Flood Risk Assessment Land to the West of Marden

Final Report

March 2022

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Contract

This report describes work commissioned by Donna Clarke of Origin Power Services Ltd, on behalf of Solarcentury, by an email dated 19 February 2021. James Hookham of JBA Consulting carried out this work.

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Purpose

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Executive summary

JBA Consulting were commissioned by Donna Clarke of Origin Power Services, on behalf of Solarcentury, in February 2021 to undertake a Flood Risk Assessment (FRA) to support a proposed planning application for development of a solar farm at the Land to the West of Marden.

The site is approximately 77.7ha in size and is currently occupied by agricultural land (i.e greenfield land). The proposed site is located approximately 0.74km west of Marden and is bound by a railway line to the north and Sheephurst Lane to the south.

The proposed development will involve the installation of photovoltaic panels and the construction of a compound area which comprises of:

- Parking
- Storage
- 33/132kV substation (POC)
- 10MW battery storage

According to NPPF and PPG guidance the proposed solar farm should be considered as 'Essential Infrastructure'.

The EA flood zones show that a large proportion of the site is located within flood zone 3; defined as land with a greater than 1 in 100-year (1.0% AEP) probability of fluvial flooding. An area of land in the south west has been modelled within Flood Zone 2; classified as land having between a 1 in 100 and 1 in 1000-year probability of fluvial flooding. Furthermore, an area of land in the centre south of the site is located outside of both Flood Zone 2 and Flood Zone 3 extents.

Following correspondence with the EA detailed hydraulic modelling for the area has been obtained (Medway Model 2015). The 20-year, 100-year and 100-year plus 35% climate change fluvial flood depths have been derived from this model and a 2016 model re-run.

Based on current layout plans the proposed compound area will be located upon land within the modelled fluvial extents. Fluvial flood depths in the north west are anticipated to range between 200-400mm during the 20-year flood event, 400-600mm in the 100-year flood scenario and 600-800mm during the 100-year plus 35% climate change modelled event.

Comparison of the proposed site layout with the modelled surface water flood risk extents indicates that the compound area will be developed upon land which is located outside of the 30-year and 100-year extents but within the 1000-year extent.

Analysis of Maidstone Borough Council Level 1 SFRA update and Level 2 SFRA indicates that the proposed development site is not at risk of groundwater or sewer surcharge flooding.

EA risk of flooding from reservoir map shows depths associated to reservoir flooding reach up to 2m within the site. However, it should be mentioned that the event of a reservoir breach is extremely unlikely.

It is recommended that a sequential approach to site layout is adopted whereby the most vulnerable elements of the proposal (such as the compound, the battery storage units and the substations) are located within the lower flood risk areas, upon land in the south west of the site.

Should the compound area remain in its current proposed location (to the north west of the site), it is recommended that the Finished Slab Level of the proposed compound is set at a minimum of 17.50mAOD, 300mm above the 100-year plus 35% climate change fluvial flood level at this location.

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Abbreviations

AEP	Annual Exceedance Probability
DTM	Digital Terrain Model
EA	Environment Agency
FRA	Flood Risk Assessment
Ha	Hectares
hr	Hour
JBA	Jeremy Benn Associates
Km	Kilometres
LPA	Local Planning Authority
m	Metres
m AOD	metres Above Ordinance Datum
mm	Millimetres
OS NGR	Ordnance Survey National Grid Reference
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RoFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TOPO	Topography

1 Introduction

1.1 Terms of Reference

JBA Consulting were commissioned by Donna Clarke of Origin Power Services, on behalf of Solar Century, in February 2021 to undertake a Flood Risk Assessment (FRA) to support a proposed application for development of a solar farm at Land to the west of Marden.

This document provides information pertaining to the nature of flood risk at the site and follows the revised National Planning Policy Framework (NPPF) June 2019 and associated Planning Practice Guidance (PPG) with regards to development and flood risk. It also considers the flood risk mitigation relevant to the nature of the proposal and the flood zone classification of the site.

1.2 FRA Requirements

It is a requirement for development applications to consider the potential risk of flooding from various sources to a proposed development over its expected lifetime and any possible impacts on flood risk elsewhere, as a result of the development.

Where appropriate, the following aspects of flood risk should be addressed in all planning applications within flood risk areas and for any proposed development sites with an area greater than 1 ha:

- The area at risk of flooding, from all sources;
- The probability of flooding occurring now and in the future;
- The extent and standard of any existing flood defences and their continuing effectiveness;
- The likely depth of flooding for a range of return periods;
- The potential impact on areas, properties and habitats in the wider catchment;
- The effects of climate change;
- The nature and likely life of the proposed development and the extent to which it is designed to deal with flood risk

The NPPF advocates a risk-based approach to flood risk management in terms of appraising, managing and reducing the consequences of flooding both to and from a development site. The flood risk for the site has been assessed in line with Environment Agency (EA) requirements and in conjunction with the Client. The primary objectives of this FRA are to determine the following:

- Whether the site is at significant risk from any form of flooding;
- If the site is at risk of flooding, determine if safe access to and from the site can be achieved and maintained;
- Mitigation measures to alleviate flood risk on the site.

2 Site Details

2.1 Site Description

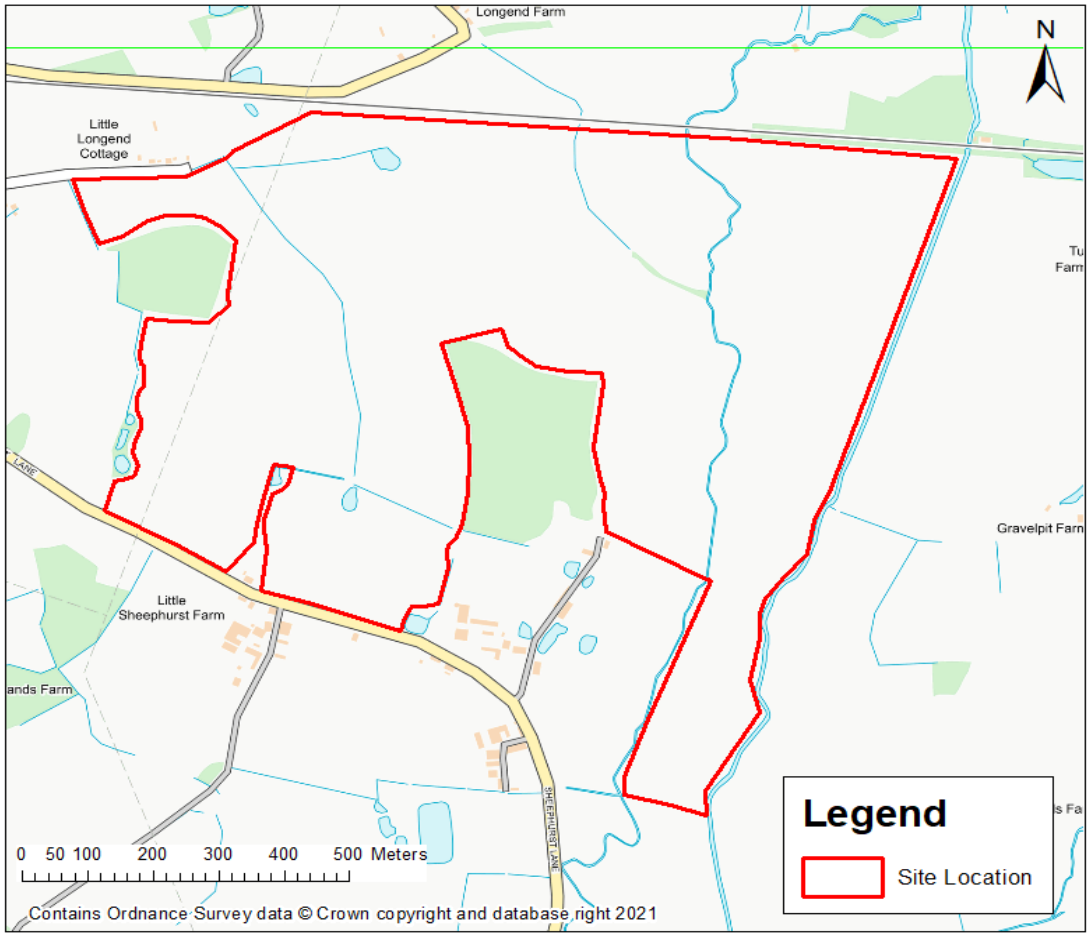
The proposed development site is approximately 77.7ha in size and is located 0.74km to the west of Marden, Kent. The site is currently occupied by greenfield land and is bound by a railway track to the North and Sheephurst Lane to the South.

The Lesser Teise flows along the eastern periphery of the red outline application boundary with the River Teise situated some 0.65km to the south.

A site location plan and key site details are outlined in Table 2-1: .

Table 2-1: Summary of Site Details

Site name	Land to the West of Marden, Kent TN12 9NP
Site area	77.7ha
Existing land-use	Agricultural Use (greenfield land)
Purpose of development	Development of a solar power farm.
OS NGR	TQ7259044548
Country	England (NPPF applies)
Local Planning Authority	Kent County Council
Lead Local Flood Authority	Kent County Council



2.2 Proposed Development

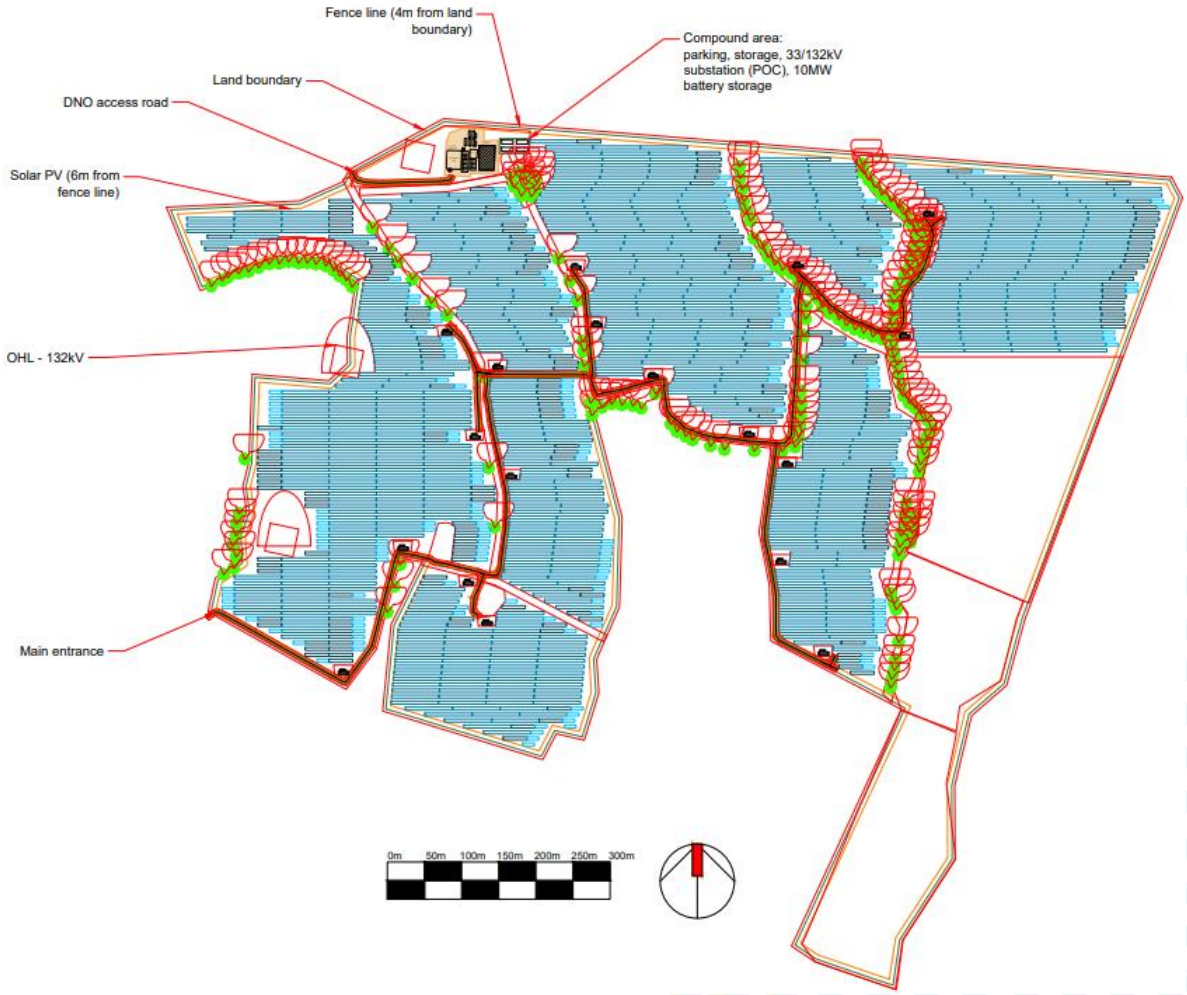
The proposed application relates to development of a solar farm including installation of photovoltaic panels and, construction of a compound area and site access road (as shown Figure 2-1).

