features as part of the drainage system have been prioritised; and

g. there is no adverse impact on, or unacceptable risk to, the quantity or quality of water resources or on meeting the objectives of the Water Framework Directive and the Habitats Directive.

SuDS for hard-standing areas for parking of 50 or more cars, or equivalent areas will be expected to include appropriate additional treatment stages/ interceptors to ensure that any pollution risks are suitably addressed.

In order to safeguard against the pollution of ground water the use of deep infiltration SuDS, such as deep borehole soakaways, will not be accepted in most circumstances. Exemptions will only be made in exceptional circumstances if the proposal is for land uses that pose a very low pollution risk and are supported by an adequate risk assessment, conceptual site model and detailed design.

4.3.2 Flood Risk Compatibility

As discussed in Section 4.1, the proposed development is classified as 'Essential Infrastructure' and would be located partly within Flood Zone 3a.

PPG Table 3: Flood risk vulnerability and Flood Zone 'compatibility' (reproduced as Table 4-1) shows the Site must pass the Exception Test.

Table 4-1: Flood Risk Vulnerability and Flood Zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (PPG Table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a	Exception Test Required	x	Exception Test Required	✓	✓
	Zone 3b (functional floodplain)	Exception Test Required	x	x	x	✓

Key: ✓ Development is appropriate x Development should not be permitted

4.3.3 Sequential Test

NPPF Paragraph 168 advises that the aim of the Sequential Test is to '*steer new development to areas with the lowest risk of flooding*' and states:

'*Development should not be allocated or permitted if there are reasonably available Sites appropriate for the proposed development in areas with a lower risk of flooding.*'

The EA Flood Map for Planning (Figure 4-1) and SFRA are geared to providing the basis for applying this test and indicate that the Site is located partly within Flood Zone 3a. Under the Sequential Test development can however still proceed in higher flood risk areas provided that there are no reasonably available alternative Sites.

The development is for a solar farm comprising of PV arrays mounted upon steel posts which will essentially act as water compatible infrastructure. Assets that are not deemed water compatible, such as transformers and substations, are situated wholly within Flood Zone 1. The development is therefore deemed appropriate in line with PPG Table 3 (Table 4-1).

4.3.4 Exception Test

The Exception Test, as set out in paragraph 170 of NPPF, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

The Exception Test is required to show that the sustainability benefits of the proposed development to the community outweigh the flood risk. The sustainability benefits of the development are considered fully elsewhere in the planning application; however renewable energy generation is clearly a key element in reducing carbon emissions. The Exception

Test also must show that the development will be safe for its lifetime and will not increase the flood risk elsewhere.

As the proposed development is for '*essential infrastructure*' which is water compatible within Flood Zone 3a, and critical infrastructure located wholly within Flood Zone 1 (**Error! Reference source not found.**), the Exception Test is not required. Development in this area is therefore suitable.

4.4 Climate Change

PPG requires that consideration of future climate change is included in FRA reporting and should be considered over the project development lifetime.

4.4.1 Anticipated Lifetime of Development

PPG and best practice both recommend that for consideration of industrial development a 30-year development lifetime is assumed unless there is specific justification for considering a shorter period.

4.4.2 Climate Change Allowances

In May 2022, the EA issued updated guidance on the impacts of climate change on flood risk in the UK[13] to support NPPF. This guidance sets out that peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change.

The guidance acknowledges that in relation to certain factors there is considerable uncertainty with respect to the absolute level of change that is likely to occur. As such, in these instances, the guidance provides estimates of possible changes that reflect a range of different emission scenarios.

Concerns relating to offshore wind speed, wave height and sea level are only of relevance in contexts that are in direct proximity to the open coast or other large open bodies of water. This is not the case for this Site and therefore potential changes in these are not considered further.

4.4.3 Allowances for Peak River Flows

An extract of *Table 1 Peak Flow Allowances by River Basin District (use 1961 to 1990 baseline)* is reproduced as Table 4-2 for the Anglian River Basin District.

Table 4-2: Peak River Flow Allowances by River Basin District (based on a 1961 to 1990 baseline)

Management catchment	Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Old Bedford and Middle Level	Upper End	23%	22%	39%
	Higher Central	-9%	4%	15%
	Central	3%	-3%	6%

13 Environment Agency, Flood Risk Assessments: Climate change allowances, February 2016 (last updated May 2022)

The Environment Agency advises that for '*Essential Infrastructure'* uses in Flood Zone 3a, the '*Upper End'* allowance category should be used to assess the impact of climate change on flood risk at the Site. Over the 30-year lifetime of the proposed development, the impact of 22% increase in peak flow should therefore be assessed.

4.4.4 Allowances for Extreme Rainfall

For peak rainfall intensity the guidance states that flood risk assessments should assess both the '*Central*' and '*Upper End*' allowances to understand the range of impact. As detailed in Table 4-3, these equate to uplifts of 10% and 20% respectively given the 30-year development lifetime.

Table 4-3: Peak Rainfall Intensity Allowance in Small and Urban Catchments

Management Catchment	Annual Exceedance Probability (%)	Allowance Category	Total potential change anticipated for the '2050s' (up to 2060)	Total potential change anticipated for the '2070s' (2061 to 2125)
Old Bedford and Middle Level	3.3	Upper End	35%	35%
		Central	20%	25%
	1	Upper End	40%	40%
		Central	20%	25%

In line with Table 4-3, the surface water drainage strategy has been developed to take into account increases in rainfall intensity catchments of 40% over the 30-year lifetime of the proposed development.

5.0 Potential Sources of Flooding

5.1 Methodology & Best Practice

This report has been prepared in accordance with the advice and requirements prescribed in current best practice documents relating to management of flood risk in development published by the Construction Industry Research and Information Association (CIRIA)[14], and BS8533[3].

A screening study has been completed to identify whether there are any potential sources of flooding at the Site which may warrant further consideration. If required, any potential significant flooding issues identified in the screening study would then be considered in subsequent sections of the assessment.

5.2 Screening Study

There are a number of potential sources of flooding and these include:

- Flooding from the sea or tidal flooding;
- Flooding from rivers or fluvial flooding;
- Flooding from surface water and overland flow;
- Flooding from groundwater;
- Flooding from sewers and water mains;
- Flooding from reservoirs, canals, and other artificial sources; and
- Flood from infrastructure failure.

The flood risk from each of these potential sources is discussed below.

5.2.1 Flooding from the Sea or Tidal Flooding

The site is approximately 53km from the nearest section of coast at The Wash and lies outside of the subsequent floodplain.

The site is therefore not considered to be as risk from tidal flooding and therefore flooding from this source is not considered further.

5.2.2 Flooding from Rivers or Fluvial Flooding

The western boundary of the Site is situated partly in Flood Zones 2 and 3a corresponding to the floodplains of the western IDB drain. Given the potential changes in flood severity associated with climate change, it is possible that future flooding could extend further into the Site than illustrated by the flood zones.

Detailed assessment of fluvial flood risk is discussed further in Section 6.0.

5.2.3 Flooding from Surface Water and Overland Flow

As discussed in Section 3.1, the Site is located on the north-facing downslope with low to moderate slopes across the Site falling away from around the top of the central drain, close to the southern Site boundary. Illustrated by the LiDAR data (Figure 3-2), the raised ridge of land to the south could therefore form a source for overland flow to drain across the Site and into the western and eastern-boundary drainage channels, exacerbated by the impermeable

14 CIRIA Report C624, Development and flood risk: guidance for the construction industry

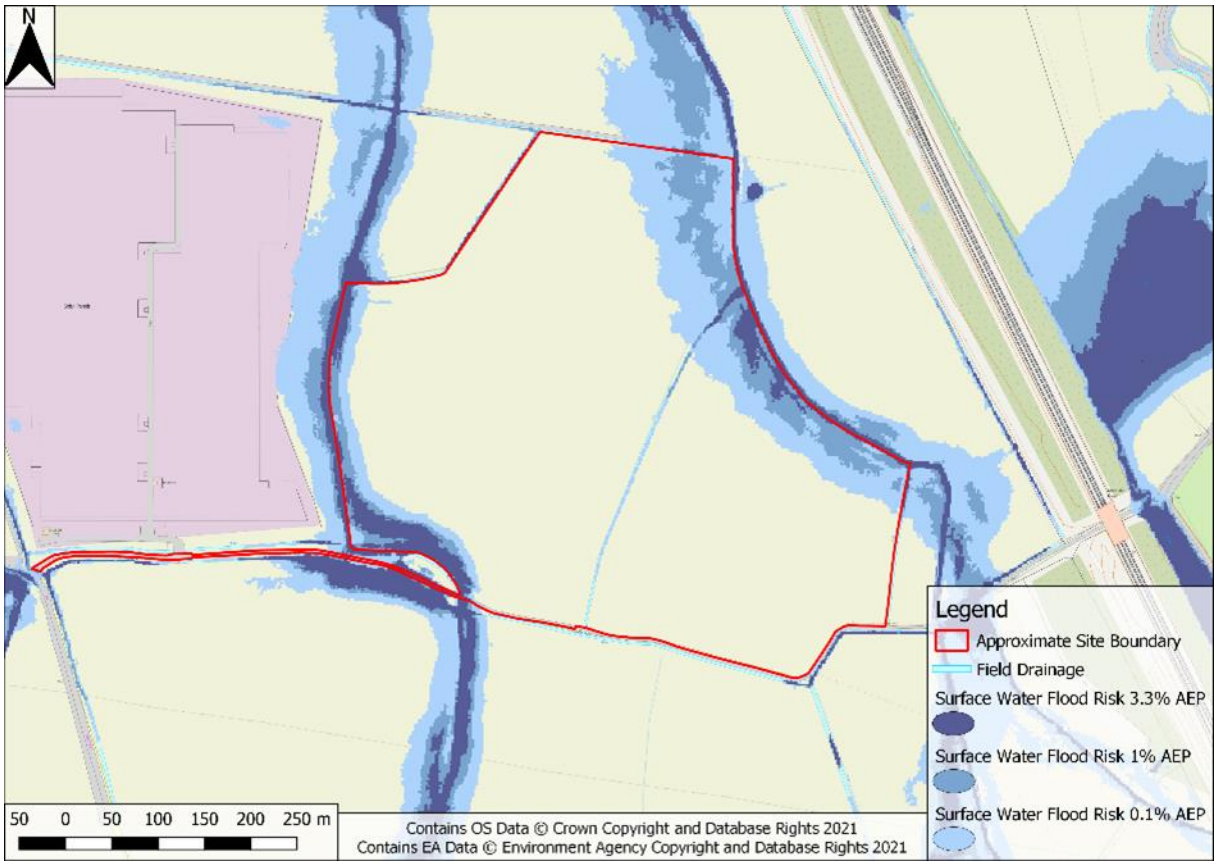
geology at the Site. However, the catchment of higher ground to the south is very small and any flow from this land would be intercepted by the drainage channel adjacent to the southern Site boundary. Significant flows draining onto the Site which could pose a risk to the development are not considered likely.

