Six Oaks Renewable Energy Park
Flood Risk Assessment

5th October 2022
Version 2.0
RAB: 3018

Disclaimer

Published by

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Quality Control

Action	Name
Prepared	T. Haskey
Checked	N. Parsons
Approved	T. Haskey

Revision History

Version	Date	Amendments	Issued to
1.0	31.08.2022	First Issued	Richard Barker
2.0	05.10.2022	Updated to reflect comments	Richard Barker

Contents

1.0 Introduction

RAB Consultants has prepared this Flood Risk Assessment (FRA) in support of the proposed development of a renewable energy park at Wilbraham Road, Six Mile Bottom, Newmarket, CB8 0UW.

The development site is located in Flood Zone 1 according to the Environment Agency's Flood Map for Planning (Rivers and Sea). A Flood Risk Assessment (FRA) for this site is required under the Planning Practice Guidance for the National Planning Policy Framework (NPPF) as it is a major development. A site-specific FRA is required to ensure that the development is safe from flooding and will not increase the risk of flooding elsewhere

2.0 Site details

2.1 Site location

TABLE 1: SITE LOCATION

Site address:	Wilbraham Road, Six Mile Bottom, Newmarket, CB8 0UW
Site area:	76.0 ha
Existing land use:	Agricultural fields
OS NGR:	TL 57143 59061
Local Planning Authority:	East Cambridgeshire District Council

2.2 Site description

The proposed site currently comprises agricultural fields and access track which connects to Wilbraham Road to the south of the site. There is an additional site access crossing over the A14 to the west of the site, although this access is not included as part of this planning application. There is a single pylon near the centre of the site. The surrounding area is predominantly agricultural land, with the nearest urbanised area being the village of Bottisham 1.5km to the northwest of the site.

2.3 Development proposal

A renewable energy park is proposed with solar panels, a customer cabin, a battery storage station, a customer substation compound area and ancillary infrastructure.

New access tracks within the site are also proposed. Access from the site will remain from Wilbraham Road to the south of the site.

3.0 Flood Risk

3.1 Sequential test

According to the Environment Agency's Flood Map for Planning the site lies in Flood Zone 1, which is described in the National Planning Policy Framework (NPPF) as land having a less than 1 in 1,000 annual probability of river or sea flooding (less than 0.1% Annual Exceedance Probability (AEP)).

The NPPF follows a sequential risk-based approach in determining the suitability of land for development in flood risk areas, with the intention of steering all new development to the lowest flood risk areas. NPPF Planning Practice Guidance (PPG) Table 2 confirms the 'Flood risk vulnerability classification' of a site, depending upon the proposed usage. This classification is subsequently applied to Table 3 'Flood risk vulnerability and flood zone compatibility' to determine whether:

- The proposed development is suitable for the flood zone in which it is located; and
- Whether an Exception Test is required for the proposed development.

The proposed development is classed as 'essential infrastructure' in accordance with NPPF PPG. The development is therefore appropriate for the Flood Zone. Neither a Sequential Test nor Exception Test are required as the development is in Flood Zone 1, the lowest risk zone.

3.2 Flood History

The Great Cambridge Integrated Water Management Study, Level 1 Strategic Flood Risk Assessment (SFRA), July 2021, includes tables recording historic flood events for Cambridgeshire. There is no mention of previous flood events at or near the proposed site.

The Environment Agency hold no record of flooding affecting the proposed site.

No information of floods affecting the site was found during internet searches.

3.3 Fluvial (Rivers)

The site is located in Flood Zone 1, the lowest risk zone, according to the Environment Agency's Flood Map for Planning (Figure 1). The nearest source of fluvial risk for the site are a series of Swaffham Internal Drainage Board (IDB) managed land drainage ditches located 670m to the northwest of the site and 1.5km southwest of the site.