According to plans provided the compound area will comprise of the following:

- Parking
- Storage
- 33/132kV substation (POC)
- 10MW battery storage

Additional plans can be found in Appendix A.

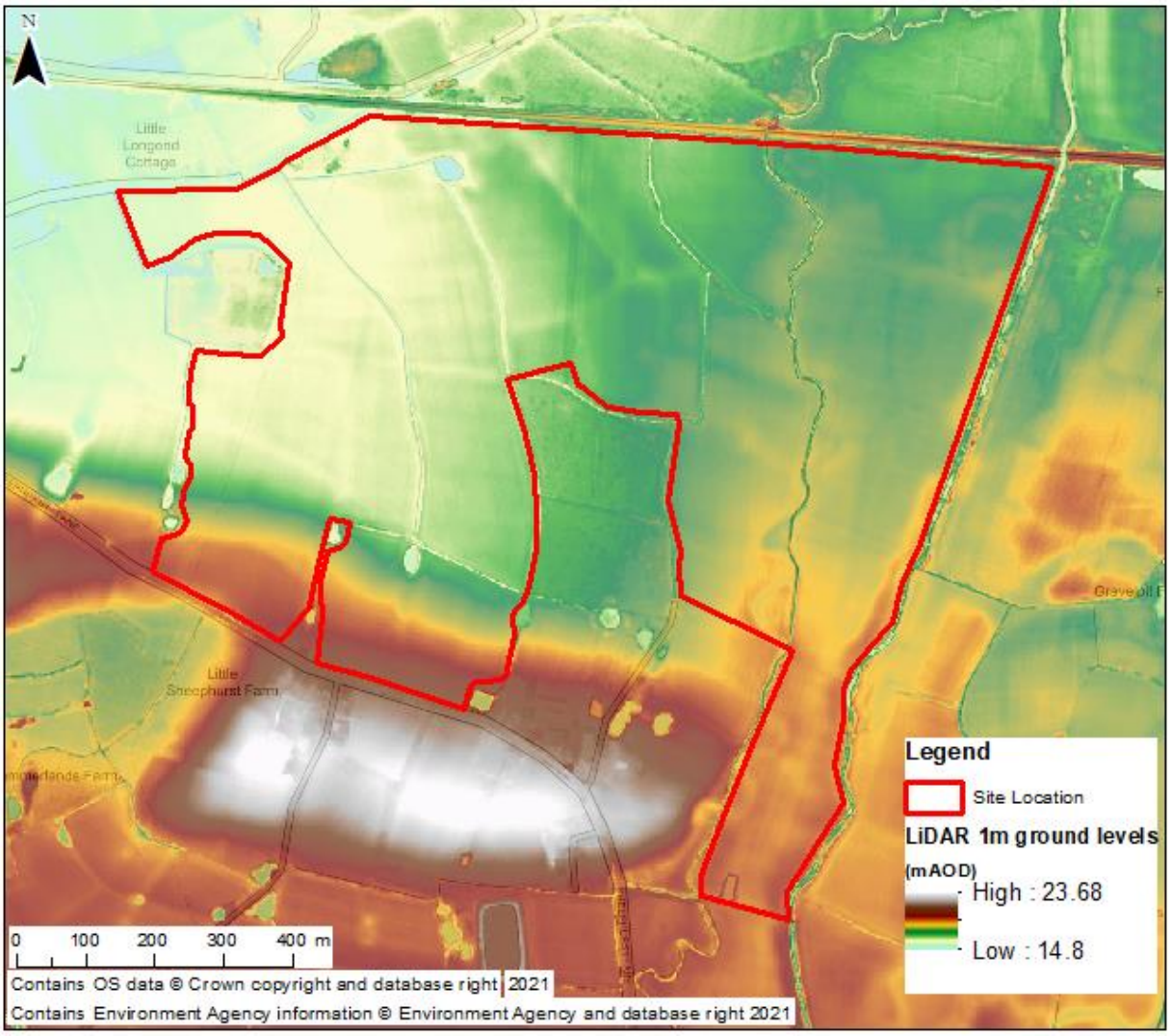
Figure 2-1: Proposed Site Layout Plan



2.3 Site Topography

Analysis of Environment Agency (EA) 1.0m LiDAR (elevation) data demonstrates that the site and surrounding area generally slopes down from land in the south towards the north western corner, associated with land adjacent to the railway embankment (refer to Figure 2-2). According to EA 1.0m LiDAR data the maximum and minimum elevations within the proposed site area are 20.54mAOD and 16.70mAOD respectively. Furthermore, based on current development plans, the compound area in the north west of the site lies upon land with an approximate elevation of 16.85mAOD.

Figure 2-2: Topography of Site and Surrounding Area



2.4 Watercourses

Several drains bisect the site and flow in a northerly direction towards the railway embankment. In addition, a number of pond features have been identified in the western half of the development.

According to EA mapping the Lesser Tiese flows along the eastern boundary of the site with the River Tiese approximately 0.65km to the south; flowing in a westerly direction.

The River Tiese is a tributary of the River Medway. The Tiese's source is in Tunbridge Wells in the High Weald to join the Medway at Yalding in the Low Weald

According to the Environment Agency, the section of River Tiese and Lesser Tiese which flows past the site is not designated artificial or heavily modified and has an overall Water Body Classification of moderate.

3 Planning and Flood Risk Policy Overview

3.1 Planning Policy Overview

The National Planning Policy Framework (NPPF)[1] was issued by the Department for Communities and Local Government in March 2012 and last updated in June 2019. The technical guidance it contains relates to development planning and flood risk using a sequential characterisation of risk based on planning zones and the Environment Agency Flood Map, and minerals policy. A principal study requirement is to identify the Flood Zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions. The NPPF is accompanied by the Planning Practice Guidance (PPG)[2] on Flood Risk and Coastal Change, which gives further information on the approaches to be adopted in the assessment of flood risk for new development.

According to NPPF and PPG guidance the proposed solar farm should be considered as 'Essential Infrastructure'.

3.1.1 Definition of Flood Zones

Table 2-1 shows how the flood zones are defined in terms of fluvial and tidal flood risk.

Table 3-1: Flood Zones and Appropriate Uses

Zone 1: low probability
Land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
Zone 2: medium probability
Land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Zone 3a: high probability
Land assessed as having a 1 in 100 or greater probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Zone 3b: functional floodplain
Land where water has to flow or be stored in times of flood Local Planning Authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designated to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify functional floodplain.

3.2 Environment Agency and Climate Change Allowances

The NPPF and supporting Planning Practice Guidance on flood risk and coastal change explains when and how Flood Risk Assessments should be prepared and applied. This includes demonstrating how flood risk will be managed now and over a development's lifetime, taking climate change into account.

The impact of climate change is assessed through uplifts, known as 'allowances'. Climate change allowances are predictions of changes in anticipation of climate change for different

[1] https://www.gov.uk/government/publications/national-planning-policy-framework--2

[2] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

climate scenarios over different epochs, or periods of time, over the coming century. To increase resilience to flooding and coastal change, allowances for climate change should be made as part of a flood risk assessment.

The range of allowances is based on percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flows fall below it, and half fall above it. For fluvial and pluvial uplifts the allowances are as follows:

- Central allowance is based on the 50th percentile
- Higher centra allowance is based on the 70th percentile
- Upper end allowance is based on the 90th percentile
- H++ allowance is based on an "extreme climate change scenario"

An allowance based on the 50th percentile is exceeded by 50% of the projections in the range. At the 70th percentile it is exceeded by 30%. At the 90th percentile it is exceeded by 10%.

It is important to use the most appropriate allowance based on the vulnerability of the development.

The site is located within the Thames River Basin District and the allowances for this are shown in Table 3-2Table 3-2: Climate change (peak river flow) allowances for the Thames river basin district. The development is considered as essential infrastructure as it is an electricity generating power station and the site falls within flood zone 3. Therefore, the Upper End climate change allowances should be considered.

Table 3-2: Climate change (peak river flow) allowances for the Thames river basin district

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)
H++	25%	40%	80%
Upper end	25%	35%	70%
Higher Central	15%	25%	35%
Central	10%	15%	25%

3.3 Maidstone Borough Council Flood Risk Policy

3.3.1 Strategic Flood Risk Assessment

A Strategic Flood Risk (SFRA) is undertaken by the Local Planning Authority to assess the current and future flood risk within the local borough to determine the impact that development may have on flood risk.

The latest SFRA Maidstone Borough Council Level 1 SFRA update and Level 2 SFRA[3] was published in August 2020.

The SFRA outlines what is expected and necessary when developing within the borough taking into account flood risk. Of particular importance to this assessment are the sections outlining the potential risk associated with groundwater and sewer surcharge flooding.

[3] https://localplan.maidstone.gov.uk/home/documents/local-plan-review-documents/lpr-evidence/7-SFRA-Level-1-update-and-Level-2.pdf

Furthermore, the SFRA includes mapping outputs showing flood risk from various sources for several return period scenarios across the Maidstone Borough, including the proposed development site.

3.3.2 Maidstone Council Solar PV Array Policies

Maidstone council has released two policies which provide planning advice for development of both domestic and medium scale solar PV arrays (up to 50kW) and solar thermal[4] and Large scale (>50kW) solar PV arrays[5].

These documents outline that any planning application associated with development of a solar park must be accompanied by a flood risk assessment. Consideration must also be given to the impact of any development on drainage at the site.

Large scale (>50kW) solar PV arrays should consider incorporation of simple sustainable urban drainage systems (SUDS) drainage techniques, such as shallow swales or infiltration trenches, to reduce the impact of concentrated run-off, from the panels, causing the formation of gullies.

3.3.3 Maidstone Surface Water Management Plan

The Maidstone Stage 1 Surface Water Management Plan[6] (SWMP) outlines the strategies for managing surface water flooding within the Maidstone Borough. This document highlights the requirement of the implementation of SUDS on all new developments within the Maidstone Borough.

3.4 Sequential and Exception Tests

The NPPF requires that the Sequential and Exception Tests should be applied when choosing the location of new development and the layout of the development site. The Sequential Test aims to promote development in low flood risk areas. The Exception Test is used where no suitable development areas can be found in low risk zones.