Long Term Flood Risk Information (LTFRI)[15] provided by the EA includes mapping of surface water flood risk. Surface water modelling has been undertaken by the EA in order to establish areas at risk of surface water flooding based upon latest hydrological techniques and surface terrain data.

An extract of the map for the Site and surrounding area is presented in Figure 5-1, where the EA define the surface water flood risk categories as:

- **Very Low:** less than 1 in 1,000 annual probability (0.1% AEP[16]) of flooding in any given year;
- **Low:** less than 1 in 100 annual probability (1% AEP) but greater than or equal to 1 in 1,000 annual probability (0.1% AEP) of flooding in any given year;
- **Medium**: between 1 in 100 annual probability (1% AEP) and 1 in 30 annual probability (3.33% AEP) of flooding in any given year; and
- **High:** greater than 1 in 30 annual probability (3.33% AEP) of flooding in any given year.

Figure 5-1: Surface Water Flood Map



15 Environment Agency, Long Term Flood Risk Information Service: https://flood-warning-information.service.gov.uk/long-term-flood-risk

16 Annual Exceedance Probability

The surface water flood mapping supports the conceptual understanding that the majority of the Site is at a '*very low'* or '*low'* risk of flooding and that there is very little potential for flows from the upgradient catchment area to drain onto the Site.

There are however areas of '*medium'* or '*high'* risk limited to the immediate corridor of the western and eastern boundary IDB drainage channels. Away from the drainage channels, any out of bank water on the main area of the site will remain shallow (<150mm for the 3.3% AEP and <300mm for the 1% AEP events), close to the immediate drainage channel corridors. There is also some limited risk to the access track serving the Site however this is not predicted to exceed 300mm depth for a 1% AEP event. Any elements of the proposed development in areas shown to be at risk area are deemed water compatible, rendering surface water flood risk to the proposals as negligible. This risk is therefore not considered further.

The risk associated with access to the Site and from the introduction of impermeable areas of development are discussed in Section 7.07.0 under flood risk management measures.

5.2.4 Flooding from Groundwater

Groundwater flooding can be defined as flooding caused by the emergence of water originating from subsurface strata. Groundwater flooding can occur where Sites are located on permeable ground. After a prolonged period of rainfall and groundwater recharge, a considerable rise in the water table can results in inundation for extended periods of time.

As discussed in Section 3.3, the Site is designated as an Unproductive aquifer, therefore groundwater flooding is unlikely to manifest at the Site. Additionally, the development is for a solar farm which comprises of water compatible steel posts anchored into the ground with all sensitive equipment raised off ground level. Groundwater emergence would not be a prevailing issue given that critical infrastructure is elevated with respect to onsite watercourses and any surface flow following emergence would become shallow overland flow to the open surface water channels around the Site.

The risk of flooding from Groundwater is therefore considered to be negligible and is not considered further.

5.2.5 Flooding from Sewers and Water Mains

Flooding from sewers or water mains inherently poses a risk at any Site. The Site is currently agricultural land, as is the majority of surrounding land (aside from the adjacent solar farm development), and is not therefore served by any sewers Although there is no known formal drainage / sewer serving the Site, mapping contained in Appendix A, the conceptual masterplan of the Site, does not indicate any interaction with sewage infrastructure within or around the Site due to it currently being undeveloped agricultural land.

The risk of flooding from sewers is not considered significant has not therefore considered further.

5.2.6 Flooding from Reservoirs, Canals, and other Artificial Sources

EA mapping[10] indicates the Site is not located with a zone at risk of reservoir breach or afforded flood protection.

Also, with reference to the 1:25,000 scale Ordnance Survey mapping, there are no canals or artificial sources upgradient of the Site which hold water above surrounding ground level.

Flooding from this source is therefore not considered further.

5.2.7 Flooding from Infrastructure Failure

The Site is not located near to any hydrological infrastructure of which failure would increase the flood risk.

Flooding from Infrastructure Failure is therefore low and not considered further.

5.3 Summary of Flood Screening

Table 5-1 summarises the flood screening assessment:

Table 5-1: Potential Risk Posed by Flooding Sources

Potential Source	Potential Significant Flood Risk at Site?
Sea or Tidal Flooding	No
Rivers or Fluvial Flooding	Yes
Surface Water and Overland Flow	No
Groundwater	No
Sewers and Water Mains	No
Reservoirs, Canals and other Artificial Sources	No
Infrastructure Failure	No

6.0 Detailed Assessment of Flood Risk

Section 5.0 highlights that the Site is at risk of flooding from fluvial sources and/or surface water sources. The flood risk to the site from these sources is evaluated below.

6.1 Historic Flood Records

EA records and the local SFRA do not highlight any recorded incidents of flooding either on or local to the Site. It should however be noted that, as arable farmland, flooding could have occurred but not have been historically reported.

6.2 Flood Defences

EA records show that there are no flood defences on or in close proximity to the Site and the Site does not benefit from any flood defence infrastructure associated with the fluvial flood risk presented by the watercourses of the Sawtry IDB.

6.3 Fluvial Modelling

A data request was submitted to the EA for detailed modelling of the local watercourses. The response received (Appendix D) indicates that the EA do not hold detailed modelling in this area. The mapped flood zones are based on broadscale JFLOW modelling which is coarse catchment scale modelling which returns flood depth data on a 5m x 5m grid.

Given the relatively flat, open rural landscape on and around the Site, it is considered that the JFLOW data will give a reasonable indication of potential flood risk to the wider development area from the western drainage channel.

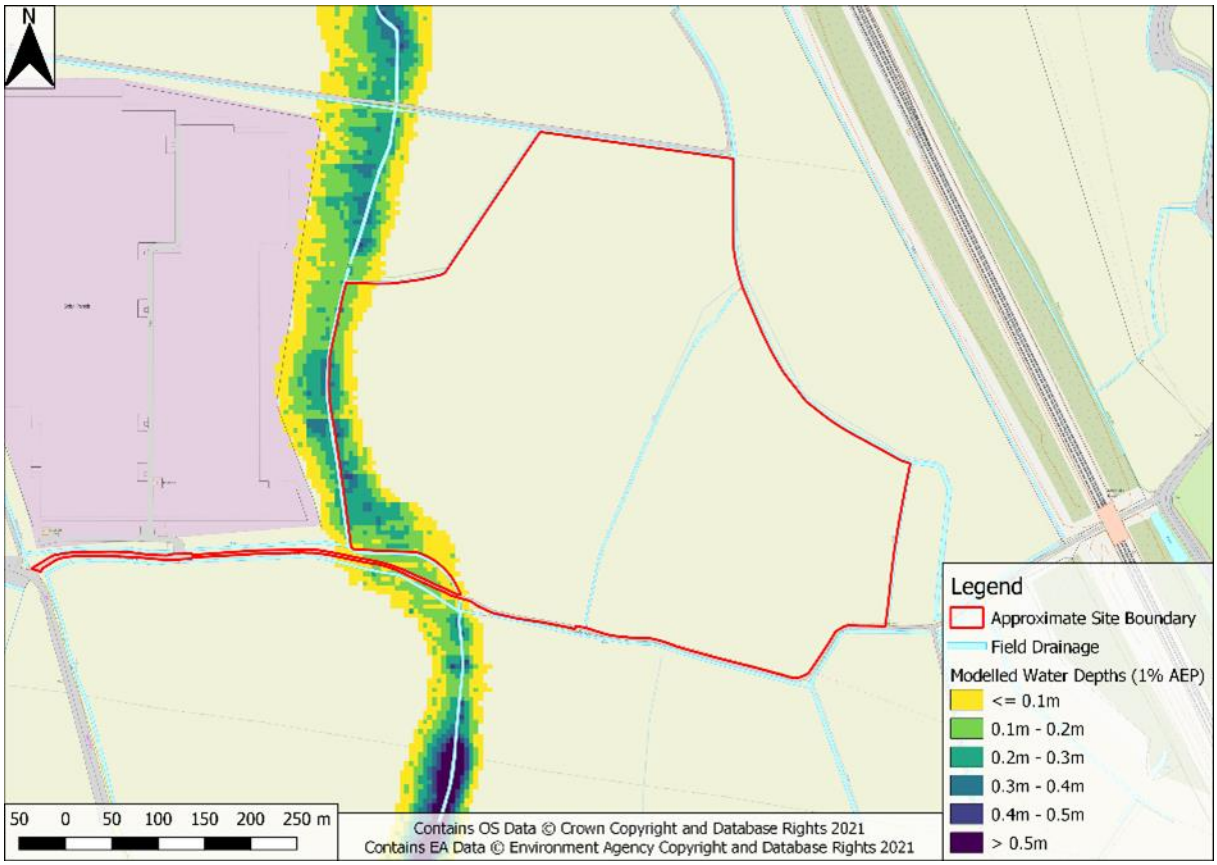
6.3.1 JFLOW Model Results

The JFLOW model data for grid square TL28SW was downloaded and is represented in Figure 6-1 and **Error! Reference source not found.** are included below for the 1% AEP and the 0.1% AEP[17] scenarios respectively. Both scenarios show the potential extent of flood risk being limited to the immediate corridor of the western IDB drainage channel. Reviewed against the Site topographical survey (Appendix B) and LiDAR data, the flood extent for both scenarios is approximately coincident with ground levels of 6.0m aOD at the southern (upstream) extent of the drainage channel on the Site boundary and 5.3m aOD at the northern (downstream) extent.

No fluvial flood risk is anticipated for the north eastern IDB drainage channel.