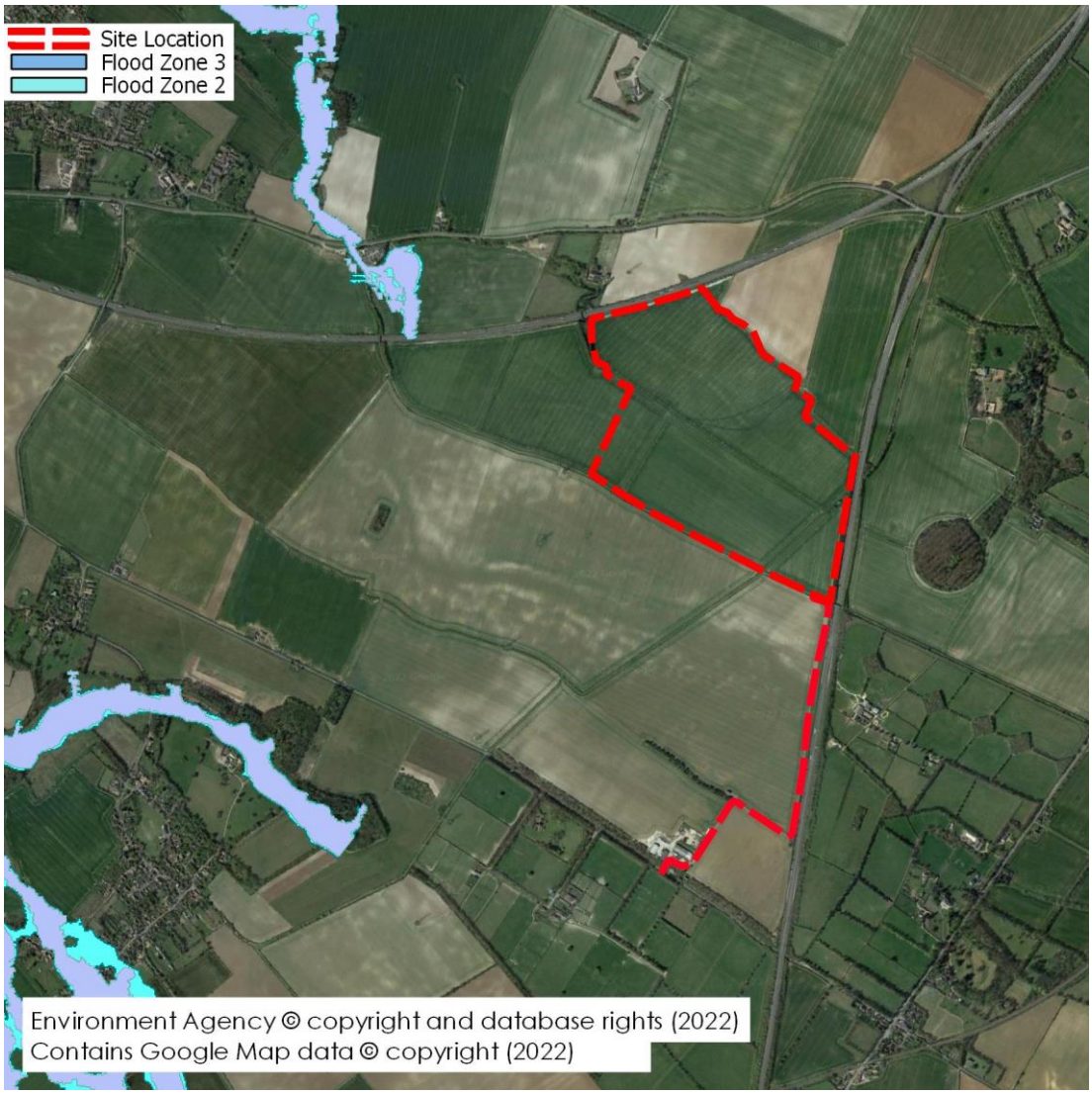


FIGURE 1: SCREENSHOT OF THE ENVIRONMENT AGENCY FLOOD MAP FOR PANNING GIS LAYER WITH GOOGLE MAP BACKGROUND

3.3.1 Climate Change Impact on Fluvial Risk

The Environment Agency guidance document 'Flood risk assessments: climate change allowances' was released in February 2016 and updated in July 2021. It includes statistical increases on peak fluvial flows by Management Catchment and allowance categories based on epochs and development vulnerability classification. Referring to the NPPF PPG, the development is classified as 'essential infrastructure' and has an expected lifetime of 40 years. In this case as the site is located in Flood Zone 1 the peak river flow allowances are not applicable.