3.4.1 Sequential Test

When planning a development, a sequential approach should be applied to identify suitable sites which are at minimal risk from fluvial flooding, avoiding Flood Zones 2 and 3 where possible. If no suitable areas can be identified in Flood Zone 1 then sites with the lowest flood risk should be considered next. If development is necessary within a medium or high-risk zone an exception test may be required to demonstrate the need for the development in that location and plans to mitigate the flood risk.

The site is located within Flood Zone 2 and 3 therefore the risk of flooding to the site is considered to be 'Medium to High'. Table 3 of the NPPF suggests that development classified as 'Essential Infrastructure' is appropriate within Flood Zone 2 and is considered appropriate in Flood Zone 3 subject to passing the Exception Test.

3.4.2 Exception Test

The exception test 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.

To pass the exception test, it must be demonstrated that the proposed development will:

- Provide wider sustainability benefits to the community that outweigh the flood risk; and
- That the development will be safe throughout its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

[4] https://maidstone.gov.uk/__data/assets/pdf_file/0006/51558/Solar-Note-Under-50KW-April-2014.pdf
[5] https://maidstone.gov.uk/__data/assets/pdf_file/0005/51557/Solar-Note-Over-50KW-April-2014.pdf
[6] https://www.kent.gov.uk/__data/assets/pdf_file/0019/51319/Maidstone-Stage-1-SWMP-Report.pdf

This FRA demonstrates that the development will be safe throughout its lifetime without increasing flood risk elsewhere, thereby satisfying the second requirement of the exception test.

4 Assessment of Flood Risk

4.1 Assessment Approach

This study assesses the risk from all sources of flooding to the proposal and the risk of flooding elsewhere as a result of the proposal, as well as how these flood risks can be managed.

The assessment has involved the usage of publicly available data, including EA Flood maps.

4.2 Historical Flooding

Historical flood data was obtained from the Defra Survey Data Download service.

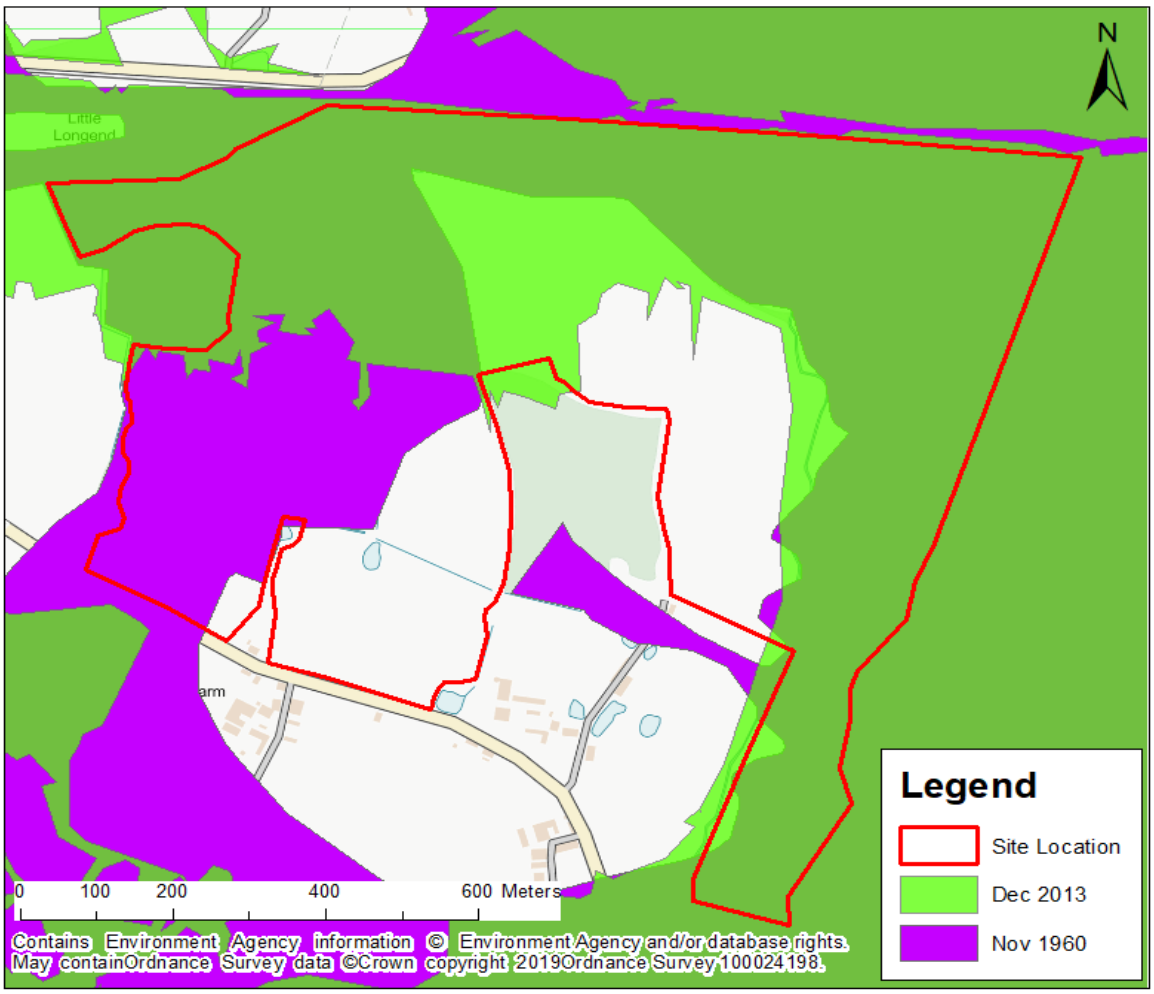
According to the EA Recorded Flood Outline dataset, the EA hold the following details of two historical flood events at the site and within the surrounding area:

- November 1960, as a result of the channel capacity being exceeded due to the lack of flood defences.
- December 2013, as a result of the channel capacity being exceeded due to the lack of flood defences.

As can be seen in Figure 4-1, the north and south east of the site was inundated during both historical flood events. Furthermore, land in the south west of the site is reported to have experienced flooding during the 1960 event.

Whilst historical flooding has been recorded at the site, it should be noted that the EA's historical flood maps are typically less accurate in rural areas. As such, the recorded flood outlines, detailed within Figure 4-1, should be considered as a proxy for the true flood extents only.

Figure 4-1: Environment Agency Recorded Flood Outline Map



4.3 Fluvial Flood Risk

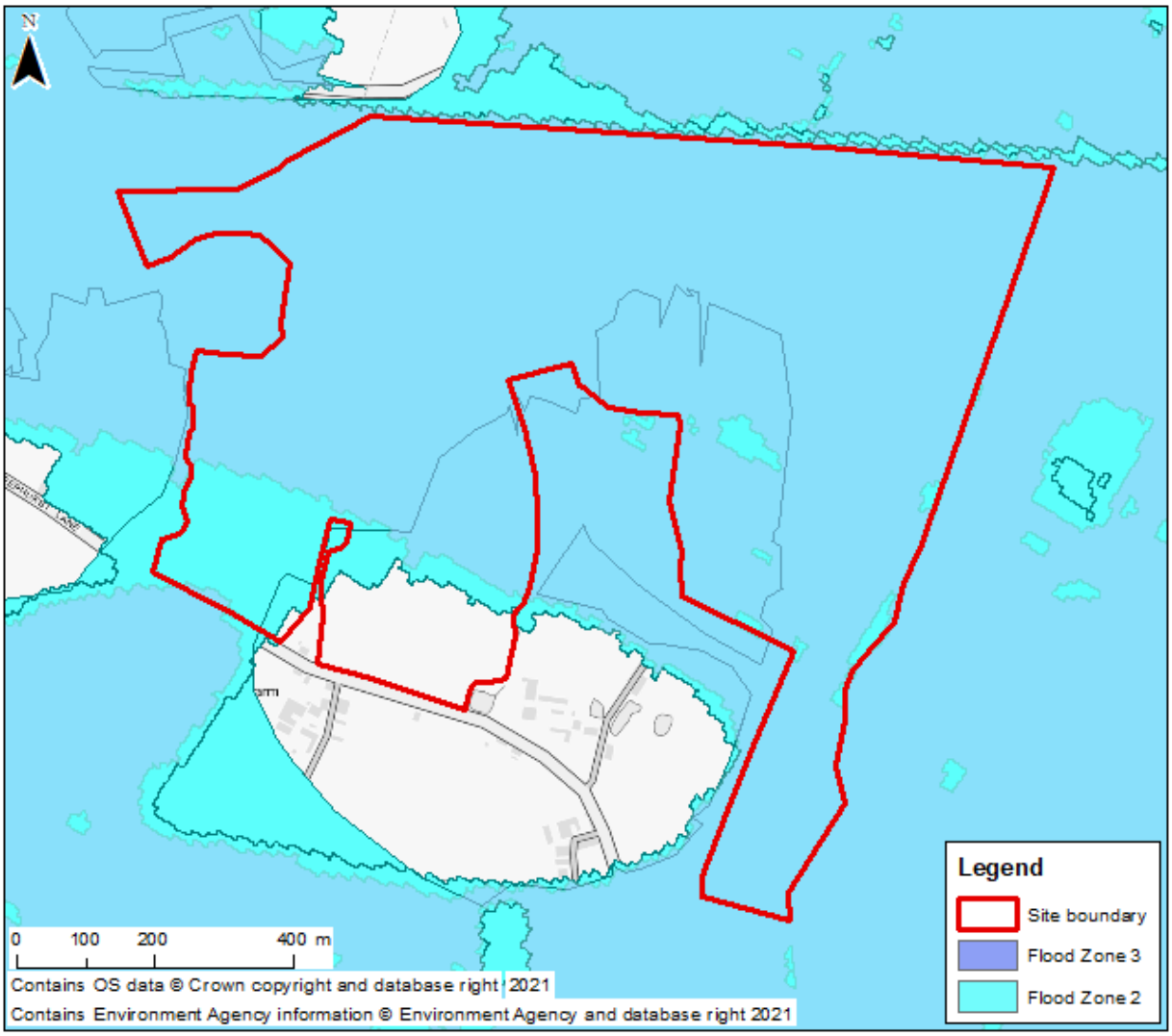
4.3.1 Flood Map for Planning

The Environment Agency (EA) Flood Zones show that the majority of the site is located within Flood Zone 3, defined as land with a greater than a 1 in 100-year (1.0% AEP) probability of fluvial flooding. See Figure 4-2.

However, a parcel of land located in the south west of the site has been modelled within Flood Zone 2. Flood Zone 2 refers to land assessed as having between a 1 in 100 and 1 in 1000-year probability of fluvial flooding (1% – 0.1% AEP).

Furthermore, an area of land in the centre south of the site is located outside of both Flood Zone 2 and Flood Zone 3 extents.

Figure 4-2: Environment Agency Flood Zone Extents Map



4.3.2 Estimated Flood Depths

A Product 4 information request was raised with the EA on 2nd March 2021 to ascertain whether any detailed modelling data was available in relation to the site. In response the EA have provided Product 5, 6 and 7 information which includes model output data for the Medway Model 2015.

The Medway Model 2015 has been used to assess flood levels/depths across the site and within the surrounding area. Furthermore, JBA are aware that the Medway Model 2015 was re-run in 2016 to incorporate a number of appropriate climate change allowances for the area. Details of the climate change flood levels from the 2016 model re-run have also been analysed to provide further assessment of future risk at the site.

Analysis of modelled flood depths for the 20-year and 100-year scenarios, derived from the Medway Model 2015, have been carried out and are outlined in Figure 4-3 and Figure 4-4, respectively.