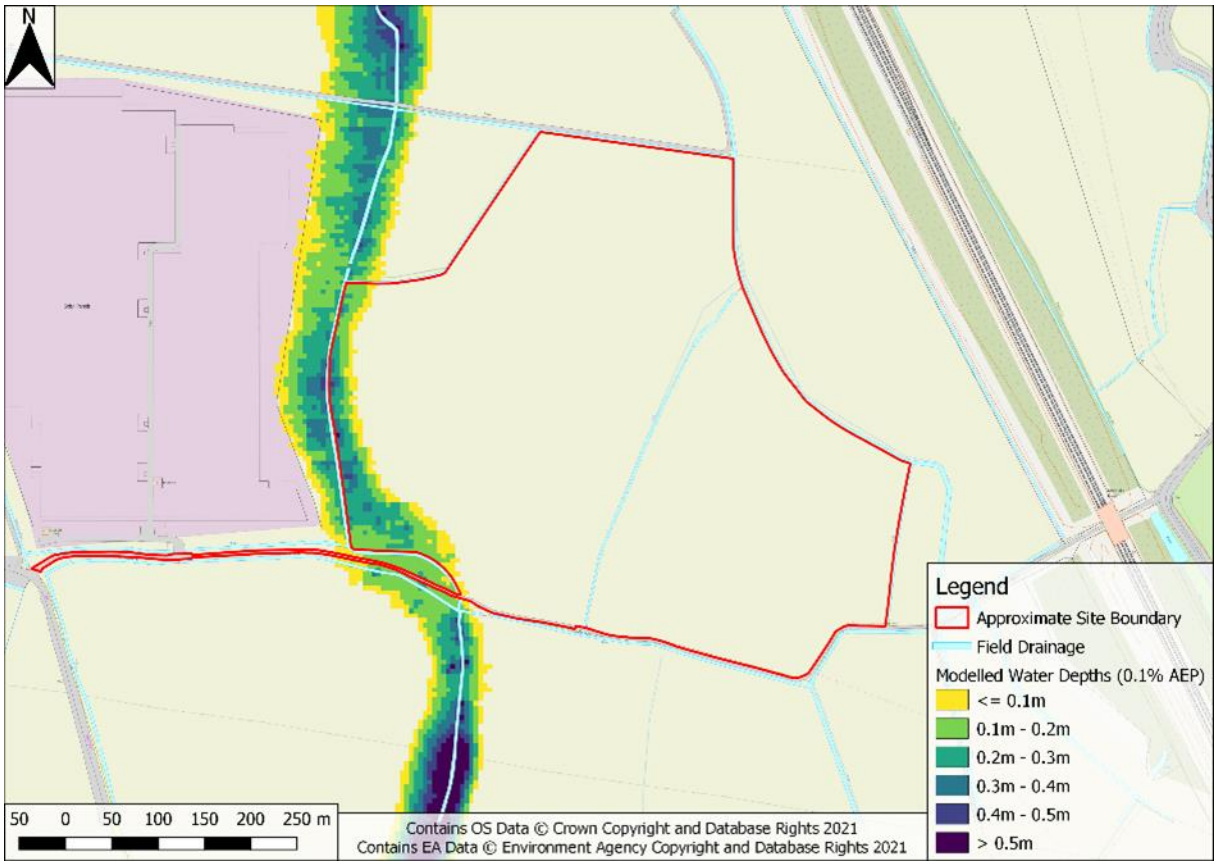
17 https://data.gov.uk/dataset/modelled-fluvial-flood-depth-data-created-2004-0-1-percent-annual-chance-for-grid-reference-tl, accessed April 2021

Figure 6-1: JFLOW Model Results -1% AEP



For the 1% AEP scenario, JFLOW model data along the western Site boundary indicates no depth of flooding greater than 0.48m, with greatest depths noted along the line of the channel. Predicted flood depths at the edge of the flood extents within the Site boundary are generally no greater than 0.1m.

Figure 6-2: JFLOW Model Results-0.1% AEP



For the 0.1% AEP scenario, JFLOW model data along the western Site boundary indicates no depth of flooding greater than 0.59m, with greatest depths noted along the line of the channel. Predicted flood depths at the edge of the flood extents within the Site boundary are generally no greater than 0.1m.

It is noted that other than the security fencing, no aspect of the proposed solar farm development is situated within Flood Zone 2, Flood Zone 3 or the extent of either JFLOW flood extents. Any potential for flooding onto the main Site area from the western IDB drainage channel beyond what is indicated by the JFLOW model data will be limited due to significantly lower ground elevations on land to the north of the Site.

6.4 Design Datum

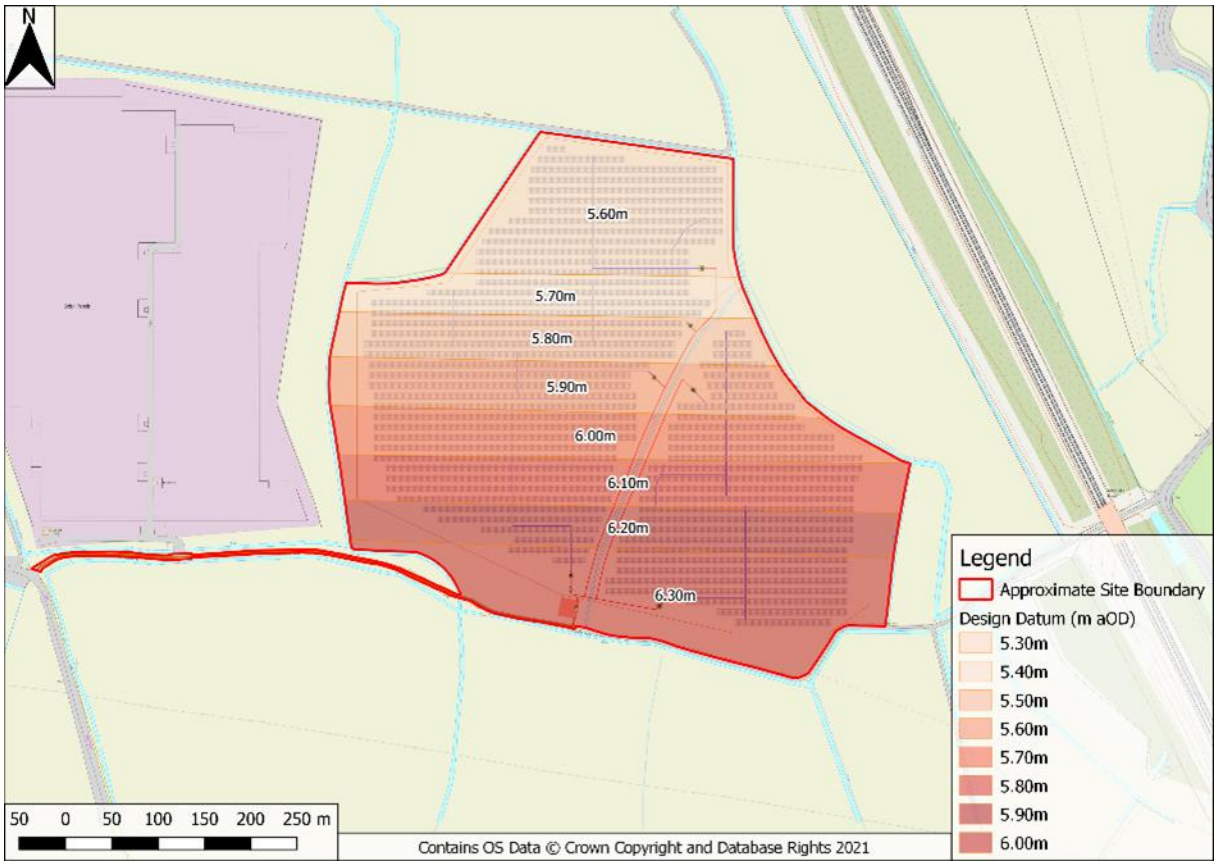
Section 4.4 sets out climate change allowances that need to be taken into consideration when considering flood risk over the life of the proposed development. For fluvial risk an uplift in flow of 22% on the current day 1% AEP event is required in order to define a peak water level datum for the Site.

In lieu of model information from the EA specific to the 1% AEP with a 22% climate change allowance applied, a reasonable value for a 100-year event plus climate change accommodation must therefore be extrapolated using professional experience and judgement. A conservative approach has been adopted for the development and the estimated peak water level for the 0.1% AEP event on the western IDB channel will be used to define the design datum for the Site.

As discussed in Section 6.3.1, the flood extent for the 0.1% AEP scenario is approximately coincident with ground levels of 6.0m aOD at the southern (upstream) extent of the drainage channel on the Site boundary and 5.3m aOD at the northern (downstream) extent. As such,

there is a falling design peak water level from upstream (south) to downstream (north), perpendicular to the western IDB drainage channel.

Figure 6-3: Adopted Design Datum for the Site



The lower edge of the PV panels is generally raised to 0.9m above adjacent ground level, with inverters raised above this level. From the topographical information at Figure 3-2 and the design datum set out in Figure 6-3 above it can be seen that there are no PV panels or associated sensitive infrastructure is situated on ground that is within an area at risk of fluvial flooding. This means that for the limited areas of the Site where the PV infrastructure is shown to be on land below the design datum, the solar array panels will remain above the datum and will not be at risk.

7.0 Flood Risk Management Measures

7.1 Design Flood Levels

The modelled flood information provided by the EA has been assessed and peak water levels estimated for a range of events. The design flood level for the Site has been estimated based on a 0.1% AEP flood event and from this a design datum for the Site has been established as discussed in Section 6.4.

With respect to this critical flood risk, vulnerable infrastructure within the development would be set so that it is resistant to flooding to an elevation that is at least 300mm above the design flood level (i.e. at or above the design datum specified for different areas of the Site in Figure 6-3). This includes the substation and other sensitive equipment essential to the operation of the solar farm.

No element of the design critical to the operation of the solar farm has been positioned in areas which would mean sensitive infrastructure could become submerged.

7.2 Surface Water Drainage

Development of the solar farm will not significantly alter the existing surface water drainage regime at the Site, however some smaller elements of the design will require runoff to be managed. Surface water drainage is discussed in detail in Section 8.0.

7.3 Risk to Human Health

The scheme proposed would normally not be manned and therefore staff would only be present on the Site for routine maintenance. Assuming planning permission is granted, an emergency flood response plan for the Site would be prepared post-planning, detailing measures that will be put into place to manage risk posed to these staff and ensure that full evacuation of the site occurs at an early stage when a potential risk for inundation is identified.