The guidance also relates to peak rainfall intensity allowance, which is relevant for surface water flooding. For the '2050s' it is recommended the 'central' allowance of 20% for the 1% AEP and 20% for the 3.3% AEP rainfall events for the Cam and Ely Ouse Management Catchment

3.4 Flood defence breach or overtopping

3.4.1 Breach Risk

The site does not benefit from flood defences, so there is no breach flood risk for the site.

3.4.2 Overtopping Risk

The site does not benefit from flood defences, so there is no overtopping flood risk for the site.

3.5 Coastal/Tidal

The site is not affected by coastal or tidal flood risk.

3.6 Pluvial (Surface water)

Environment Agency's Surface Water Flood Map (Figure 2) identifies the majority of the site and access road to be at 'very low' risk of flooding from surface water. The surface water flood map identifies a few very small, localised areas of 'low risk' towards the north of the site. The depth for these highlighted areas is shown as less than 0.15m in the 'low risk' event.

The map also shows a small area of 'low risk' through the site access, associated with an overland flow route. This flow route crosses the main access track and continues to flow west within the natural valley of the landscape. The Surface Water Flood Map show this to be a shallow sheet flow with flood depths of less than 0.3m and a velocity greater than 0.25m/s.

It is worth noting that the Surface Water map seems to indicate that there is a culvert beneath the A11, which allows the aforementioned flow route to continue unobstructed. There is however no evidence of this culvert on satellite images. A review of freely available LiDAR data shows that the surface water crosses the A11 in the centre of the natural valley, as expected. Therefore, if there is no culvert or the culvert became blocked, surface water would simply weir over the road and continue along the highlighted route in the surface water map.