Considering that the development is classified as Essential Infrastructure, in accordance with EA guidance, the Upper End Allowance should be applied to the 1 in 100-year flood level to account for future climate change. The Upper End Allowances for the River Thames Basin are detailed within *Table 1: peak river flow allowances by river basin district (based on a 1961 to 1990 baseline)* (refer to Table 3-2 of this report for specific values which

relate to the River Thames basin). Given the nature of the proposals and the design lifetime it is considered most appropriate to apply a 35% allowance for future climate change.

As part of the 2016 model update, the Medway Model 2015 was re-run to incorporate a 35% allowance for climate change. The updated model outputs for the 1 in 100-year event with 35% allowance for climate change have also been analysed as part of this assessment (see Figure 4-5).

Figure 4-3: Modelled 20-year Fluvial Flood Depths

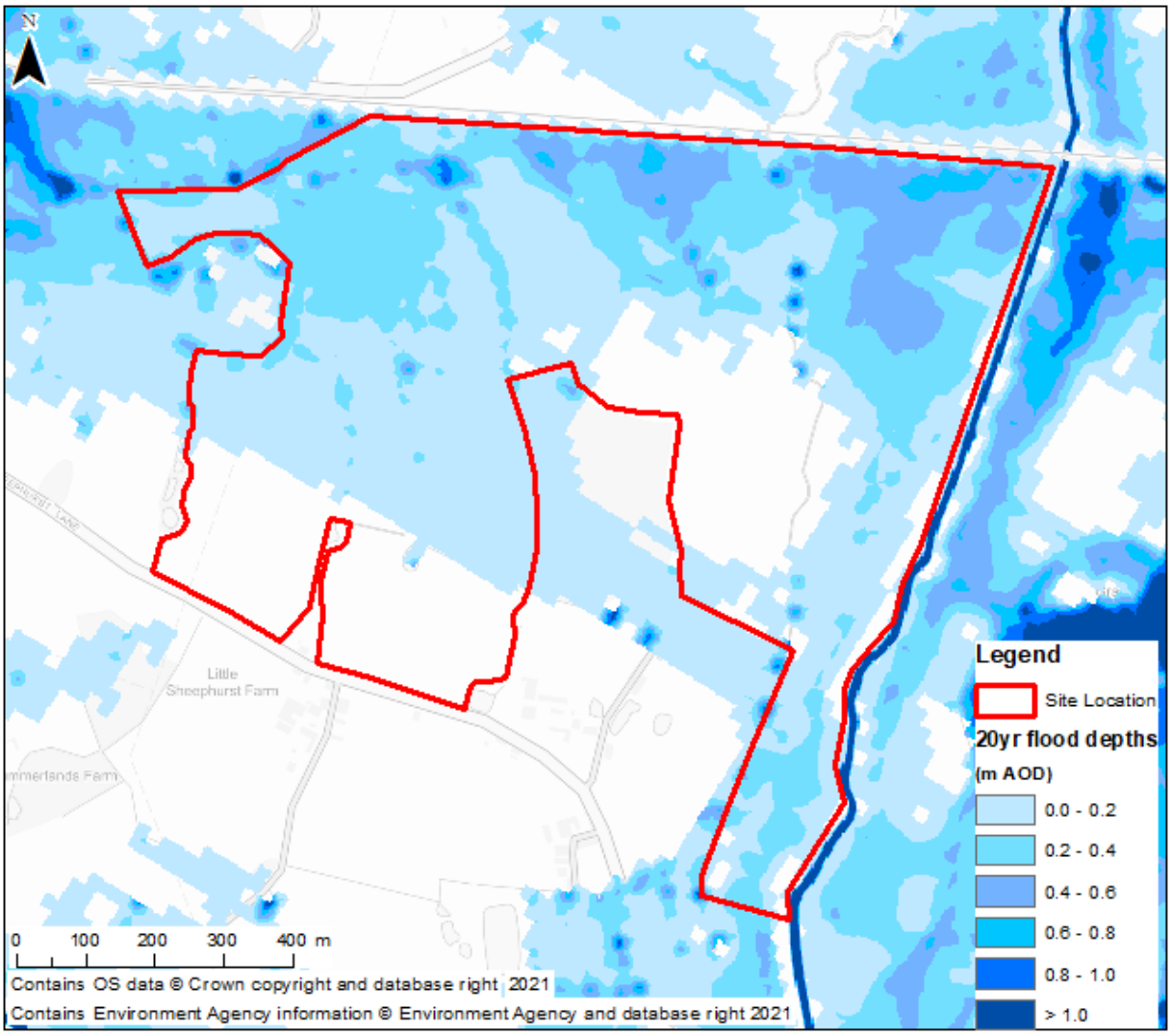


Figure 4-4: Modelled 100-year Fluvial Flood Depths

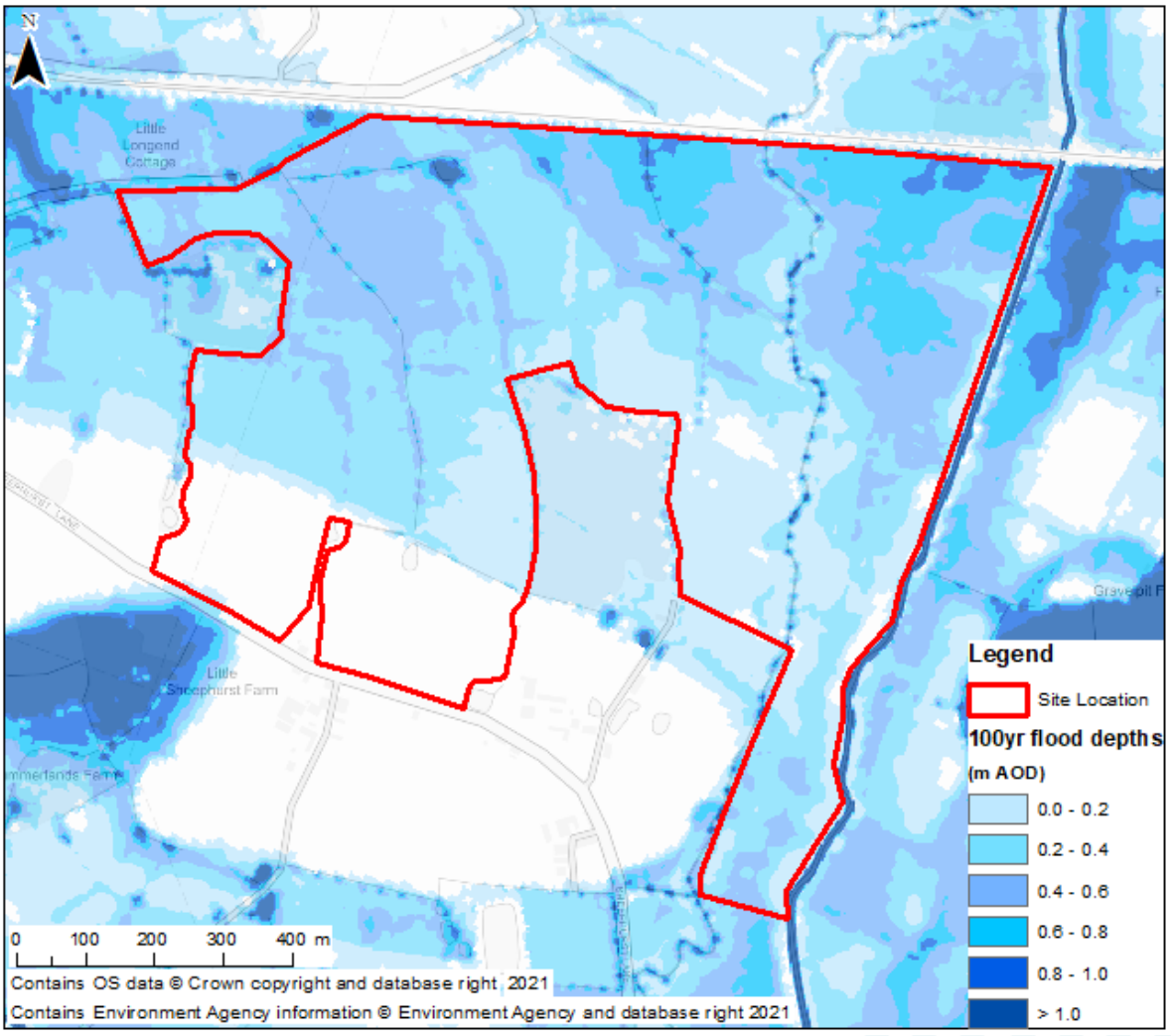


Figure 4-5: Modelled 100-year plus 35% Climate Change Fluvial Flood Depths

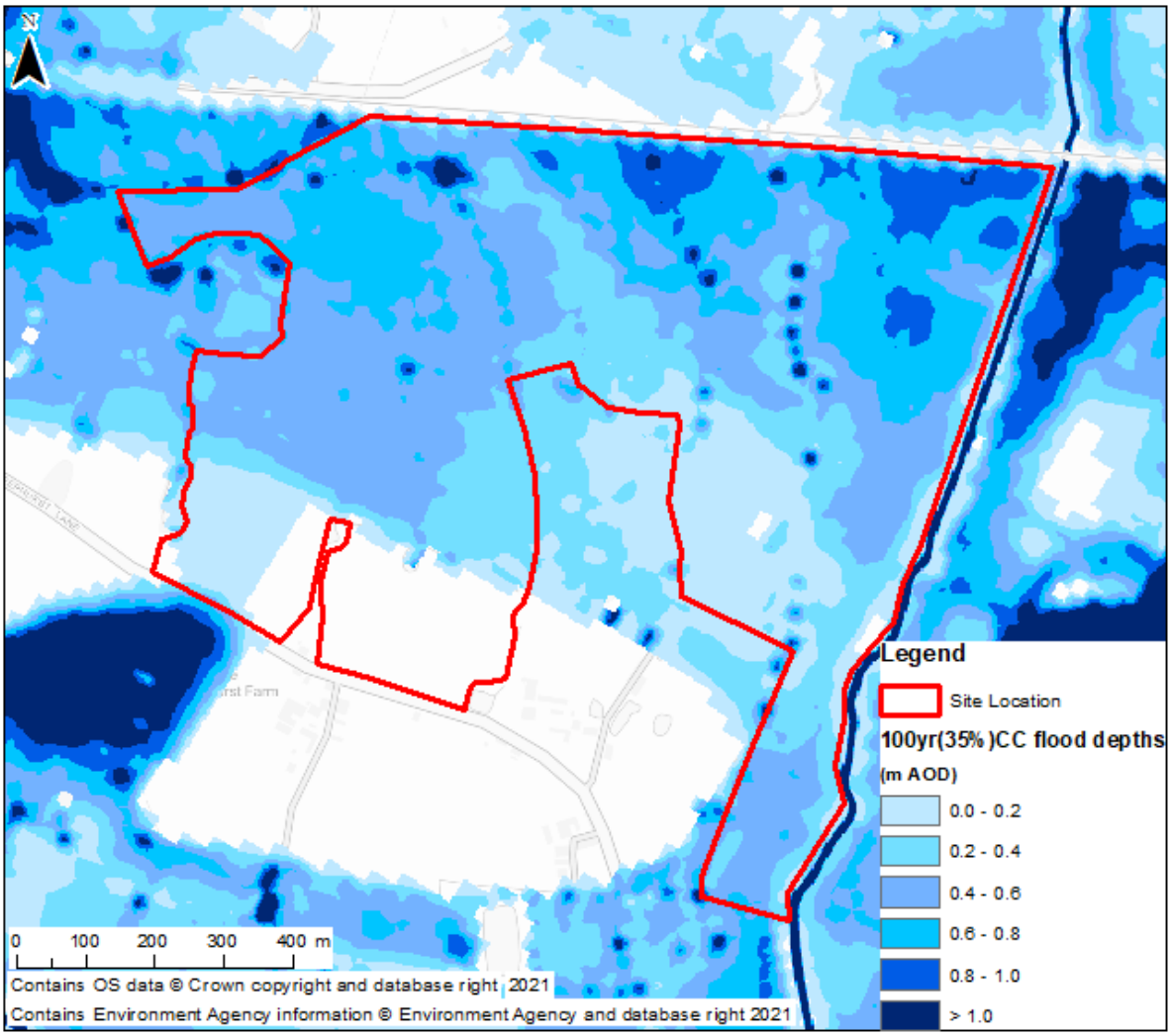


Figure 4-3, Figure 4-4 and Figure 4-5 show that much of the site becomes inundated from fluvial flooding during the modelled 20-year, 100-year and 100-year plus 35% climate change scenarios.