Key elements of this document will include;

- Details of the prevailing flood risk;
- Details of the local flood warning service;
- Roles and responsibilities for maintaining and implementing the plan;
- Action to be implemented in the event of a flood alert or warning, including full evacuation of Site in advance of flooding; and
- Safe egress routes for departing from the site during periods of heightened flood risk.

8.0 Surface Water Drainage Strategy

This surface water drainage strategy sets out high level principles for managing storm water on the Site in line with best practice and the requirements of Cambridgeshire County Council (the LLFA), Huntingdonshire District Council and Sawtry IDB. The strategy has been produced in support of the planning application.

This strategy is intended to demonstrate that, given the nature and quantum of development proposed, it will be feasible to drain the Site in line with planning requirements.

8.1 Context

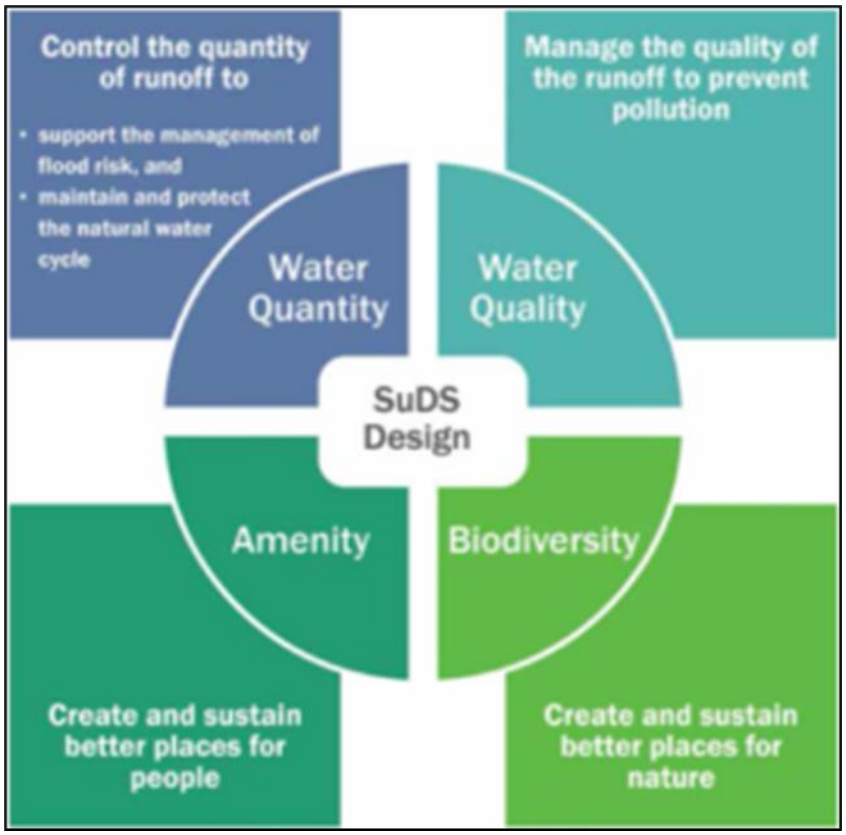
Without mitigation, the proposed redevelopment of the Site could lead to a small increase in the rate and volume of surface water runoff generated due to the small increase in impermeable coverage. To comply with current guidance and best practice, sustainable drainage systems (SuDS) will be required to manage the quantum and quality of surface water runoff discharge off-Site.

8.2 Key Principles of Surface Water Management

8.2.1 Overview

Current best practice guidance document, The SuDS Manual (CIRIA Report C753), promotes sustainable water management using sustainable drainage techniques (SuDS). There are four main categories of SuDS which are referred to as the ‘four pillars of SuDS design’ as depicted in Figure 8-1.

Figure 8-1: Four Pillars of SuDS (extract from CIRIA Report C753)



The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a ‘management train’. The hierarchy of techniques is identified as:

- **Prevention** – the use of good Site design and housekeeping measures on individual Sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).
- **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).
- **Regional Control** – management of runoff from several Sites, typically in a retention pond or wetland.

8.2.2 National Policy Context

Current national planning policy guidance and best practice, namely NPPF and PPG, require development proposals in all Flood Zones to seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

8.2.3 Local Policy Context

Paragraph 5.36 of the Huntingdonshire Local Plan[12] supports the use of SuDS, stating that;

'It is acknowledged that the geology in Huntingdonshire is relatively impermeable, consisting mainly of soils with properties similar to clay. These soil types are not generally conducive to infiltration, and this will mean that careful consideration in SuDS design will be needed.'

8.3 Existing Surface Water Drainage Regime

Incidental rainfall is considered to drain via a combination of evaporation, infiltration into the underlying strata, and following topographic gradients overland into the existing surface water drainage channels which are present across the Site.

8.3.1 Pre-Development Runoff Rates (Greenfield)

Greenfield runoff rates for the area equivalent to the proposed impermeable development were estimated through application of the Revitalised Flood Hydrograph Model (ReFH2). ReFH2 is recommended by the EA as the methodology for estimating flood peaks and hydrographs for small catchments[18].

The ReFH2 method is applied using software 'The Revitalised Flood Hydrograph' modelling tool. The FEH parameters obtained from FEH webservice for 1km grid[19] were used in the assessment.

Greenfield runoff rates for the whole Site, and areas of the Site equivalent to the proposed impermeable development, were estimated through application of ReFH2. The following parameters were incorporated, and summarised in Table 8-1:

- Whole Site Area: 24.14 ha
- Proposed Permeable Area: 24.10 ha
- Proposed Impermeable Area: 0.04 ha

18 Environment Agency, Estimating flood peaks and hydrographs for small catchments: Phase 1, Project SC090031, May 2012

19 The FEH parameters have been reviewed and are considered to be appropriate for the known geology and soils at the site.

Table 8-1: Greenfield Runoff Rates Analysis

Annual Probability	Site Greenfield Runoff Rate (l/s/ha)	Permeable Area Greenfield Runoff Rate (l/s)	Impermeable Development Area Greenfield Runoff Rate (l/s)	Whole Site Greenfield Runoff Rate (l/s)
50%	6.94	167.2	0.28	167.5
3.3%	20.24	487.8	0.81	488.6
1%	28.2	679.7	1.13	680.8

All values are rounded to 1 decimal place.

8.4 Constraints on the use of SuDS

8.4.1 Geology

As discussed in Section 3.3, the Site is underlain by mudstone and lime-rich and clayey soils with *'slightly impeding drainage'.* These soils and mudstone have some potential for infiltration to ground, such as the current situation, but is limited overall. Topography

8.4.2 Topography

The topography across the Site naturally falls towards the boundary drainage channels at the western, northern and eastern edges of the Site. The area of hardstanding which requires SuDS management is located within the south of the Site, approximately 10m downslope from the head of the central drain. This means any runoff from the hardstanding would naturally be discharged west towards the boundary drainage channels downgradient.

8.4.3 Hydrology and Flooding

The development uses a design flood datum (100-year plus climate change) which does invoke some flooding of the Site. No SuDS features can be situated within this flood outline. With respect to the area of hardstanding, an attenuation feature would be suitable to control and maintain increased rates and volumes of surface water.

8.4.4 Site Constraints

Appendix A shows the conceptual master planning of the Site, identifying locations of cable routes, access points and other critical infrastructure. SuDS features must not be sited in any area which may interfere with existing or proposed infrastructure.

8.5 Proposed Discharge Arrangements

With reference to the SuDS Manual, the hierarchy of preferred disposal options for surface water runoff from development Sites in decreasing order of sustainability is as follows:

- Infiltration to Ground;
- Discharge to Surface Waters; or
- Discharge to Sewer.

Table 8-2 summarises the suitability of disposal methods suitability in the context of the Site and the proposed development.

Table 8-2: Suitability of Surface Water Disposal Methods

Surface Water Disposal Method (in Order of Preference)	Suitability Description	Method Suitable? (Y / N)
Infiltration to Ground	Considered suitable in combination with suggested SuDS feature.	Y
Surface Water Discharge	Not suitable due to IDB management of local drains in proximity to or on the Site. IDB request no additional discharge into their drainage network.	N
Sewer Discharge	The location of surface water sewers in proximity to the Site is currently unknown.	N

8.6 Conceptual Surface Water Drainage Strategy

The proposed drainage strategy will manage surface water runoff as close to the source as possible.

The proposed solar panels would intercept precipitation and shed this onto the ground along the lower edge of each array (the 'drip-line'). However, runoff from each solar panel would continue to infiltrate into the underlying soils locally, be taken up by vegetation or evaporate in much the same way as existing conditions. During significant rainfall events, runoff would effectively flow in accordance with local topography into the watercourses which pass around and through the Site, following the same hydrological regime as is currently experienced on the Site.

The vegetation that would be maintained between and beneath the solar panel arrays would also ensure that runoff generated from the panels would continue to drain diffusely across the Site, following the general topography.

The scheme would result in a small increase in impermeable surface area due to the construction of the DNO substation, which contributes to 0.04ha of the Site area.

This surface water drainage strategy will seek to mimic the existing runoff regime (towards the west) and ensure that there is no increase in peak discharge from the impermeable area on Site. This will be achieved through the introduction of a swale on the downgradient boundary of the DNO substation to collect surface water runoff. Also, a channel drain and short connecting surface water sewer are proposed on the DNO substation platform to direct water to the attenuation feature. In the event of extreme rainfall, there will be a controlled overflow on the western side of the swale which will control discharge of excess surface water as overland flow through vegetated ground, simulating the current conditions. Water discharged from the swale is expected to follow local topography in a westerly direction towards the field drainage channels on the west boundary of the Site.

The conceptual drainage strategy is shown on the proposed development plan in Appendix E .

8.7 SuDS Attenuation Storage

Temporary storage volumes were estimated using the Causeway Flow drainage software as an appropriate methodology for planning and master planning purposes. This has been undertaken for the swale on the downgradient extent of the DNO substation.

Full calculation results are presented in Appendix F.

The Flood Estimation Handbook (FEH) rainfall model was used with a design standard return period of 1% AEP (1 in 100-year return period) plus an allowance for climate change as recommended within climate change guidance detailed in Section 4.4.4 (applied as a 40% uplift in peak rainfall intensity).