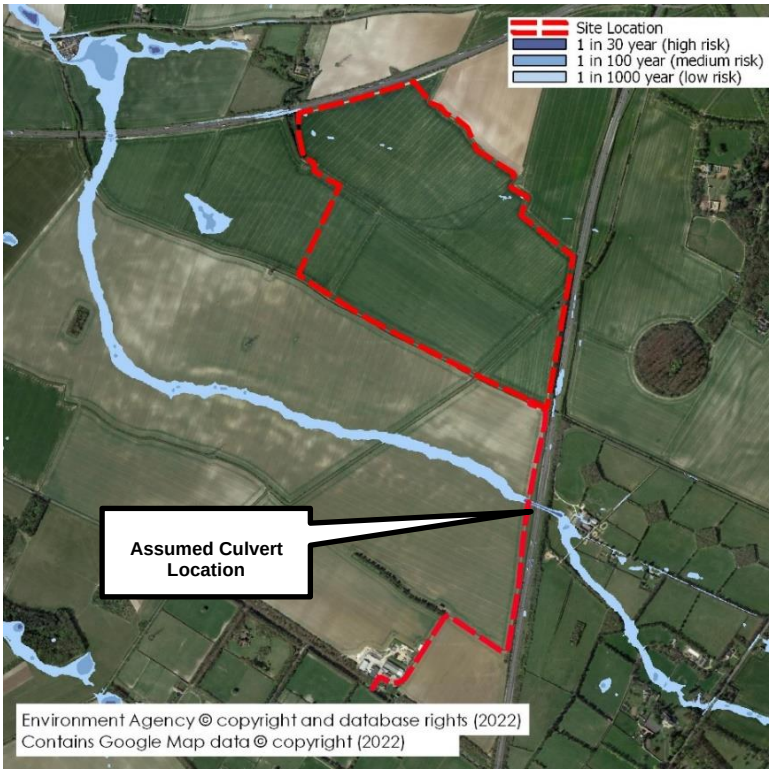


FIGURE 2: ENVIRONMENT AGENCY'S RISK OF FLOODING FROM SURFACE WATER OVERLAYED WITH GOOGLE MAP

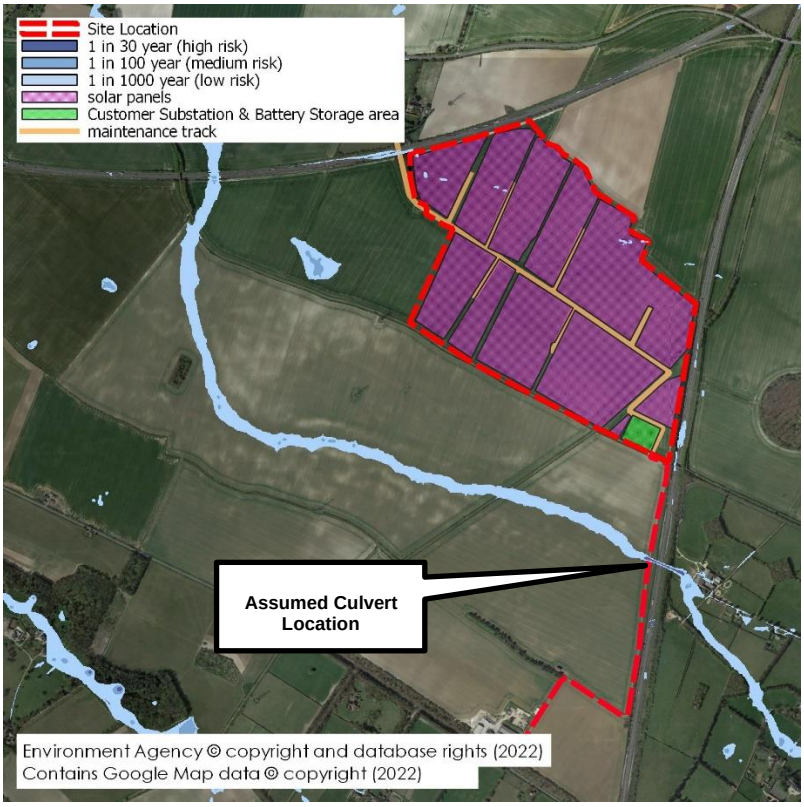


FIGURE 3: ENVIRONMENT AGENCY'S RISK OF FLOODING FROM SURFACE WATER OVERLAYED WITH PROPOSED ASSET LOCATIONS

Figure 3 shows the proposed scheme with the surface water risk map overlain. The map indicates that the customer cabin, customer substation and battery storage compound are not located in an area at risk from surface water flooding.

TABLE 2: ENVIRONMENT AGENCY SURFACE WATER RISK CATEGORIES

Surface Water Risk Category	Surface water flooding Annual Exceedance Probability
Very Low	< 0.1%
Low	Between 1% and 0.1% (1 in 100 years and 1 in 1000 years)
Medium	Between 1% and 3.3% (1 in 100 years and 1 in 30 years)
High	> 3.3% (1 in 30 years)

3.7 Artificial water bodies

The Environment Agency Reservoir Flood Map identifies that the site is not at risk of flooding from this source.

There are no canals near the site that could pose a risk.

3.8 Groundwater

The Great Cambridge Integrated Water Management Study, SFRA, July 2021, provides limited information on groundwater flooding. The historic flooding record within the SFRA shows that there are records of suspected groundwater flooding, but these events are located close to main rivers. This is unsurprising as groundwater is expected to be closely linked with fluvial water.

Based on this information, a further assessment of groundwater flooding is not appropriate.

3.9 Sewers

There is no information of the site being affected by sewer flooding in the July 2021 SFRA.

Given the rural nature of the proposed site, no sewers are expected to be present. From this initial review no issue has been identified to warrant a more detailed assessment of risk from this source.

4.0 Mitigation Methods

4.1 Risk to buildings

4.1.1 Finished floor levels

The proposal includes the construction of solar panels, a customer cabin, a battery storage compound, a customer substation and access tracks throughout the site. As described in Section 3.6, the customer cabin, customer substation and battery storage compound are not located in areas at risk from surface water flooding.

A small number of solar panels are proposed to be located within areas at risk of surface water flooding, with depths below 0.3m.

The cross section drawing of the solar panels provided (Figure 4) shows the structures to be mounted such that the lowest edge of the panel will be a minimum of 0.9m above the ground. This is significantly higher than the expected water depths of below 0.15m. This is considered reasonable mitigation for the identified risk; however, this should be confirmed by the manufactures.