The south of the site is largely not at risk of fluvial flood risk during any of the modelled flood scenarios. However, the north of the site is modelled to experience depths of between 600-800mm in all flood scenarios, particularly in the 100-year and 100-year plus 35% climate change.

Based on current layout plans the proposed compound area will be located upon land within the modelled fluvial extents. Fluvial flood depths in the north west are anticipated to range between 200-400mm during the 20-year flood event, 400-600mm in the 100-year flood scenario and 600-800mm during the 100-year plus 35% climate change modelled event.

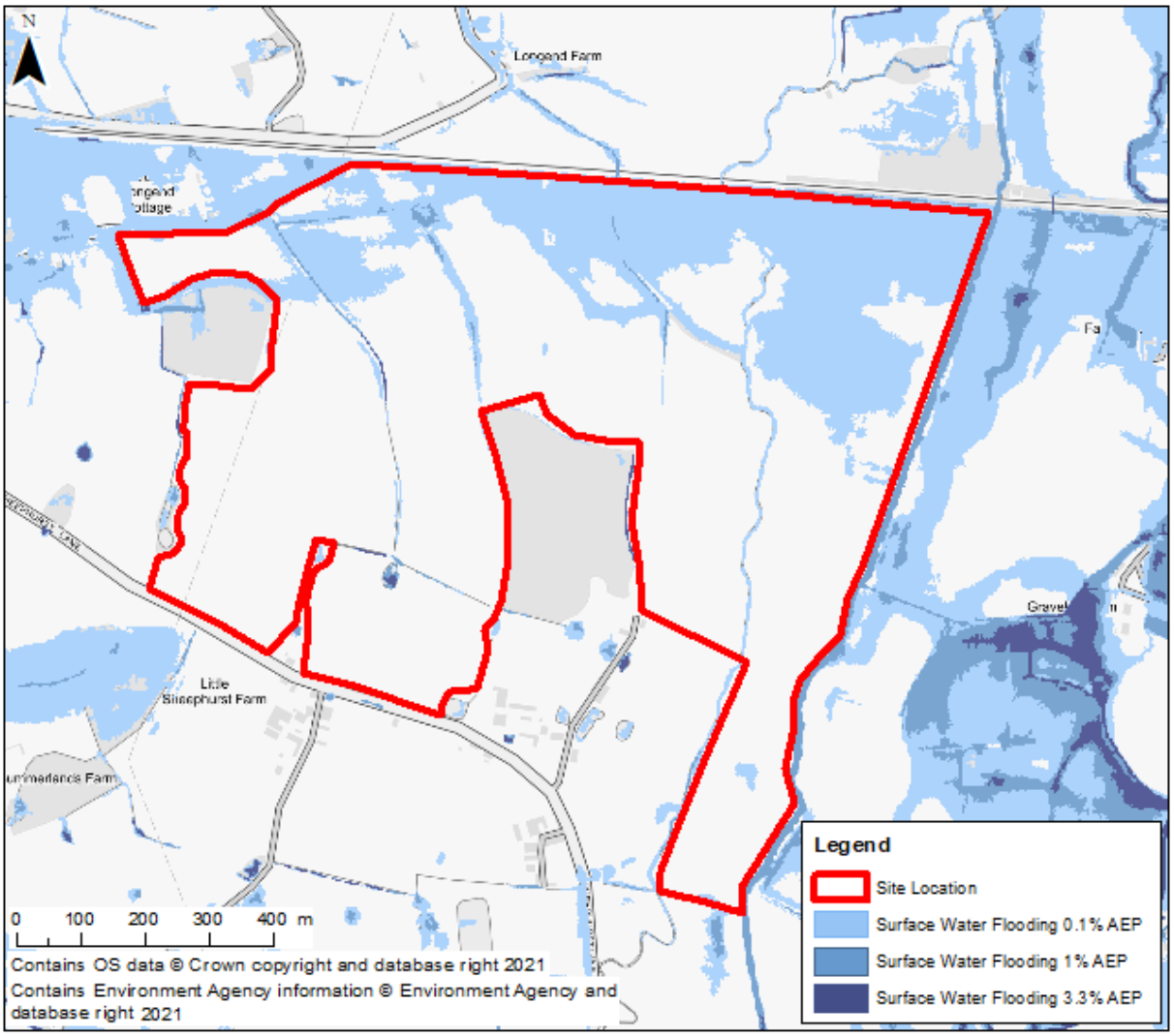
4.4 Surface Water Flood Risk

4.4.1 To the Site

Surface water flooding arises following periods of intense rainfall, or rain falling on saturated soil, that is unable to soak into the ground or where drainage systems are unavailable or unable to manage surface water runoff. This surface water runoff forms overland flow when following the topography of the land, often pooling in topographic low spots. Surface water flooding and subsequent overland flow can also originate from surcharging or blocked sewers and drains.

The Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping has been used to identify surface water flood risk at the site. As can be seen in Figure 4-6 the majority of the site is modelled at very low risk of surface water flooding however, land in the north has been identified at risk during the 1 in 1000-year event.

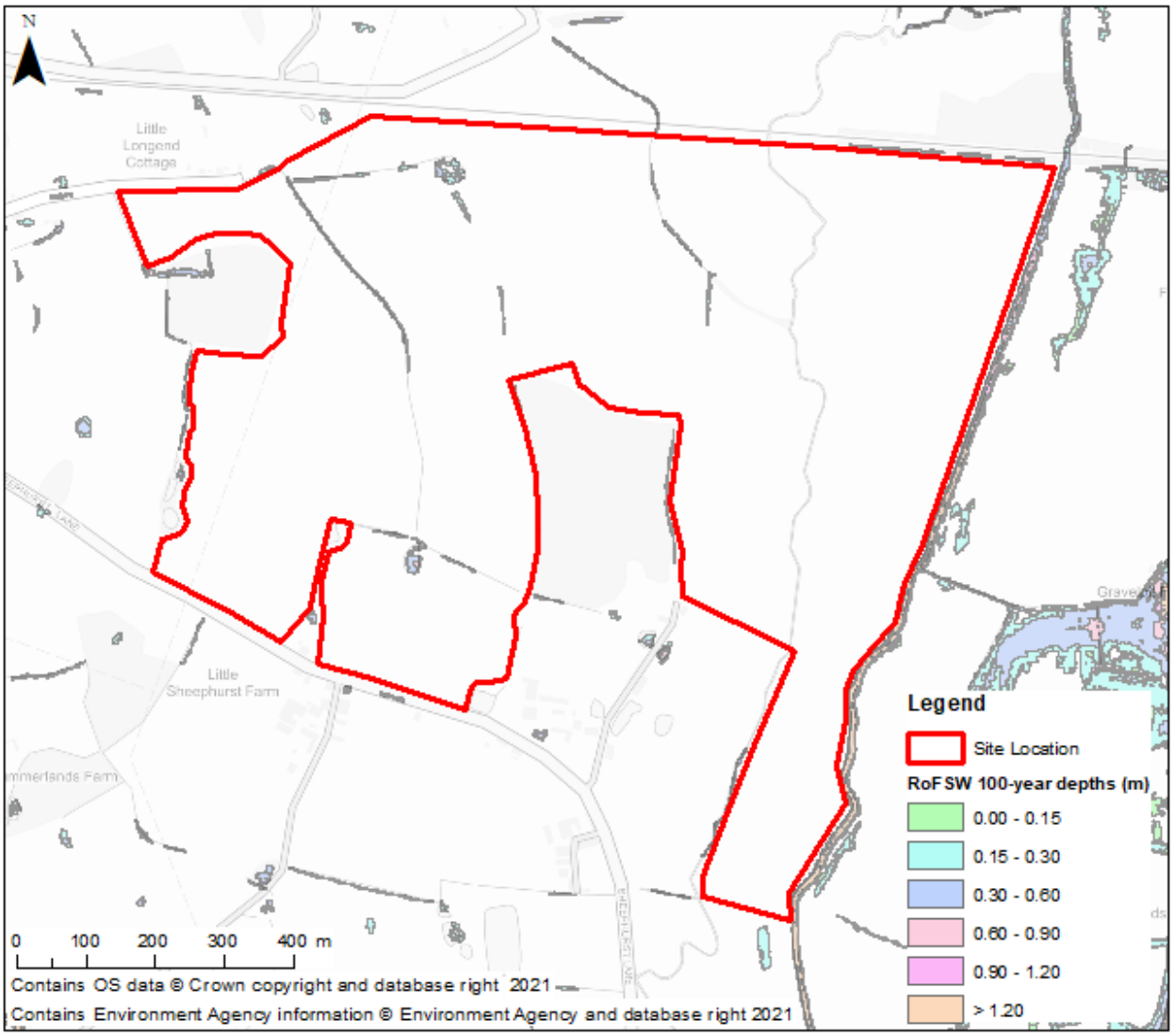
Figure 4-6: Environment Agency Risk of Flooding from Surface Water Flood Extent Map



Given that the development site has been identified at risk of flooding from surface water further analysis has been carried out to investigate the location(s) of water accumulation across the site and the associated modelled depths for each return period scenario. The detailed flood mapping below (refer to Figure 4-7 and Figure 4-8) shows modelled flood depths, taken from the Risk of Flooding from Surface Water dataset, across the site during