8.7.1 Swale

Exact positioning of the swale will be determined as part of the post-development detailed drainage design.

The following parameters have been incorporated into the modelling:

- Impermeable area: 400m^2
- Cover Level: 9.0 m
- Invert Level: 8.1 m
- Base Width: 1.0 m
- Top of bank Width: 6.4 m
- Length: 16 m
- Side Slope (1:X): 3.0

8.8 SuDS Performance: Water Levels

The swale has capacity to retain water from a 1 + 40% CC event with a freeboard of 100mm to the overflow feature which is set at 9 m aOD. The remaining sides are raised to approximately 9.32 m aOD to prevent the flow of water back upslope towards the DNO substation. If levels do overtop the weir height water will run in a westerly direction, following local topography, over vegetated land towards the existing field drainage channel.

The critical performance of the swale is for the 1% AEP + 40% CC. Full results are presented in Appendix F and the critical events are summarised in Table 8-3below.

Table 8-3: Summary of SuDS Performance Attenuation Volumes

SuDS Feature	Number on Site	Annual Probability (%)	Peak Water Level from Invert Level (m)	Maximum Storage Volume (m^3)
Swale	1	1 + 40% CC	0.80	10.2

8.9 SuDS Attenuation Performance: Discharge

The proposed development will discharge surface water as infiltration, evaporation and in the case of extreme events greater than 1 + 40% CC, as surface water exceedance flow towards the western field drainage ditch. There is an additional 100mm freeboard capacity within the attenuation swale on top of the peak water level for the 1 + 40% CC design.

Despite the slightly impeded nature of drainage at the Site, this SuDS feature aims to store the additional surface water created from the impermeable area for the period of time necessary for infiltration to ground. This will reduce runoff from the developed area to below the current greenfield conditions while controlling the discharge of excess surface water.

8.10 SuDS Performance Assessment: Water Quality

SuDS provide a number of water quality benefits, including:

- Swales - shallow and vegetated open channels which convey, treat and attenuate surface water. The swale acts as an attenuation feature allowing, where necessary, infiltration directly into the ground. Surface vegetation can filter coarse to medium sediments and associated pollutants.

The simple index method, as outlined within the SuDS Manual, provides a way of quantifying the benefit to water quality of the SuDS Management Train. The pollution hazard from the land use and the mitigation from the SuDS component are each assigned an index. The total mitigation index must be greater than the pollution hazard index for adequate treatment to be delivered.

Total SuDS mitigation index (for each contaminant type) ≥ pollution hazard index (for each containment type)

The total SuDS mitigation is the summation of the first components mitigation index and half the mitigation index of any subsequent component.

With reference to the SuDS Manual, post-development surface water runoff generated from the development is considered to have a 'Low' *Pollution Hazard Level* as presented in Table 8-4.

Table 8-4: Pollution Hazard Potential for the Proposed Development

Land Use	Pollution Hazard Level	Pollution Hazard Indices		
		Total Suspended Solids (TSS)	*Metals*	*Hydro-Carbons*
Other Roofs (typically commercial/ industrial roofs)	Low	0.3	0.2	0.05
Low Traffic Roads	Low	0.5	0.4	0.4

The proposed SWDS is required to demonstrate sufficient treatment capability to manage the specified *Pollution Hazard Indices.*

Table 8-5: SuDS Mitigation Indices for Discharges to Surface Water for the Proposed Development

SuDS Component	Mitigation Indices		
	Total Suspended Solids (TSS)	*Metals*	*Hydro-Carbons*
Swale	0.5	0.6	0.6

Table 8-6 compares the SuDS Mitigation Indices, provided by the proposed 'Source Control', 'Conveyance' and 'Site Control' measures against the Pollution Hazard Indices.

Table 8-6: SuDS Performance: Water Quality Indices Assessment – Swale

Land Use	Pollution Hazard Level	*Pollution Hazard and SuDS Mitigation Indices Comparison*					
		Total Suspended Solids (TSS)		*Metals*		*Hydro-Carbons*	
		Pollution Index	SuDS Mitigation Index	Pollution Index	SuDS Mitigation Index	Pollution Index	SuDS Mitigation Index
Industrial Roof	Low	0.3	0.5	0.2	0.6	0.05	0.6
Substation Platform (low traffic road parameters)	Low	0.5	0.5	0.4	0.6	0.4	0.6

As the SuDS Mitigation Index provided by the proposed SuDS measures are ≥ Pollution Hazard Index the water quality assessment criteria are satisfied for all Land Use criteria.

8.11 SuDS Operation Maintenance Requirements

A SuDS maintenance plan would be produced as part of the detailed drainage design, post-development, and the precise requirement would depend on manufacture specification of the final design. This plan may form part of a wider Site Operations and Maintenance Plan. At this time, it is considered that:

- The responsibility for the swale would pass to the operator of the solar farm.

An outline of the typical maintenance requirements for SuDS features is outlined below.

8.11.1 Swale

The proposed drainage scheme will utilise a swale as a mechanism for treatment, attenuation, and infiltration of surface water runoff.

The anticipated maintenance and management for swales associated with the surface water drainage system is outlined in Table 8-7.

Table 8-7: Typical Swale Maintenance Requirements

Maintenance Schedule	Required Action	Minimum Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut grass- to retain grass height within specified design range	Monthly (during growing season), or as required.
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly.

Maintenance Schedule	Required Action	Minimum Frequency
	Inspect inlets and facility surface for silt accumulation, establish appropriate slit removal frequencies.	As required or if bare soil is exposed over 10% or more of the swale treatment area
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plan types to better suit conditions, if required	Annually.
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required.
	Relevel uneven surfaces and reinstate design levels	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required.
	Remove and dispose of oils or petrol residues using safe standard practices.	As required.

8.12 Exceedance

In the low probability event of an exceedance within the swale, water would overtop the western edge of the swale and water will run in a westerly direction, following local topography, over vegetated land towards the existing field drainage channel. Flows will discharge diffusely across land, mimicking the existing drainage regime and will not increase the risk of flooding on the downslope areas. This exceedance is conceptualised in the Surface Water Drainage Strategy for the Site included at Appendix E.

No adverse flooding would be anticipated as a result of surcharging from the surface water network.

9.0 Conclusion

SLR Consulting Limited (SLR) has been appointed by Anesco Ltd (the client) to produce a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) for a proposed solar energy generation facility at Woodwalton, on land north of Double Bank Lane, PE28 5YL.

9.1 Flood Risk

Flood risk has been assessed in line with BS8533[3], taking account of national and local planning policy and guidance, and all potential sources of flooding to the Site have been considered.

A screening assessment has reviewed the flood risk posed by other sources including, tidal, fluvial, groundwater, sewer and water mains, reservoirs, canals and infrastructure failure. This concluded that there is potential fluvial risk at the Site, however this would not be significant to the proposed development due to water compatibility of any infrastructure within or close to the areas at risk.

Detailed assessment of the potential flood risk on the proposed development estimated potential peak water levels for an extreme event, which were adopted as the design flood levels for the site. To mitigate the assessed fluvial risks associated with flooding to this extent, critical and flood sensitive aspects of the development have been sited away from the lowest parts of the Site and would be raised above the design flood datums, meaning that infrastructure is not at risk of flood ingress.

More localised infrastructure that needs to be distributed around the site including the solar panels, inverters and transformers would be set above the design flood datums.

A Surface Water Drainage Strategy has been developed to control surface water discharge from the Site (and thereby downstream surface water flood risk) as well as mitigate against the impacts of climate change.

9.2 Surface Water Drainage Strategy

The surface water drainage strategy has been developed to demonstrate that the requirements of national and local planning policy can be achieved at the Site given the nature and the quantum of development proposed. A singular swale is proposed in order to mitigate impacts of changes in storm water runoff from the Site including impacts to water quality.

The swale is to be located on the downgradient (western) boundary of the DNO substation. The conceptual surface water drainage strategy is shown in Appendix E which will attenuate and regulate flood flows.

Modelling indicates that the swale is sufficient to avoid surface discharge from the Site up to the 1% AEP with a 40% uplift to accommodate for changes in storm severity associated with climate change over a projected 30-year development lifetime.

The proposed Surface Water Drainage Strategy will ensure that proposed development will not increase the flood risk elsewhere and the runoff will have no adverse impact on the water quality at the point of discharge.

9.3 Emergency Planning

The site would normally be unmanned. Post planning, an emergency flood response plan would be developed for the facility to ensure the safety of contractors and maintenance staff working on the Site.

Appendix A Site Masterplan

Woodwalton 2 Solar Farm

Flood Risk Assessment and Surface Water Drainage Strategy

Anesco Ltd

SLR Project No.: 410.05075.00095

October 2024

Legend

- Security Fence
- Overhead Electrical Cables
- DNO Access Route
- Site Boundary
- LV Cable Route(Cable Tray)
- PV Array
- LV Switch/transformer
- DNO Substation
- Hardstanding Area
- Customer Substation
- Badger Gaps in Fencing

NOT FOR CONSTRUCTION
INFORMATION ONLY

535W Modules @ 15° Pitch
Spacing - back to front = 4.50m
front to front = 11.12m
Inverters - 105KTL = 139
Total no. of modules = 37530 modules
Total no. of 3000KVA Tx = 4
Total no. of 2500KVA Tx = 2

Total Installed Capacity = 20.079 MWp

Declared Net Capacity = 16.124 MW

Double Bank Solar Farm

Track

El Sub Sta

El Sub Sta

Drain

Drain

Drain

Drain

Drain

DOUBLE BANK LANE (TRACK)

7.9m

Installer Details

Anesco Ltd.
The Green,
Easter Park,
Benyon Road,
Reading,
RG7 2PQ
Tel: 0845 894 4444

Comments

SITE AREA: 59.66 Acres / 24.14ha
GRID REFERENCE: TL 20463 81318

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Revision	Description	Revised By	Approved By	Date
A	Issued for comment	JH		02/02/2021
B	Redesign using 105KTL Inverters	JH		16/02/2021
C	Previous design used with Bager Gaps added to fencing	JH		02/03/2022
D	Various amendments	JH		22/03/2022
E	10m wide maintenance gap added along NE boundary	PJB		07/06/2022

Scale	Drawn By	Checked By	Signed by PM	Date Checked	Page	Sheet
1:2500 @ A3	JH				1 of 1	A3