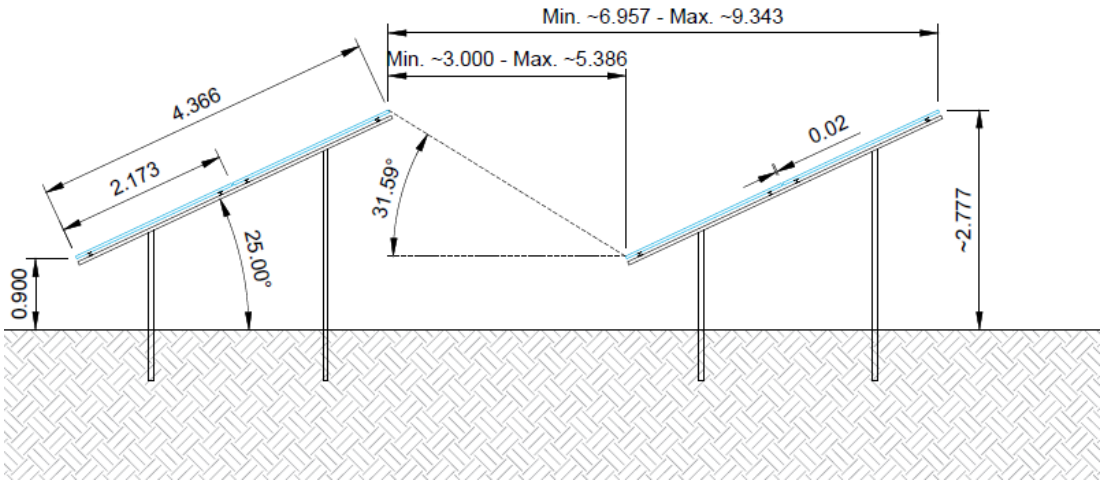


FIGURE 4: CROSS SECTION OF THE PROPOSED SOLAR PANELS

4.1.2 Flood resistance

Flood resistance is a strategy of temporary or permanent measures taken to reduce the amount of flood water that will enter buildings.

The use of flood resistance measures is not appropriate given the nature of the development and the assessed risk.

4.1.3 Flood resilience

Flood resilience measures are intended to reduce damage to a building such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment.

The use of a flood resilience strategy is not considered appropriate given the nature of the development and the assessed risk.

4.2 Risk to occupiers

4.2.1 Safe access/egress

The main access track at the south of the site has a small area identified at risk of surface water flooding (Figure 2). At this location flood depths are expected to be less than 0.3m with a velocity greater than 0.25m/s. In accordance with Table 13.1 of the Flood Risk Assessment Guidance for the New Development

– R&D Technical Report FD2320/TR2, the danger of people is classified as between 'low hazard' and 'Danger for Some'.

The site will be an unmanned facility with routine inspections, general maintenance and repair work undertaken throughout the site when required. This risk to people should be managed by a flood plan which will include a map of potential flood-affected areas (Figure 3). In addition, as part of the plan, the site manager and staff should monitor Met Office Severe Weather Warnings and the 5-day flood risk (see Section 4.2.2) and Environment Agency flood alerts (Section 4.2.2). This will enable them to make an appropriate decision on whether site visits can be undertaken safely during severe weather.

4.2.2 Flood warning and evacuation plan

The Environment Agency does not provide a Flood Warning or Alert for the site. Given the assessed risk to the site, a bespoke flood warning plan is not considered necessary.

As recommend above the site manager has the option to monitor the Met Office Severe Weather Warnings and the 5-day flood risk. This will enable them to make appropriate decisions to safeguard their health and safety. Table 3 includes a list of useful links staff can use to monitor flood risk and weather warnings.

The site manager should be aware of water levels near the main access track roads and maintain visual observations of the surroundings to check for flooding.

TABLE 3: USEFUL WEBSITE LINKS

USEFUL WEBSITE LINKS	
Description	**Website Link**
Weather Warning Guide	https://www.metoffice.gov.uk/weather/guides/warnings
EA Live Flood Alert information	https://flood-warning-information.service.gov.uk/
Flood Guidance Statement User Guide	http://www.ffc-environment-agency.metoffice.gov.uk/services/FGS_User_Guide.pdf
Guide to email alert service	https://www.metoffice.gov.uk/about-us/guide-to-emails
5-day flood risk for England and Wales	https://flood-warning-information.service.gov.uk/5-day-flood-risk
5-day flood risk for England and Wales – What the Risk Types Mean	https://flood-warning-information.service.gov.uk/5-day-flood-risk/things-you-should-do
Severe Weather Warning Service including weather warning impacts and what they mean	https://www.metoffice.gov.uk/weather/guides/severe-weather-advice

Met Office Live Severe Weather Warnings	https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-warnings#?date=2020-10-02
BBC Weather	https://www.bbc.co.uk/weather

4.3 Risk to others

4.3.1 Floodplain compensation

Environment Agency guidance states there must be no loss of flood storage capacity for flooding up to the 1% AEP plus climate change event.