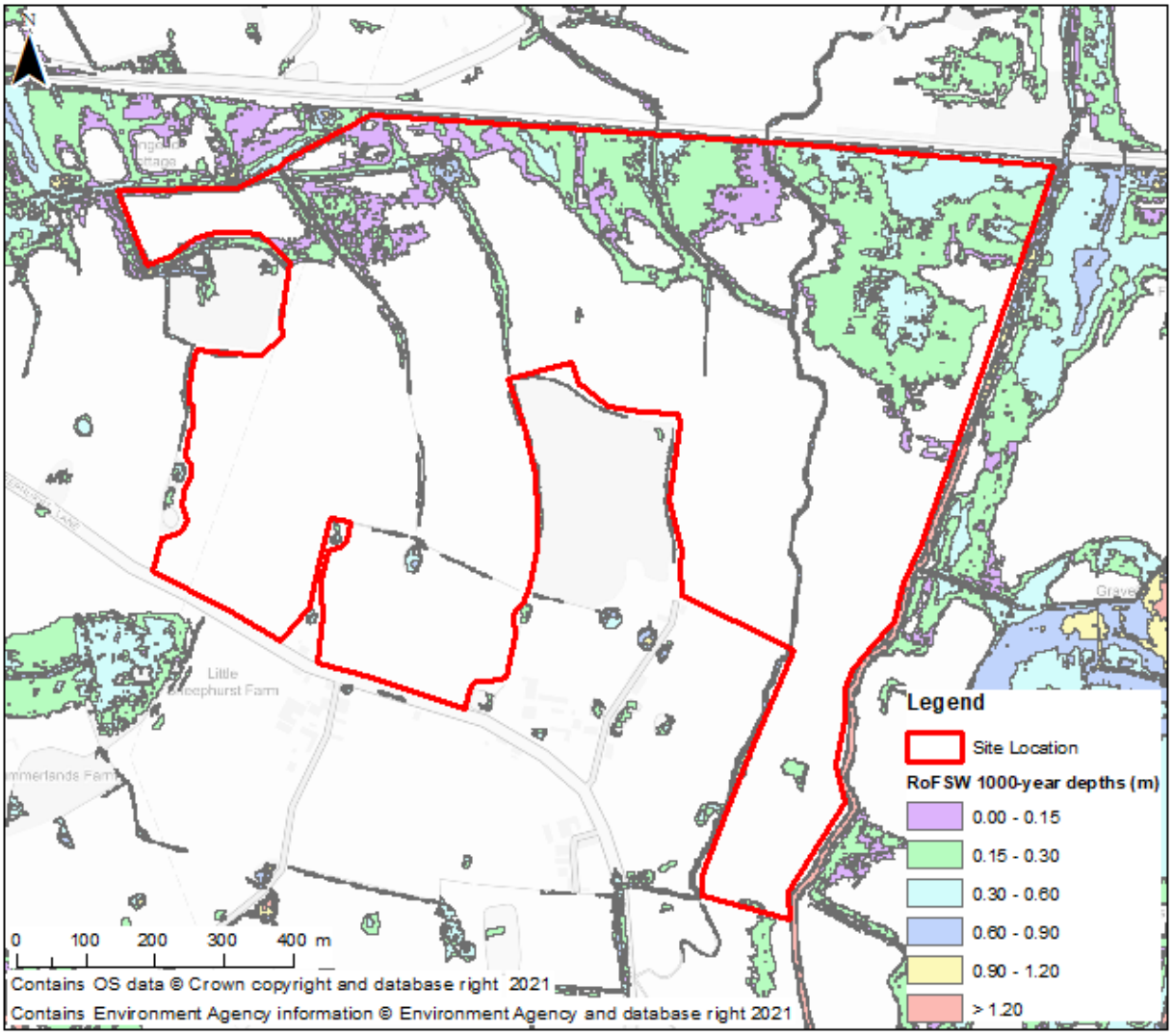
the 1 in 100-year and 1 in 1000-year pluvial flood events, respectively. Mapping has not been provided for the 1 in 30-year scenario as the site has not been identified at High risk.

Figure 4-7: Environment Agency Risk of Flooding from Surface Water 100yr Depths



According to Environment Agency modelling much of the site is not at risk from surface water flooding during the 1 in 100-year scenario. However, several linear and circular areas of water accumulation have been identified throughout the site. Upon review of aerial imagery, the areas identified at risk appear to correlate with the locations of a number of drains and ponds. Any surface water flooding modelled within water features would be attributed to in-channel flows by virtue of being located within a water body therefore should not be considered a surface water risk.

Figure 4-8: Environment Agency Risk of Flooding from Surface Water 1000yr Depths



Modelled depths for the 1000-year scenario indicate that surface water flood risk is highest along the northern periphery of the site. According to EA modelled outputs land in the north east of the site could experience flood depths of between 0.15m and 0.3m during the 1000-year event. Depths in the range of 0.3-0.6m are anticipated within the centre north and north east.

Comparison of the proposed site layout with the modelled surface water flood risk extents indicates that the compound area will be developed upon land which is located outside of the 30-year and 100-year extents but within the 1000-year extent.

4.4.2 From the Site

Modifications and increases of impermeable areas can lead to increased surface water runoff rates and volumes. These increases can exacerbate or create new surface water flood risks downstream of the site and can also cause pollution of the water environment.

The only increases in impermeable surfacing associated with the development relate to construction of the compound area, the access road and the substations. Review of the proposed layout plans indicate that, post development, the total area of newly introduced impermeable surfacing will amount to only 3% of the total site area.

Furthermore, all newly introduced impermeable surfacing will be managed using sustainable urban drainage systems (SuDS) to protect and alleviate potential risk from surface water flooding. Details of this will be outlined as part of the formal planning submission.

4.5 Other Flood Risks

4.5.1 Groundwater Flood Risk

Groundwater flooding occurs when water table rises above ground level, especially after a prolonged rainfall when the soil becomes saturated and the storage capacity available within it is reduced. This is most likely to occur in low-lying areas that are underlain by permeable bedrock and superficial geology. Unlike other forms of flooding, groundwater flooding does not pose a significant risk to life however, it can cause a serious damage to buildings.

Details of intrusive ground investigations have not been provided as part of the assessment. However, ground conditions have been preliminarily assessed using publicly available information. According to the Maidstone Borough Council Level 1 update and Level 2 Strategic Flood Risk Assessment (SFRA), reports of groundwater flooding within the Maidstone Borough tend to be associated with isolated singular instances.

Further analysis of the SFRA's Groundwater Flood Map shows that the proposed development does not appear to be at risk of groundwater flooding.

4.5.2 Sewer Flood Risk

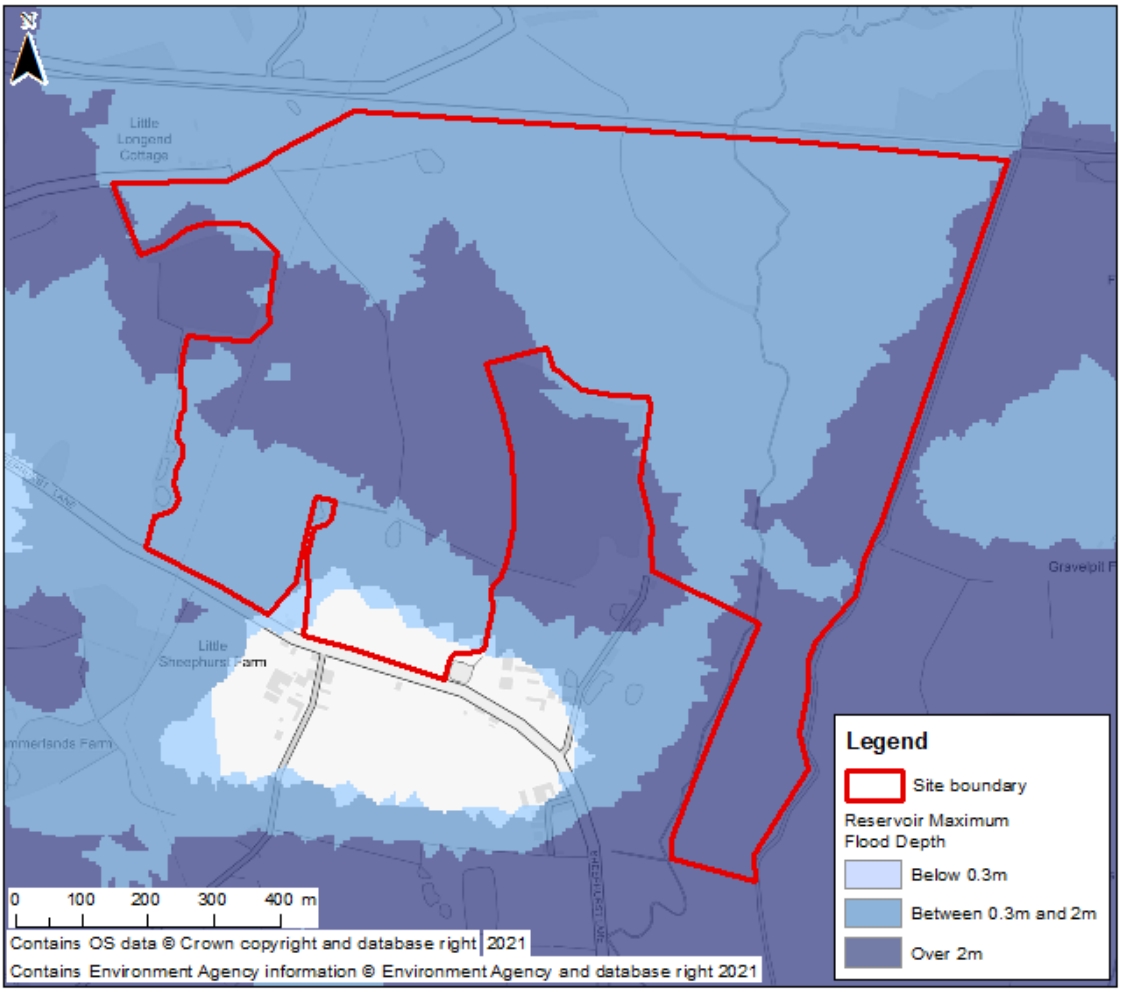
Maidstone Borough Council Level 1 update and Level 2 Strategic Flood Risk Assessment (SFRA) published in August 2020 has collated recorded flood incidents from Southern Water to assess the risk from sewer flooding across the Maidstone Borough. The SFRA details instances of sewer flooding based on the first three characters of a postcode. There is no specific mention of sewer flooding at the postcode associated with the proposed site within the SFRA therefore the site is considered to be at low risk of sewer surcharge flooding.

4.5.3 Reservoir Flood Risk

The EA Risk of Flooding from Reservoirs Map indicates that most of the site is at risk of reservoir flooding. However, an isolated area of land adjacent north of Sheephurst Lane is not modelled to be at risk in the event of a reservoir breach.

In the event of a reservoir breach flood depths across the site are anticipated to range between 0m and 2.2m. Figure 4-9Figure 4-9 shows the range of modelled depths across the site in the event of reservoir breach. However, it should be noted that the event of a reservoir breach is extremely uncommon.