Installation Address

DOUBLE BANK LANE,
WOODWALTON,
HUNTINGDON,
CAMBRIDGESHIRE,
PE28 5YL

Project: WOODWALTON TWO

Title: SITE LAYOUT PLANNING

Drawing No.: C0002445_01_PL

Rev.: E

Anesco™ AMAZING ENERGY

Appendix B Topographic Survey

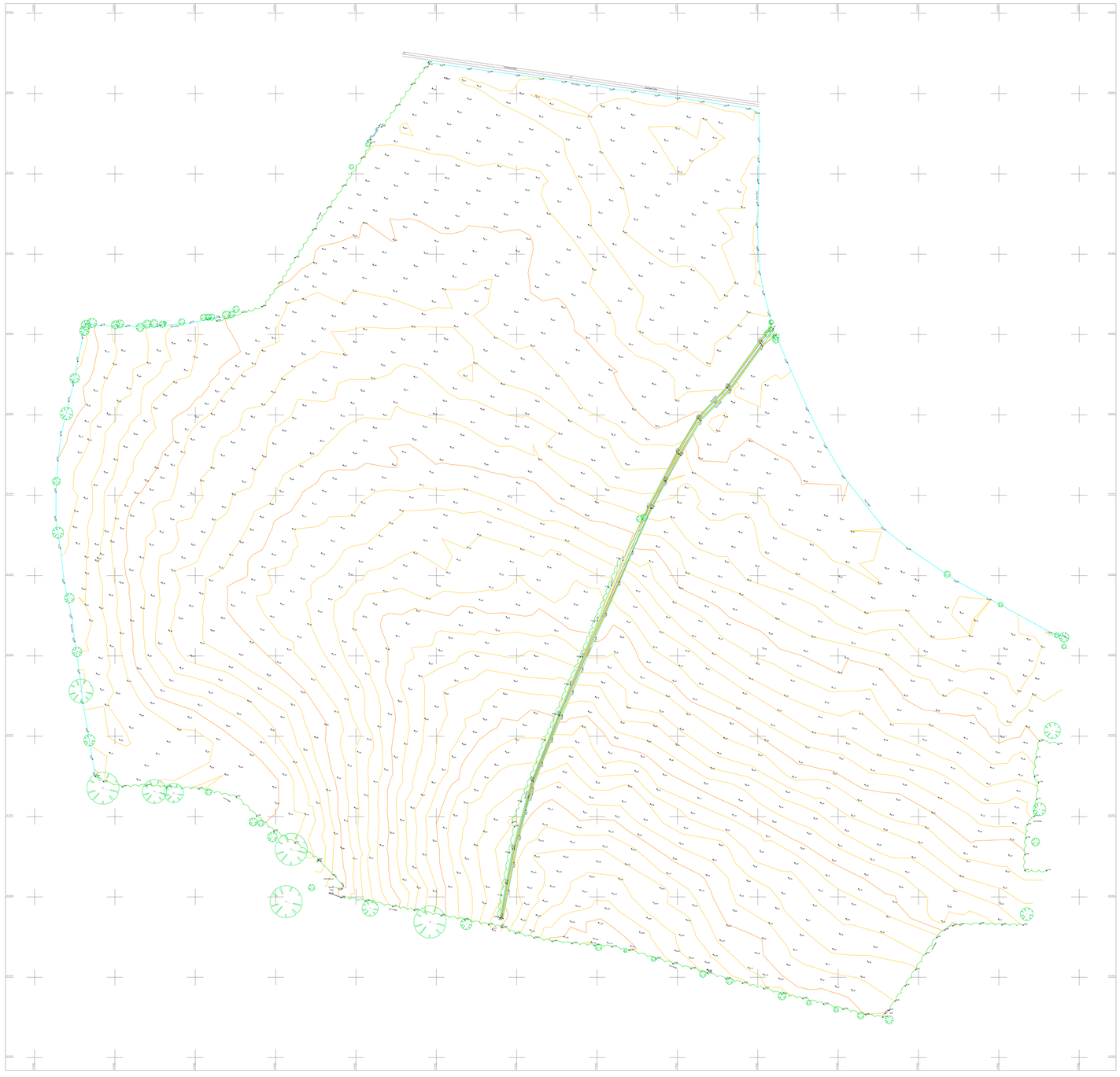
Woodwalton 2 Solar Farm

Flood Risk Assessment and Surface Water Drainage Strategy

Anesco Ltd

SLR Project No.: 410.05075.00095

October 2024



N

NOTES

THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH. THE SURVEY IS TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCES.

LOCAL SCALE FACTOR 1.000

ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM GENERATED BY ACTIVE GPS NETWORK.

DRAINAGE:

NO ALLOWANCE HAS BEEN MADE FOR SUB SURFACE ACCESS TO MANHOLES OR CHAMBERS. ANY PIPE SIZES, DEPTHS OR BELOW GROUND DIMENSIONS ARE TAKEN FROM THE SURFACE AND THUS WILL BE APPROXIMATE ONLY. ANY FLOW TYPES (FOUL WATER, SURFACE WATER OR COMBINED) ARE ASSUMED AND THEREFORE REQUIRE VERIFICATION.

EVERY EFFORT HAS BEEN MADE TO IDENTIFY ALL VISIBLE ABOVE GROUND FEATURES, HOWEVER IT IS POSSIBLE THAT THERE MAY BE ITEMS THAT WERE OBSCURED AT THE TIME OF SURVEY.

TREES:

TREE DIAMETER MEASURED APPROXIMATELY 1.5M ABOVE GROUND LEVEL. TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE GENERALISED CANOPY SIZE. TREE BOLE MAY NOT BE CENTRAL TO THE CANOPY. TREE HEIGHT ESTIMATED FROM GROUND LEVEL.

ONLY TREES OF STEM > 100MM HAVE BEEN SHOWN. ONLY THOSE TREES THAT FALL WITHIN THE SITE LIMITS HAVE BEEN SURVEYED UNLESS OTHERWISE SPECIFIED.

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LEGEND

- BANK TOP
- BANK BOTTOM
- BUILDING
- EARTH & STONE HEDGE
- DITCH BOTTOM
- DITCH TOP
- MISCELLANEOUS
- OVERHEAD CABLE
- RIDGE
- ROAD CHANNEL
- STEPS
- UNDERGROWTH
- WALL
- TOP OF WALL
- ROAD MARKINGS

ABBREVIATIONS

A/L	ARCH LEVEL	OHC	OVERHEAD CABLE
AV	AIR VALVE	OSBM	OS BENCHMARK
BL	BOLLARD	PO	POST
BB	BELISHA BEACON	P/R	POST & RAIL FENCE
BH	BOREHOLE	P/W	POST & WIRE FENCE
BT	BT COVER	RE	RODDING EYE
B/W	BARBED WIRE FENCE	RF	ROCK FACE
C/B	CLOSE BOARD FENCE	RP	REFLECTOR POST
C/L	CHAIN LINK FENCE	RWI	RETAINING WALL
CL	COVER LEVEL	SAP	SAPLING
CT	CCTV	SEC	SECURITY CAMERA
D	DIAMETER	SGY	STRIP GULLY
DK	DROPPED KERB	SI	SIGN POST
DP	DOWNPIPE	SoL	SOFFIT LEVEL
EC	ELECTRIC INSP. COVER	SV	STOP VALVE
EP	ELECTRICITY POLE	SY	CABLE STAY
ER	EARTH ROD	TCB	TELEPHONE KIOSK
FH	FIRE HYDRANT	ToW	TOP OF WALL
FL	FLOOR LEVEL	ToH	TOP OF HEDGE
FP	FLAG POLE	TP	TELEPHONE POLE
GU	GULLY	TRK	TRACK LINE
GUD	GULLY & DOWNPIPE	TL	TRAFFIC LIGHT
GP	GATE POST	VP	VENT PIPE
GV	GAS VALVE	WP	WOODEN PANEL FENCE
IC	INSPECTION COVER	W/M	WIRE MESH FENCE
IL	INVERT LEVEL	WLV	WATER LEVEL
I/R	IRON RAILING FENCE	WM	WATER METER
KO	KERB OUTLET	WT	WATER TAP
LP	LAMP POST		
MH	MANHOLE		
MKR	MARKER		
OHB	OVERHEAD BUILDING		