The development of the site for a renewable energy park will include the construction of solar panels, some of which are in an area identified at 'low risk' of surface water flooding. Given the stations will have a small cross-section, with a separation between units the impacts on surface water storage volumes will be minimal and localised to each panel. The customer substation and battery storage area will be located outside of flood risk areas.

4.3.2 Surface water run-off

The existing site is entirely agricultural land. The development proposal, of a solar farm with battery storage, will create a large impermeable area with the potential to increase surface water runoff from the site. The scheme will however include gaps between individual panels throughout all of the arrays. This will allow water to drain direct onto the undeveloped ground below each panel section. Research has shown that *'solar panels themselves should not have a significant impact on runoff volumes, peak rates or time to peak rates, provided the ground beneath the panels remains* vegetated' (Cook, L. M., & McCuen, R. H. (2011). Hydrologic response of solar farms, Journal of Hydrologic Engineering, 18(5), 536-541).

5.0 Drainage strategy

5.1 SuDS applicable policies

The Great Cambridge Integrated Water Management Study, Level 1 (SFRA), July 2021 discusses the requirements of surface water drainage and the key principles of SuDS. This has been used to assist with this drainage strategy, along with CIRIA's SUDS Manual and LASOO Non-Statutory Technical Standards for Sustainable Drainage, Practice Guidance.

5.2 Existing drainage

The existing site comprises 73.50 ha of agricultural land. No topographic survey is available however, freely available LiDAR data (1m 2018 DTM) shows that the site falls to the west with a typical gradient of 1:90. Runoff is therefore expected to follow the natural topography and flow west, as shown in Figure 5 below.

FIGURE 5: EXISTING SITE RUNOFF DIRECTION

Pre -development runoff rates have been calculated using the IH124 method (based on the interim Code of Practice of Sustainable Drainage Systems given the small site area).

IH124 parameters:

- Area = 76.0 (total site area)
- SOIL = 0.150
- SAAR = 581mm
- Region = 6

TABLE 4: ESTIMATE OF PRE-DEVELOPMENT RUNOFF RATES

Annual Exceedance Probability (AEP)	Peak Runoff Rate
QBAR	23.6 l/s
100% (1 in 1)	20.1 l/s
3.3% (1 in 30)	53.6 l/s
1% (1 in 100)	75.4 l/s
1% (1 in 100) plus 20% climate change*	90.48 l/s

** 'central' allowance of 20% for the 1% AEP rainfall for the Cam and Ely Ouse Management Catchment*

5.3 SuDS feasibility

The SuDS Manual (2015), discusses the SuDS approach to managing surface water runoff which is intended to mimic the natural catchment process as closely as is possible. The approach sets out the design objectives in respect of SuDS:

- Use of surface water runoff as a resource;
- Manage rainwater close to where it falls (at source);
- Manage runoff on the surface (above ground);
- Allow rainwater to soak into the ground (infiltration);
- Promote evapotranspiration;
- Slow and store runoff to mimic natural runoff rates and volumes;
- Reduce contamination of runoff through pollution prevention and by controlling the runoff at source; and
- Treat runoff to reduce the risk of urban contaminants causing environmental pollution.

Depending on the characteristics of the site and local requirements, these may be used in conjunction and to varying degrees. Table 5 presents the functions of the SuDS components (from which a management train can be created) and their feasibility in respect of the site.