Figure 4-9: Environment Agency Risk from Reservoirs Flood Depth Map



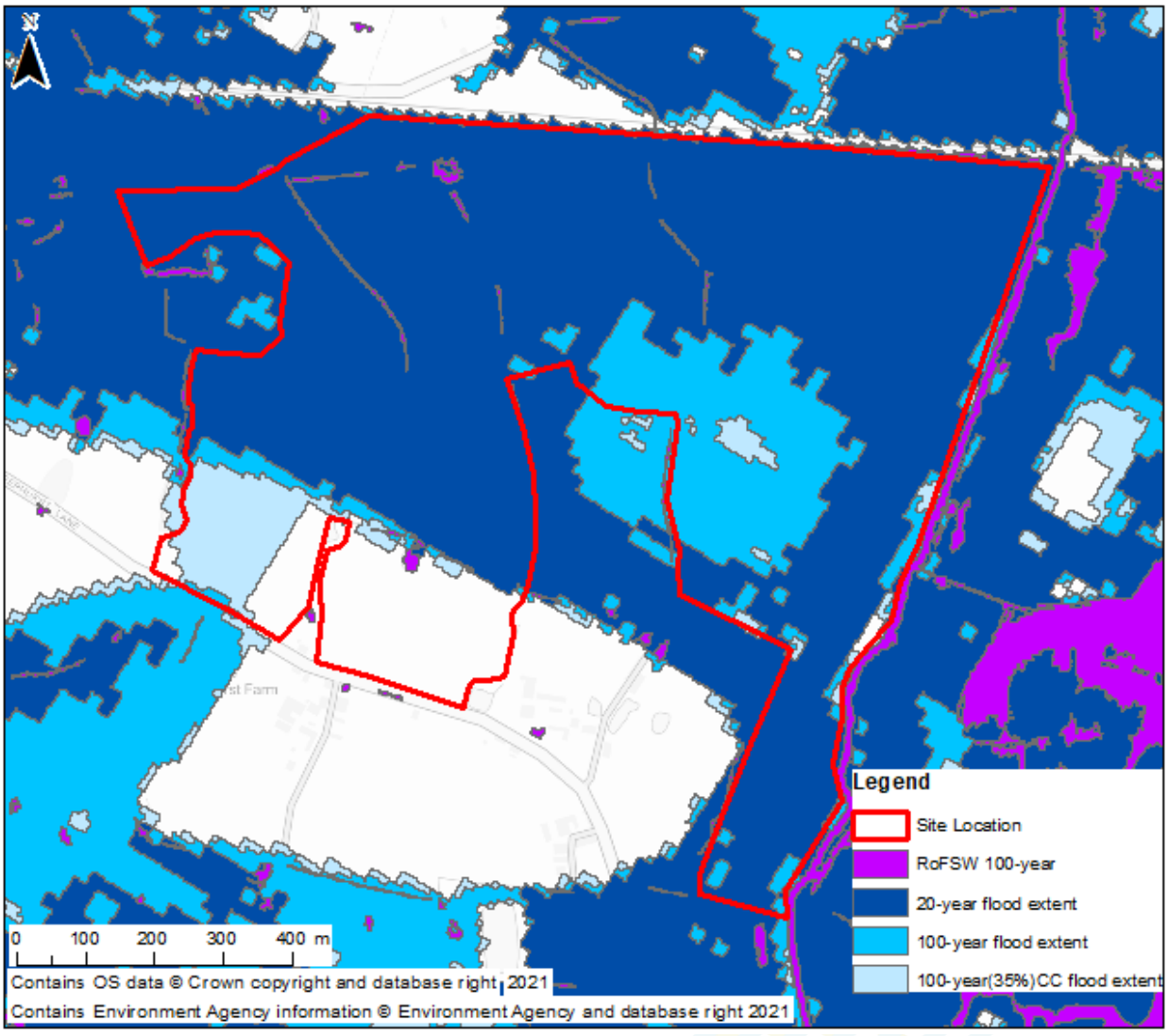
5 Mitigation Measures

In accordance with the NPPF and the associated PPG, it must be demonstrated that the proposed development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. To mitigate the risk of river and surface water the following measures are recommended.

5.1 Sequential Approach to Site Layout

Figure 5-1 shows the fluvial flood extents for the 20-year, 100-year, 100-year plus 35% climate change events and the 100-year risk of surface water flooding. It is recommended that any development follows a sequential approach to the site layout. As such, it is advised that further consideration is given to the location of the compound area.

Figure 5-1: Environment Agency Modelled Fluvial and Pluvial Extents



Assessment of fluvial and pluvial flood extents at the site indicates that an area of land in the south west has been modelled at very low risk of flooding during all scenarios. Therefore, dependent on other planning constraints, following a sequential approach to site layout it is considered most appropriate to locate development, including the compound area, to land in the south west of the site.

5.2 Finished Slab Level

The slab levels of the proposed compound area and all substations should be set above the predicted flood level.

The 2020 Maidstone Borough Council Level 1 SFRA update and Level 2 SFRA states that the Minimum Finished Floor Level (FFL) for development that does not include sleeping accommodation on the ground floor should normally be set to whichever is higher of the following:

- A minimum of 300mm above the fluvial 1% AEP + 35% climate change level.
- The fluvial 1% AEP + 70% climate change level.
- A minimum of 300mm above the tidal 0.5% AEP level, and appropriate allowance should be made for climate change based on the vulnerability classification of the development.
- A minimum of 300mm above the general ground level of the site.

Considering the non-residential nature of the development and its lifetime, the recommended slab level of the compound, battery storage unit and any substations should be set to the highest of the following values:

- 300mm above the 100-year plus 35% climate change (as such the minimum slab level associated with the current proposed location of the compound should be set at 17.5mAOD), or
- 150mm above the highest surrounding ground level (to prevent surface water ingress).

5.3 Post-Development Surface Water Management

The post-development runoff rates from hardstanding areas (compound area, sub-station and access tracks) should ideally be attenuated to the pre-development greenfield rates prior to off-site disposal.

Appropriate arrangements should also be made to minimise occurrence of rutting/soil erosion down the slope due to the rainfall falling off solar panels.

Details of post development surface water management will be provided by the developer once the development plans have been finalised.

5.4 Flood Response Plan

Following planning permission, it is recommended that a Flood Response Plan is developed for the site to formalise the evacuation procedures for the site users. It is recommended that the plan addresses the following:

- Safe access and egress routes to a safe location;
- Confinement measures;
- Flood warnings and lead times;
- How the plan is triggered;
- Actions required by key people;
- Outline evacuation procedure and/or safe refuges;
- Procedures for implementing, monitoring and maintaining the plan.

5.5 Other Mitigation Measures

Positioning of the compound area and substations within natural depressions should be avoided.

Cable ducts should be properly sealed to prevent ingress of water which could then disrupt the operation of the site and potentially convey flood risk elsewhere.

The installation and use of access tracks within the solar farm site should be kept to minimum. Gravel surfacing is preferred to tarmac due to reduced runoff potential.

Vehicular movement on the site should be restricted to designated access tracks. No access tracks between rows of solar panels, other than those considered in the proposals, should be constructed. Instead, the site operation team should aim to service the facilities utilising tractors, quad bikes and four-wheel drive vehicles thus minimising the compaction of the soils.

A role of vegetation on such large sites is important in limiting sediment transfer, slowing the runoff down and reinforcing the soil limiting the risk of soil erosion. The site should be grassed / have good vegetation cover maintained throughout the life cycle of the scheme.

Topsoil stripping and use of construction machines should be kept to minimum to prevent soil erosion and reduce the construction phase impact on the natural permeability of the ground.

Gravel trenches should be installed beneath the downward slope of photovoltaic panels. This will mitigate soil erosion occurring from precipitation running off the solar panel faces and striking the ground. The use of gravel trenches should also be considered next to any hardstanding areas to increase infiltration into the underlying soils and offer attenuation storage.

6 Conclusions and Recommendations

6.1 Conclusions

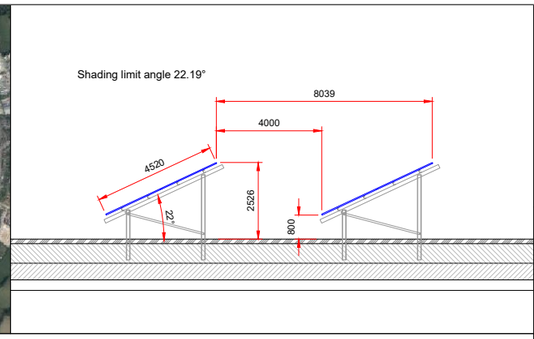
- JBA Consulting were commissioned by Donna Clarke of Origin Power Services, on behalf of Solarcentury, in February 2021 to undertake a Flood Risk Assessment (FRA) to support a proposed planning application for development of a solar farm at the Land to the West of Marden.
- The site is approximately 77.7ha and is currently occupied by agricultural land (i.e greenfield land). The proposed development will involve the installation of photovoltaic panels and the construction of a compound area which comprises of:
    - Parking
    - Storage
    - 33/132kV substation (POC)
    - 10MW battery storage
- Historical flooding data for the site was obtained via the Defra Survey Data Download service. Flood outlines indicate that the site and the surrounding area experienced historical flood events in November 1960 and December 2013. Both historical flood events caused inundation across much of the site particularly in the North. However, it should be noted that historical flood maps are typically less accurate in rural areas. Therefore, the flood outlines presented should be taken as a proxy for the true extents.
- The EA flood zones show that a large proportion of the site is located within flood zone 3; defined as land with a greater than 1 in 100-year (1.0% AEP) probability of fluvial flooding. An area of land in the south west has been modelled within Flood Zone 2; classified as land having between a 1 in 100 and 1 in 1000-year probability of fluvial flooding. Furthermore, an area of land in the centre south of the site is located outside of both Flood Zone 2 and Flood Zone 3 extents.
- Following correspondence with the EA detailed hydraulic modelling for the area has been obtained (Medway Model 2015). The 20-year, 100-year and 100-year plus 35% climate change fluvial flood depths have been derived from this model and a 2016 model re-run.
- Based on current layout plans the proposed compound area will be located upon land within the modelled fluvial extents. Fluvial flood depths in the north west are anticipated to range between 200-400mm during the 20-year flood event, 400-600mm in the 100-year flood scenario and 600-800mm during the 100-year plus 35% climate change modelled event.
- Comparison of the proposed site layout with the modelled surface water flood risk extents indicates that the compound area will be developed upon land which is located outside of the 30-year and 100-year extents but within the 1000-year extent.
- Analysis of Maidstone Borough Council Level 1 SFRA update and Level 2 SFRA indicates that the proposed development site is not at risk of groundwater or sewer surcharge flooding.
- EA risk of flooding from reservoir map shows depths associated to reservoir flooding reach up to 2m within the site. However, it should be noted that the event of a reservoir breach is extremely uncommon.