STATION CO-ORDINATES

Rev	Date	Revision Notes	By
-	-	-	-

DO NOT SCALE

Project

Double Bank Lane
Woodwalton
Huntingdon,Cambridgeshire
PE28 5YL

Drawing Title

Topographic Survey

Originator

3D Land Surveys Ltd
Reen Cottage
Reen Manor Farm
Perranporth
Cornwall
TR6 0AJ

www.3dlandsurveys.co.uk
info@3dlandsurveys.co.uk

Drawn By	Checked By	Publish Date	Scale(s)
BRO	BRO	20/01/21	1:1500 @ A1

Project No.	Drawing No.	Revision
20-000	Topo_01_3D	0

Appendix C Sawtry IDB District Plan

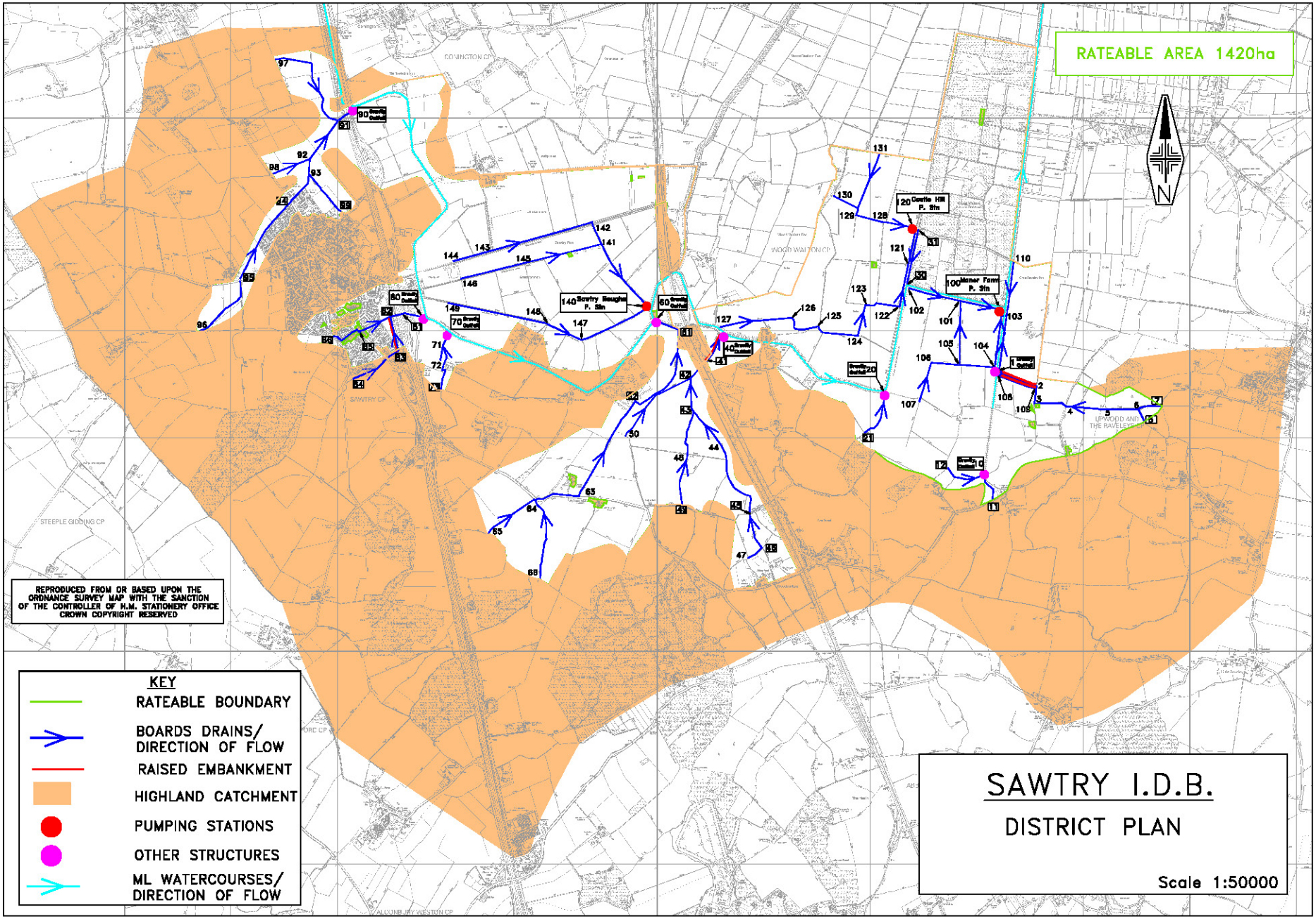
Woodwalton 2 Solar Farm

Flood Risk Assessment and Surface Water Drainage Strategy

Anesco Ltd

SLR Project No.: 410.05075.00095

October 2024


RATEABLE AREA 1420ha
N
Castle Hill P. Stn
Manor Farm P. Stn
Sawtry Slaughter P. Stn
KEY
RATEABLE BOUNDARY
BOARDS DRAINS/ DIRECTION OF FLOW
RAISED EMBANKMENT
HIGHLAND CATCHMENT
PUMPING STATIONS
OTHER STRUCTURES
ML WATERCOURSES/ DIRECTION OF FLOW
REPRODUCED FROM OR BASED UPON THE ORDNANCE SURVEY MAP WITH THE SANCTION OF THE CONTROLLER OF H.M. STATIONERY OFFICE CROWN COPYRIGHT RESERVED
SAWTRY I.D.B.
DISTRICT PLAN
Scale 1:50000

Appendix D Environment Agency Response

Woodwalton 2 Solar Farm

Flood Risk Assessment and Surface Water Drainage Strategy

Anesco Ltd

SLR Project No.: 410.05075.00095

October 2024

From: Enquiries_EastAnglia <Enquiries_EastAnglia@environment-agency.gov.uk>
Sent: 23 April 2021 14:30
To:
Subject: EAN/2021/212923 - Final response to your request for Product 4 for Double Bank Lane, Woodwalton, Huntingdon,Cambridgeshire,PE28 5YL

Dear

Thank you for your enquiry which was received on 17th March 2021.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Unfortunately, we do not hold detailed modelling in this area. The flood map here is the only information available. The flood zones are the result of broadscale JFLOW modelling and this is the best information we have available.

For your information, JFLOW datasets are available for download under an open licence. Please find below a link to the 1% AEP and 0.1% AEP JFLOW outlines for the TL national grid square;

- 1% AEP - https://data.gov.uk/dataset/modelled-fluvial-flood-depth-data-created-2004-1-percent-annual-chance-for-grid-reference-tl
- 0.1% AEP - https://data.gov.uk/dataset/modelled-fluvial-flood-depth-data-created-2004-0-1-percent-annual-chance-for-grid-reference-tl

The section of relevance to this area is: TL28SW

However, please note that JFLOW modelling is indicative only and is not suitable for identifying whether an individual property will flood, for detailed decision making or for use in site specific Flood Risk or Strategic Flood Risk Assessments. Where this data is used for anything other than broad catchment or Shoreline Management Plan scale further evidence, verification and studies should be undertaken.

The nearest Main Rivers to this location are the Alconbury Brook and the Bury Brook, which are respectively 5Km to the SW and 6Km to the SRE, as such there are no nearby Environment Agency defences. However the location does fall within the remit of the Sawtry Internal Drainage Board, part of the Middle Level Commissioners. However the area surrounding this location falls entirely under the remit of the Middle Level Commissioners, an Internal Drainage Board. Any propose works in this area would therefore require their consultation. They can be contacted at Middle level Offices, 85 Whittlesey road, March PE15 0AH-Tel +44(0)1354 653232

Please refer to the Open Government Licence available here: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ which explains the permitted use of this information.

Data Available Online
Many of our flood datasets are available online:

- Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences)

- Risk of Flooding from Rivers and Sea
- Historic Flood Map
- Current Flood Warnings

Additional information
Please be aware that we now charge for planning advice provided to developers, agents and landowners. If you would like advice to inform a future planning application for this site then please complete our https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion and email it to our Sustainable Places team planning.brampton@environment-agency.gov.uk. They will initially provide you with a free response identifying the following:

- the environmental constraints affecting the proposal;
- the environmental issues raised by the proposal;
- the information we need for the subsequent planning application to address the issues identified and demonstrate an acceptable development;
- any required environmental permits.

If you require any further information from them (for example, a meeting or the detailed review of a technical document) they will need to set up a charging agreement. Further information can be found on our website.

Please note we have published revised climate change allowances, which are available online. These new allowances will need to be reflected in your Flood Risk Assessment. If you want to discuss this please call our Sustainable Places team on 020 8474 5242.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards

Customers & Engagement Officer, Customers & Engagement Team, East Anglia Area
Environment Agency | Iceni House, Cobham Road, Ipswich IP3 9JD
Environment Agency | Bromholme Lane, Brampton, Huntingdon, Cambridgeshire, PE28 4NE
Please note that we are currently unable to receive post due to office closures- please contact us electronically.

Email : enquiries_eastanglia@environment-agency.gov.uk
Telephone:





If you use the Defra **Data Sharing Platform** (DPS) you can use this link to find out about new and updated datasets and much more. Not using DPS yet? **Register for an account** here and you will receive email notifications direct.

Appendix E Conceptual Drainage Strategy

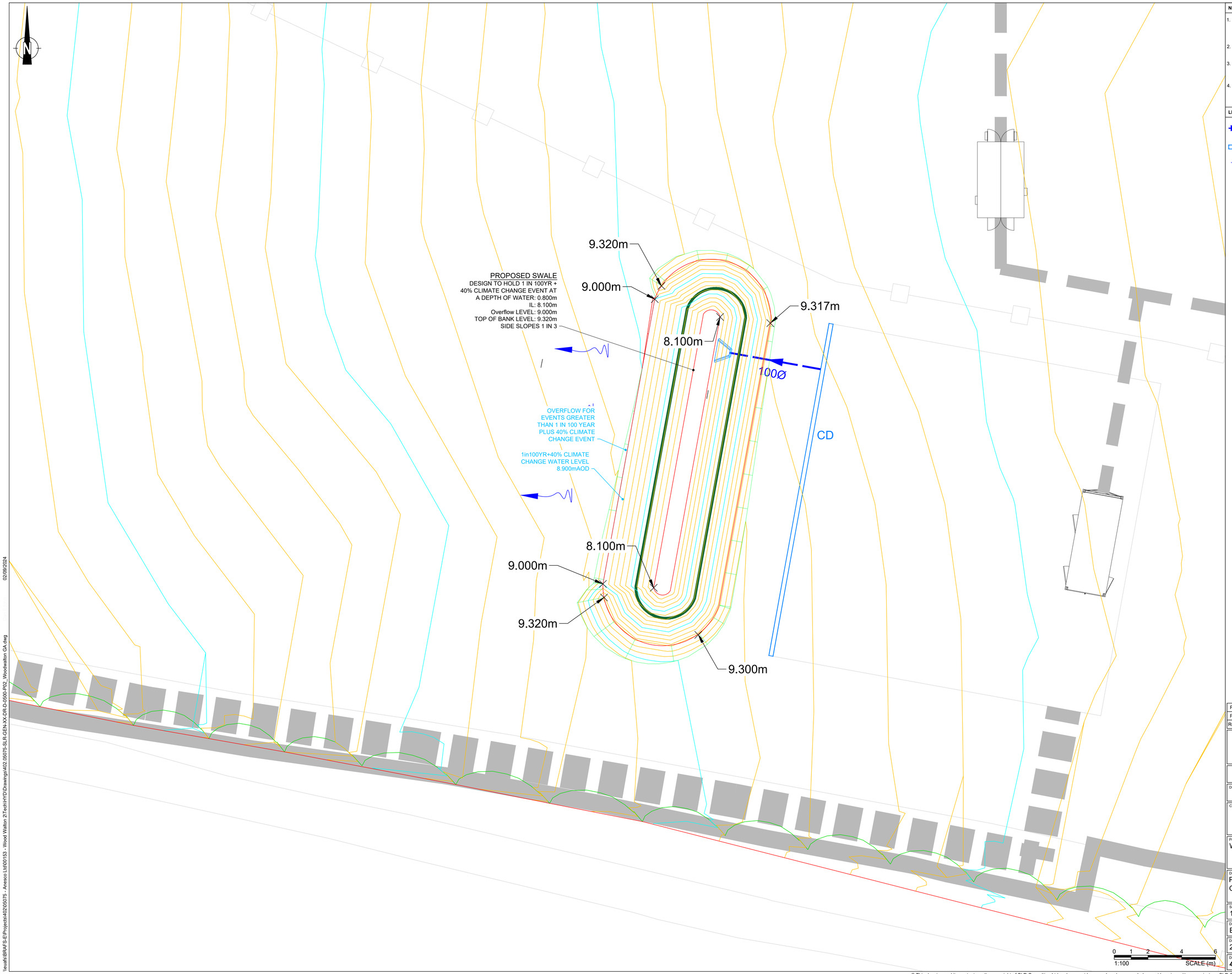
Woodwalton 2 Solar Farm

Flood Risk Assessment and Surface Water Drainage Strategy

Anesco Ltd

SLR Project No.: 410.05075.00095

October 2024



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4. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER FOR ACTION.