TABLE 5: FEASIBILITY OF SUDS TECHNIQUES AT THE DEVELOPMENT SITE

Technique	Description	Feasibility Y / N / M (Maybe)
Good building design and rainwater harvesting	Components that capture rainwater and facilitate its use within the building or local environment.	N - There is no requirement for water to be used within the site.
Porous and pervious surface materials	Structural surfaces that allow water to penetrate, thus reducing the proportion of runoff that is conveyed to the drainage system (green roofs, pervious paving).	Y - Porous surfaces could be used on proposed access tracks constructed around the solar farm.
Infiltration Systems	Components that facilitate the infiltration of water into the ground. These often include temporary storage zones to accommodate runoff volumes before slow release to the soil.	M – There is scope to incorporate infiltration systems, however the extent to which infiltration is possible would need to be confirmed via ground testing.

Conveyance Systems	Components that convey flows to downstream storage systems (e.g. swales, watercourses).	M – There is scope to incorporate some conveyance systems into the development.
Storage Systems	Components that control the flows and, where possible, volumes of runoff being discharged from the site, by storing water and releasing it slowly (attenuation). These systems may also provide further treatment of the runoff (eg ponds, wetlands, and detention basins).	Y – There is scope to incorporate small surface water storage features into the development.
Treatment Systems	Components that remove or facilitate the degradation of contaminants present in the runoff.	Y - There is scope to incorporate small SuDS features that would provide water treatment.

5.4 Proposed Drainage

The proposed development and drainage strategy has been split into 3 main parts:

1. The formation of the solar panel farm.
2. The Battery storage area, which will also contain the customer cabin and customer substation.
3. The access tracks throughout the site.

(1) The proposed development primarily constitutes a matrix of permanently fixed, south facing solar panels arranged on racks with 2cm gaps between each panel. It is not proposed to formally drain the solar panels but to allow rain to simply fall onto the adjacent ground where it has opportunity to infiltrate, collect and flow overland as currently occurs.

Given each rack has a maximum vertical capacity of three panels, rainwater will fall to the ground below in three main concentrated drip lines beneath the bottom edge of each solar panel. The proposed panel arrangement will enhance water dispersion across the site, minimising localised runoff concentration and as such is expected to reasonably mimic greenfield condition without further measures. The use of vegetation below the panels will also enhance infiltration, retention, detention and soil erosion protection, while also promoting evapotranspiration

(2) The battery storage area at the southeast of the site which will also contain customer cabin and customer substation will be created using a crushed stone / gravel so that rain falling on this area will act as greenfield condition.

(3) Finally, it is also not proposed to formally drain the access tracks that will be constructed around the site. They will be created with permeable materials (e.g. gravel, grass-crete) such that rain falling on these areas will act as greenfield condition.

The soil condition and level of vegetation should be restored to pre-construction condition (or better) to mitigate the effects of soil compaction during the construction process of the solar farm. This will aid with infiltration of water through the top level of soil.

Water quantity and **quality** will be managed by moving away from intensive agricultural use and ploughing such that the land will re-naturalise to some extent. **Amenity** and **Biodiversity** can be enhanced through the use of planting of wildflower / grass meadow throughout the site. Excess runoff will behave as greenfield, by following the natural topography of the land.

6.0 Conclusion

Planning permission is sought to develop a renewable energy park at Wilbraham Road, Six Mile Bottom, Newmarket.

The site is located in Flood Zone 1 according to the Environment Agency's Flood Map for Planning. The site is not expected to be impacted by flood water in all but the most extreme scenario.

Risk to staff during site visits can be managed by monitoring weather warnings and the implementation of a basic flood plan. The site is an unmanned facility and therefore will rarely impact people.

The proposed scheme will introduce a large impermeable area into the site, however this will comprise of a large number of small panels. Separations between individual panels will allow water to fall onto the undeveloped ground below. The impact on site runoff will therefore be negligible. Local effects will be managed through the use of suitable vegetation beneath the solar panels.

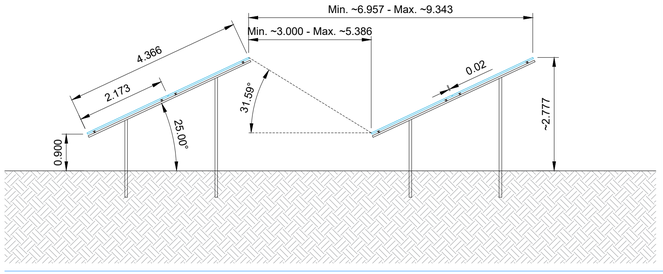
It is concluded that the site offers scope to deliver the proposed development such that it will be appropriate for the flood risk and is not expected to increase the risk of flooding elsewhere.