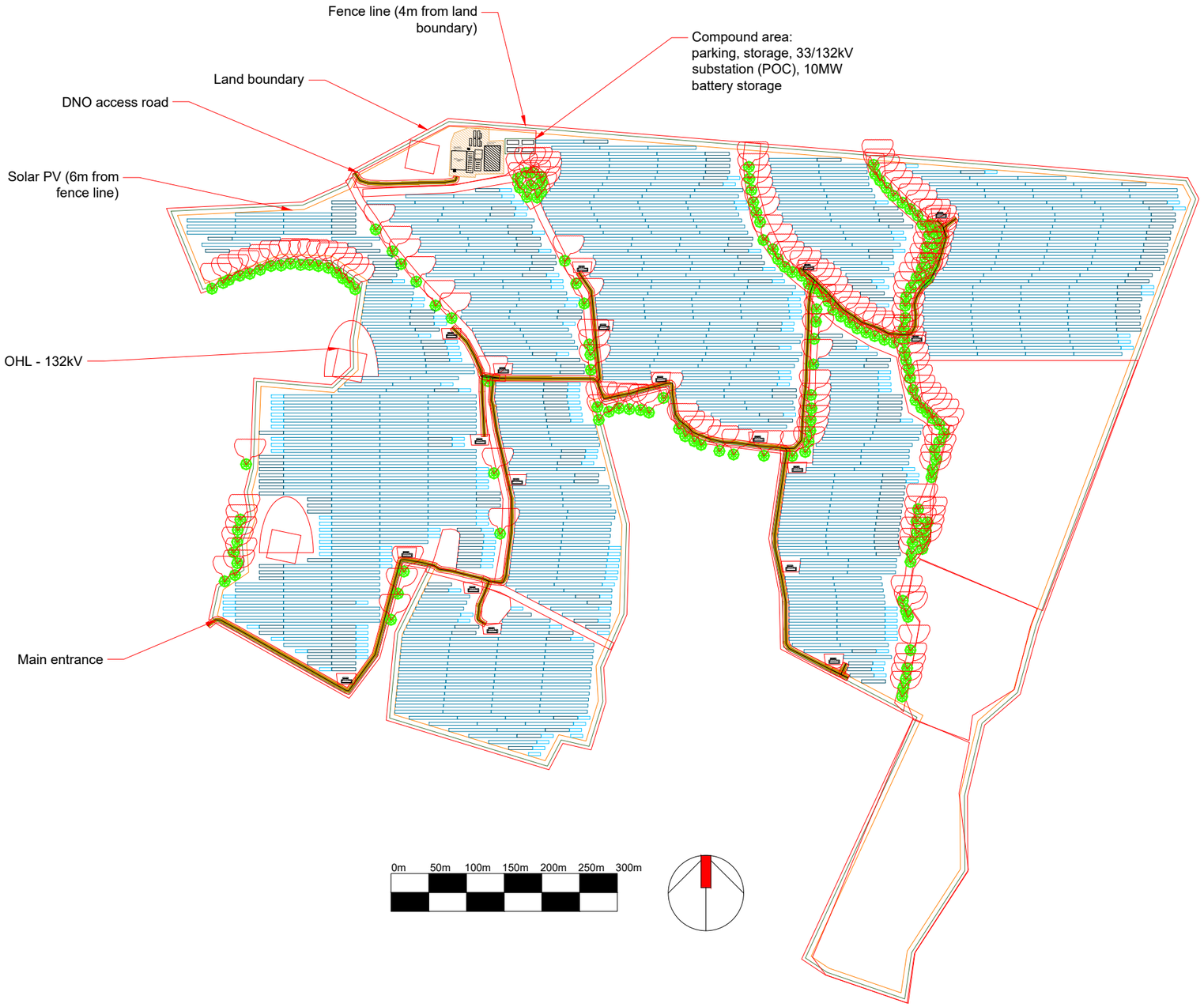
6.2 Recommendations

- It is recommended that a sequential approach to site layout is adopted whereby the most vulnerable elements of the proposal (such as the compound, the battery storage units and the substations) are located within the lower flood risk areas, upon land in the south west of the site.
- Should the compound area remain in its current proposed location (to the north west of the site), it is recommended that the Finished Slab Level of the proposed compound is set at a minimum of 17.50mAOD, 300mm above the 100-year plus 35% climate change fluvial flood level at this location.
- Positioning of the compound and battery storage unit within natural depressions should be avoided.
- Cable ducts should be properly sealed to prevent ingress of water which could then be conveyed and create flood risk elsewhere.
- The installation and use of access tracks within the solar farm site should be kept to minimum. Gravel surfacing is preferred to tarmac due to reduced runoff potential. Vehicular movement on the site should be restricted to designated access tracks. No access tracks between rows of solar panels, other than those considered in the proposals, should be constructed. Instead, the site operation team should aim to service the facilities utilising tractors, quad bikes and four-wheel drive vehicles thus minimising the compaction of the soils.
- A role of vegetation on such large sites is important in limiting sediment transfer, slowing the runoff down and reinforcing the soil limiting the risk of soil erosion. The site should be grassed / have good vegetation cover maintained throughout the life cycle of the scheme.
- Topsoil stripping and use of construction machines should be kept to minimum to prevent soil erosion and reduce the construction phase impact on the natural permeability of the ground.
- A gravel trench is advised to mitigate soil erosion occurring from runoff of the solar panels.

Appendices

A Existing and Proposed Plan





0m 50m 100m 150m 200m 250m 300m

SCUKX-MARDN-000
Marden

Module technology:	Canadian Solar CSS7-590MS
PV module size:	2168 x 1305 x 35 mm
No. of modules:	84,744
Inverter technology:	Huawei 215KTL
No. of inverters:	196
Total DC kWp:	49,998
Total AC kVA:	40,033 @ 25°C
Total AC kW:	40,033 @ 0.95PF
Array slope:	22°
Array orientation:	0° South

Legend:

- Access Track = ~2917 m *(4m wide Permanent - O&M access)*
- Access Track = 0 m *(4m wide Temporary - Construction only)*
- Fence = ~6161 m
- Land boundary
- No. 18 Substations 40ft (2.5 MVA, Tx ratio 0.88/1)
- Exporting substation (10x6m)
- Trees (inc clearance zones)
- No. PV tables = 1107

Notes:

1. All dimensions are in mm and indicative only unless otherwise specified.
2. Any deviations to be recorded and communicated to Solarcentury.
3. Design complies with GS6 regulations for OHL and HSG47 for Underground services.
4. Overview map copyright: © Microsoft Corporation © 2020 Maxar © CNES (2020) Distribution Airbus DS.

Revisions:

PROPOSAL ONLY
NOT CDM 2015 COMPLIANT

Rev	Date	Comments	Dwn.	Chkd.

Client: Solarcentury
Location: Marden, Kent
Project: SCUKX-MARDN-000
Title: PV layout and road

Dwn: CPE Chkd: SG Scale: 3500:1 @A3 Date: 09/12/20
Drg No.: SCUKX-MARDN-000-100 Rev:

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www.solarcentury.com
info@solarcentury.com

B Environment Agency Information Request Response

Tom Smith

From: KSL PSO West Kent <PSO.WestKent@environment-agency.gov.uk>
Sent: 09 April 2021 14:05
To: Tom Smith
Cc: KSL Enquiries
Subject: RE: KSL 211924 AC - Land to the West of Marden Kent TN12 9NP
Attachments: KSLES FRA Checklist v3.0 June 2020.docx

Follow Up Flag: Follow up
Flag Status: Completed

Dear Tom,

Re: KSL 211924 AC – Land to the West of Marden Kent TN12 9NP

Thank you for your enquiry which was received by this team on 01 April 2021.

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

Please note that we have changed our process for responding to modelled data requests, please read the information within this email for further details.

You have requested a Product 4. Please see below table detailing each product:

Product 4	Detailed Flood Risk Assessment Map, including flood zones, defences and storage areas, areas benefiting from defences, statutory main river designations, historic flood event outlines and more detailed information from hydraulic models (including model extents and 2D flood level data for specific points)
Product 5	Reports, including flood modelling reports, model user logs and guides, hydrology reports, etc
Product 6	Model Output Data, including product 5. • flood outlines usually provided in shapefile format • 2D grids (level (h), depth (d) velocity (v) and hazard ZKU0) usually provided in ASCII format • 1D flow and level data Requires GIS software such as ArcGIS, MapInfo, QGIS or similar.
Product 7	Calibrated and Verified Model Input Data (CaVMID), including product 5. Enables customer to re-run and/or make changes to a hydraulic model. Requires specific hydraulic modelling software such as Flood Modeller, TUFLOW, or ICM InfoWorks.
Product 8	Breach Hazard Map Provides a hazard map of breaches in PDF format including, maximum flood depth, maximum flood velocity and maximum flood hazard. Please note product 8 is not available for fluvial models.

Your request for a Product 4 falls under the exemption in provision 6(1)(a) and (b) of the Environmental Information Regulations 2004 (EIR) which states that

'……6.—(1) Where an applicant requests that the information be made available in a particular form or format, a public authority shall make it so available, unless—
(a) it is reasonable for it to make the information available in another form or format; or
(b) the information is already publicly available and easily accessible to the applicant in another form or format……'

On this occasion we are not providing the information in the Product 4 format for the following reasons:

- Complying with the preference would incur a significant cost, which the public authority [The Environment Agency] cannot pass on to the requester;
- Using a Product 5/6/7 allows us to make the information available at a lower cost; and
- The impact on the available resources of the public authority [The Environment Agency], of supplying a Product 5/6/7, is therefore much less.

Please find below the link containing the Product 5 and 6.

Medway Model (2015): https://ea.sharefile.com/d-sb48b98421ae401eb

We are licensing the supplied data to you under the Environment Agency Conditional Licence, details of which are included in the ShareFile link. You must first check this supporting information, to determine if the conditions of use are suitable for your purposes. If the conditions for use are not suitable for your purposes, this information is not provided with a licence for use, and the data is provided for the right to read only.

Product 4 data is derived from the product 6 supplied above and the following open data sources;

Flood Zone 3 https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-flood-zone-3
Flood Zone 2 https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-flood-zone-2
Historic Flood Map https://data.gov.uk/dataset/historic-flood-map1

Product 8 data is not available for the model you have requested.

Please note, that the Flood Map for Planning is available to view and export maps for your site at: https://flood-map-for-planning.service.gov.uk/

Please note that our historic flood event maps may not be comprehensive. We would therefore advise that you make further enquiries locally with specific reference to flooding at your location. You should consider contacting the relevant Local Planning Authority and/or water/sewerage undertaker for the area.

Please be aware that flooding can come from different sources. Examples of these are:
- from rivers or the sea
- surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system)
- overflowing or backing up of sewer or drainage systems which have been overwhelmed
- groundwater rising up from underground aquifers

Currently the Environment Agency can only supply flood risk data relating to the chance of flooding from rivers or the sea.

Flood Risk Assessment Checklist
If you are planning on using this data within a Flood Risk Assessment, we recommend that you take the time to fill in the attached FRA checklist, and to read the attachments which contain information relevant to the area that interests you.

We would like to stress the importance of filling in the Flood Risk Assessment check list, and providing up-to-date and correct data. The data will be checked against our records when we review the Flood Risk Assessment in our role as statutory consultee.

It is important that you provide a map in section 2 of the FRA checklist (See Appendix A), including the highest and most representative flood levels for your site. We recommend using a number of nodes that provide a fair representation of the modelled data across your site. For example, if it is a small extension (< 250 square metres) then approximately 5-10 nodes would be sufficient. For larger sites, approximately 10 to 20 nodes would be appropriate.

Please contact our Sustainable Places team at KSLPLANNING@environment-agency.gov.uk if you have any further enquiries regarding the planning process and Flood Risk Assessments.

If you have any further queries regarding how to use the above data please contact the Partnership and Strategic Overview (PSO) team directly by reply email.

If you have a new enquiry or would like us to review the information we have provided under the Freedom of Information Act 2000 and Environmental Information Regulations 2004 please contact us within two months by email at KSLE@environment-agency.gov.uk

Kind Regards,
Georgia

Georgia Sawyer BSc (Hons)
Flood & Coastal Risk Management Officer | Partnership & Strategic Overview (West Kent)
Environment Agency Orchard House, Endeavour Park, London Road, Addington, Kent, ME19 5SH
Phone: 02077142762 **| Mobile:** 07825756239

General Enquiries NCCC
+44 3708 506506

www.gov.uk/floodsdestroy

From: Enquiries, Unit
Sent: 05 March 2021 13:06
To: 'Tom.Smith@jbaconsulting.com' <Tom.Smith@jbaconsulting.com>
Subject: 210305/ic12 FW: Product 4 enquiry: Land to the West of Marden Kent TN12 9NP (2021s0321)

Good Afternoon,

I have passed your e-mail to the local customer team who will deal with your request.

The Freedom of Information Act and Environmental Information Regulations state that a public authority must respond to requests for information within 20 working days.

However due to the ongoing COVID-19 pandemic affecting staff and resources we may take longer than the 20 working days to reply. We will aim to provide an answer as soon as we can.

You can find more information about our service commitment by clicking on the link below:

https://www.gov.uk/government/publications/environment-agency-customer-service-commitment

You can contact our customer team directly on the contact details below, or call the National Customer Contact Centre on 03708 506506 who will transfer you to the area team.

Please quote your enquiry reference 210305/ic12 in any correspondence with us regarding this matter.

Customers & engagement team
Environment Agency - Kent,South London & East Sussex Area - KSLE@environment-agency.gov.uk

Kind Regards,

Ian Collier
National Customer Contact Centre
Environment Agency

☎ Tel: 03708 506 506
💻 Web Site: www.gov.uk/environment-agency

From: Tom Smith [mailto:Tom.Smith@jbaconsulting.com]
Sent: 02 March 2021 14:24
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Subject: Product 4 enquiry: Land to the West of Marden Kent TN12 9NP (2021s0321)

Good Afternoon

Please can I request Product 4 flood model details in relation to a development site I am working on at Land to the West of Marden Kent TN12 9NP

The full site address is: Land to the West of Marden Kent TN12 9NP
Easting / Northing:
E: 572530
N: 144651

Site boundary plan attached and below

If you need any further information please do not hesitate to get in touch.

Kind regards
Tom
Tom Smith
Flood Risk Analyst | JBA Consulting
JBA Consulting, 35 Perrymount Rd, Haywards Heath RH16 3BW
t: 01444 473652

COVID-19. JBA has remained open for business throughout the Coronavirus pandemic. However, by adopting more flexible working I may not always be available in the office.

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