LEGEND:

- PROPOSED SURFACE WATER SEWER
- CD — PROPOSED CHANNEL DRAIN WITH RODDABLE SUMP OUTFALL
- EXCEEDANCE FLOW TO ADJACENT VEGETATED GROUND

AWAITING TECHNICAL APPROVAL

This drawing has NOT been technically approved by Local Authority and/or Water Authority.
All works subject to change through technical review process with relevant approving authorities.

Rev	Amendments	Date	By	Chk	Auth
P02	UPDATED SWALE	24.07.24	DE	MB	MB
P01	FIRST ISSUE	24.07.24	EMM	DE	DE

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Drawing Status & Suitability Code: FOR INFORMATION — S2

Client:

Project: WOODWALTON SOLAR FARM

Drawing Title: PROPOSED DRAINAGE GENERAL ARRANGEMENT

Scale	SLR Project No.
1:100 @ A1	402.05075.00153

Designed	Drawn	Checked	Authorised
EMM	EMM	DE	DE
Date: 22.07.24	Date: 22.07.24	Date: 24.07.24	Date: 24.07.24

Drawing Number: **402.05075-SLR-GEN-XXX-DR-D-0001** — Rev.: **P02**

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02/09/2024
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Appendix F Post-Development Runoff Calculations

Woodwalton 2 Solar Farm

Flood Risk Assessment and Surface Water Drainage Strategy

Anesco Ltd

SLR Project No.: 410.05075.00095

October 2024

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.600
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SWALE01			9.000		520457.785	281317.671	0.900
SWALE02			9.000		520454.912	281301.930	0.900
SW01			8.800	1200	520452.519	281299.833	0.290
GULLY01	0.040	5.00	9.630		520479.224	281307.545	0.450

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	SWALE01	SWALE02	16.001	0.030	8.100	8.100	0.000	0.0	1000	5.59	50.0
1.000	GULLY01	SWALE01	23.710	0.600	9.180	8.600	0.580	40.9	100	5.33	50.0
1.002	SWALE02	SW01	3.182	0.030	8.520	8.510	0.010	318.2	150	5.85	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	1.000	4000.0	5.4	-0.100	-0.100	0.040	0.0	0	∞
1.000	1.209	9.5	5.4	0.350	0.300	0.040	0.0	54	1.250
1.002	0.209	3.7	5.4	0.330	0.140	0.040	0.0	150	0.213

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	16.001	0.0	1000	1:3 Swale	9.000	8.100	-0.100	9.000	8.100	-0.100
1.000	23.710	40.9	100	Circular	9.630	9.180	0.350	9.000	8.600	0.300
1.002	3.182	318.2	150	Circular	9.000	8.520	0.330	8.800	8.510	0.140

Link	US Node	Node Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	SWALE01	Junction	SWALE02		Junction	
1.000	GULLY01	Junction	SWALE01		Junction	
1.002	SWALE02	Junction	SW01	1200	Manhole	Adoptable

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SWALE01	520457.785	281317.671	9.000	0.900		1	1.000	8.600	100
									
						0	1.001	8.100	1000
SWALE02	520454.912	281301.930	9.000	0.900		1	1.001	8.100	1000
									
						0	1.002	8.520	150
SW01	520452.519	281299.833	8.800	0.290	1200	1	1.002	8.510	150
									
GULLY01	520479.224	281307.545	9.630	0.450					
									
						0	1.000	9.180	100

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node SWALE02 Online Head/Flow Control

Flap Valve	x	Replaces Downstream Link	✓
Downstream Link	1.002	Invert Level (m)	8.520

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.001	0.000	9.999	0.000

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Results for 1 year Critical Storm Duration. Lowest mass balance: 91.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	SWALE01	1440	8.478	0.378	0.4	0.0000	0.0000	OK
1440 minute winter	SWALE02	1440	8.478	0.378	0.2	0.0000	0.0000	OK
15 minute winter	SW01	1	8.510	0.000	0.0	0.0000	0.0000	OK
15 minute winter	GULLY01	10	9.241	0.061	6.7	0.1088	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	SWALE01	1.001	SWALE02	0.2	0.013	0.000	12.9228	
1440 minute winter	SWALE02	Head/Flow	SW01	0.0				0.0
15 minute winter	GULLY01	1.000	SWALE01	6.5	1.303	0.686	0.1186	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 91.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	SWALE01	1680	8.660	0.560	0.8	0.0000	0.0000	OK
1440 minute winter	SWALE02	1680	8.660	0.560	0.4	0.0000	0.0000	OK
15 minute winter	SW01	1	8.510	0.000	0.0	0.0000	0.0000	OK
15 minute winter	GULLY01	11	9.630	0.450	16.5	1.0695	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	SWALE01	1.001	SWALE02	0.4	0.013	0.000	24.0311	
1440 minute winter	SWALE02	Head/Flow	SW01	0.0				0.0
15 minute winter	GULLY01	1.000	SWALE01	12.8	1.636	1.348	0.1836	

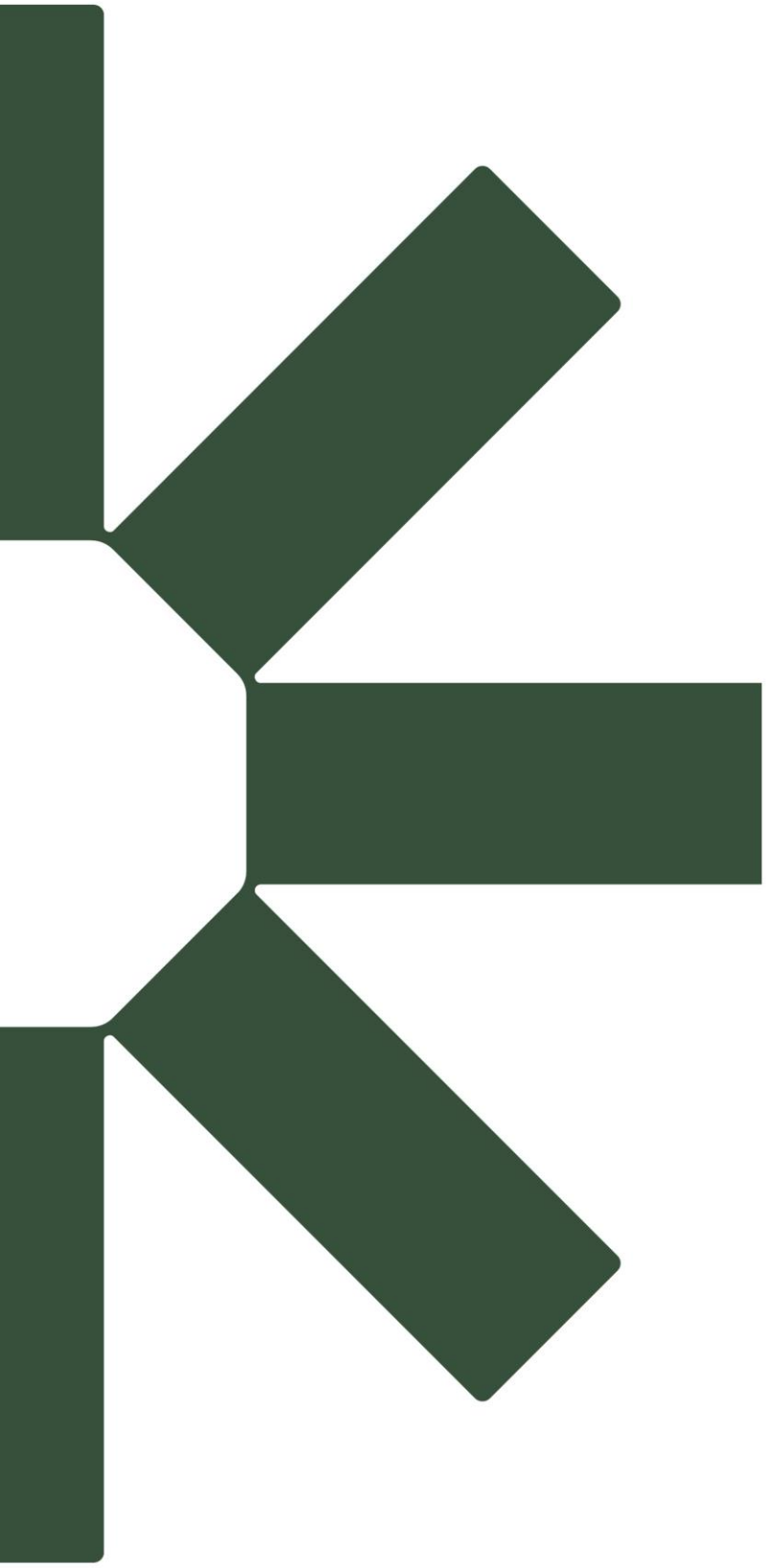
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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 91.73%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	SWALE01	1680	8.900	0.800	1.3	0.0000	0.0000	OK
1440 minute winter	SWALE02	1680	8.900	0.800	0.7	0.0000	0.0000	FLOOD RISK
15 minute winter	SW01	1	8.510	0.000	0.0	0.0000	0.0000	OK
15 minute winter	GULLY01	8	9.630	0.450	29.9	3.6344	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	SWALE01	1.001	SWALE02	0.7	0.013	0.000	43.5634	
1440 minute winter	SWALE02	Head/Flow	SW01	0.0				0.0
15 minute winter	GULLY01	1.000	SWALE01	19.5	2.498	2.058	0.1836	

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Making Sustainability Happen