7.0 Recommendations

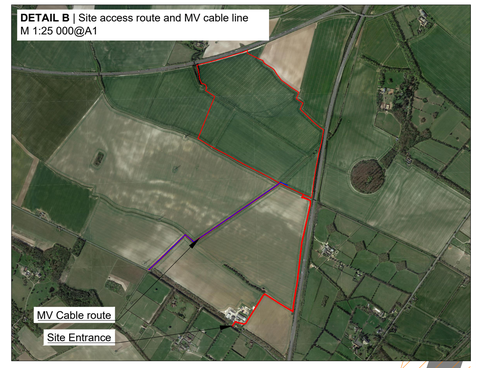
- Locate the customer cabin and customer substation, away from the areas identified at risk from surface water flooding.
- Implement suitable post-construction decompaction and vegetation across the site and beneath solar panels to enhance local infiltration, retention and detention.
- *Construction (Design and Management) Regulations 2015*
    - *The revised CDM Regulations came into force in April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the Designer's responsibilities is to ensure that the Client organisation, in this instance Ridge Clean Energy Ltd, is made aware of their duties under the CDM Regulations.*

Appendix A – Proposed Plans

DETAIL A | Frame side view
M 1:75@A1



DETAIL B | Site access route and MV cable line
M 1:25 000@A1



Proposal only

30m OFFSET FROM PYLONS
Min.6.500
Min.6.500
GATE 2
5.3m
5.3m
5.3m
Min.5.000
Min.5.000
20.000
OVERHEAD LINES
CADENT GAS PIPE
EXTERNAL TRACK
NATIONAL GRID GAS PIPE
SITE BOUNDARY (~76.09ha)
SECURITY FENCE (~72.41ha)
POWER STATION
MAINTENANCE TRACK
COMPOUND AREA
80mx50m
CUSTOMER SUBSTATION &
BATTERY STORAGE COMPOUND
140mx100m
CUSTOMER SUBSTATION
CUSTOMER CABIN
SITE ENTRANCE (GATE 1)

N
0
125
250m

Notes:

1. All dimensions to be confirmed on site prior to installation.
2. All dimensions are indicative only and in m unless otherwise specified.
3. Drawing based on satellite data:
   Imagery date: 22/04/2021

Reference drawings

Drawing name	Rev	Date
Six Oaks Boundary and Layout 07072022	—	03/08/22
ENGN1010-100	A	21/03/22

Legend:

- Site boundary
- Perimeter fence (~3 628 m)
- Maintenance track
- External track
- Cadent gas pipe
- National grid gas pipe
- Customer substation & Battery storage area
- Compound area
- Road restriction area
- Customer cabin
- DNO
- 20ft. Customer Substation
- 20ft. Power Station (9x 6 000 kVA)
- Table of 2P26 modules (2 185 pcs.)
- Table of 2P13 modules (232 pcs.)
- Gate

System description:

DC Power kWp:	70594.68
AC Power kVA:	49880 (@Pmax) / 46400 (@Pnom)
No. of modules:	119652
Module type:	Canadian Solar CS7L-590MB
Dimensions:	2173x1305x35
Substructure type:	2 modules in portrait
Modules per string:	26
Number of strings:	4 562
Tilt angle:	25°
Shading angle:	~31.59°
Azimuth from South:	0°
Inverter model:	Huawei SUN2000-215KTL-H1
Inverter power, kVA:	215 (@Pmax) / 200 (@Pnom)
No. of inverters:	232
DC / AC ratio:	1.52 (@Pnom)

Proposed location:

Revisions:

Rev	Date	Comments	Drawn	Approve
0	04/08/22	First issue	MC	UZ
0	10/08/22	Frames added over compound area	UZ	UZ

Project:	Six Oaks
Location:	Wilbraham Road, Six Mile Bottom,New Market, CB8 0UW,UK 52.209753°, 0.297069°
Title:	PV Layout
Drawn:	Detra Solar / MC
Checked:	RB
Scale:	1:2500@A1
Date:	04/08/22
Drawing No:	RCE1002-100
Rev:	A

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