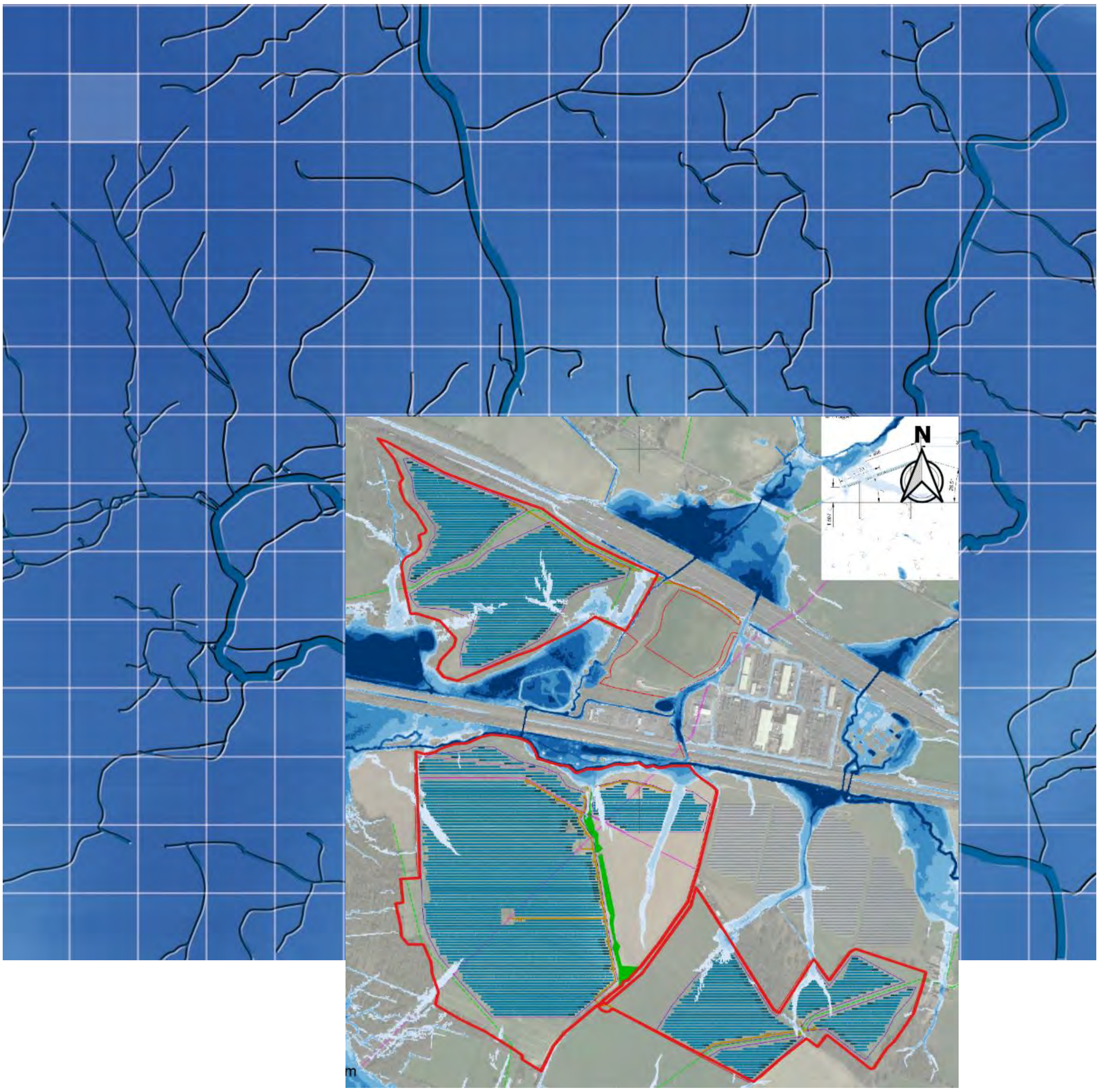
Engena

March 2022

East Stour Solar Farm FRA and Outline Drainage Strategy



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East Stour Solar Farm FRA and Outline Drainage Strategy

Document issue details

WHS1861

Version	Issue date	Issue status	Prepared By	Approved By
1.0	22/12/2021	Draft	Alex Garratt (*Consultant*)	Paul Blackman (*Director*)
2.0	04/03/2022	Final	Sam Pucknell (*Consultant*)	Paul Blackman (*Director*)

For and on behalf of Wallingford HydroSolutions Ltd.

WHS

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Contents

1 Introduction

Wallingford HydroSolutions Ltd (WHS) has been commissioned by the Applicant to undertake a Flood Risk Assessment (FRA) and Outline Drainage Strategy for a proposed solar farm located at Church Lane, Sellindge, Kent. The solar farm site has three land parcel areas, these are centred on NGR: TR 07760 37867, TR 07652 38665 and TR 08403 37415. An FRA is required in line with National Planning Policy Framework (NPPF) to support the planning application, the site covers a total area of 104 ha with the developed area within a fenced area of 65.5 ha.

This report will assess current flood risk to the site and provide an outline drainage strategy in accordance with the best practice principles of Sustainable Drainage Systems (SuDS) to manage surface water runoff from the site. In summary, this report will;

- Describe the site location and outline the proposed development details;
- Review available flood risk data;
- Provide an outline drainage strategy suitable for sustainably managing surface water runoff at the site.

The report is appended to the Geology, Hydrology and Hydrogeology chapter of the Environmental Statement accompanying the East Stour Solar Farm planning application.

1.1 Sources of Data

The main sources of data used to inform this document include;

- EA Online Flood Mapping[1]
- The British Geological Survey (BGS) online mapping service[2]
- National LiDAR programme 1m LiDAR data[3]
- Proposed site layout plans provided by the client

[1] Environment Agency Flood Map for Planning, accessed April 2021, via: https://flood-map-for-planning.service.gov.uk/
[2] British Geological Survey, Geology of Britain Viewer, accessed April 2021, via: https://mapapps.bgs.ac.uk/geologyofbritain/home.html
[3] National LIDAR programme, DEFRA, 2021, National LIDAR Programme - data.gov.uk

2 Site Details

2.1 Site Location

The proposed development is to be located on agricultural land approximately 2km to the west of Sellindge. The northern site is located between the M20 motorway and railway line, whilst the southern site is to the south of the railway line. The south eastern site lies to the west of Partridge Farm and east of Church Lane. The site area covers a total of 104ha, the principal development area is presented in Figure 1.

The site is in close proximity to the Aldington flood storage area (FSA), associated with the East Stour River as found in the EA online flood maps. An unnamed watercourse runs along the boundary of the northern site in a south westerly direction before joining the East Stour River. The south eastern site drains towards a small unnamed watercourse which flows through Partridge Farm to the East Stour River.

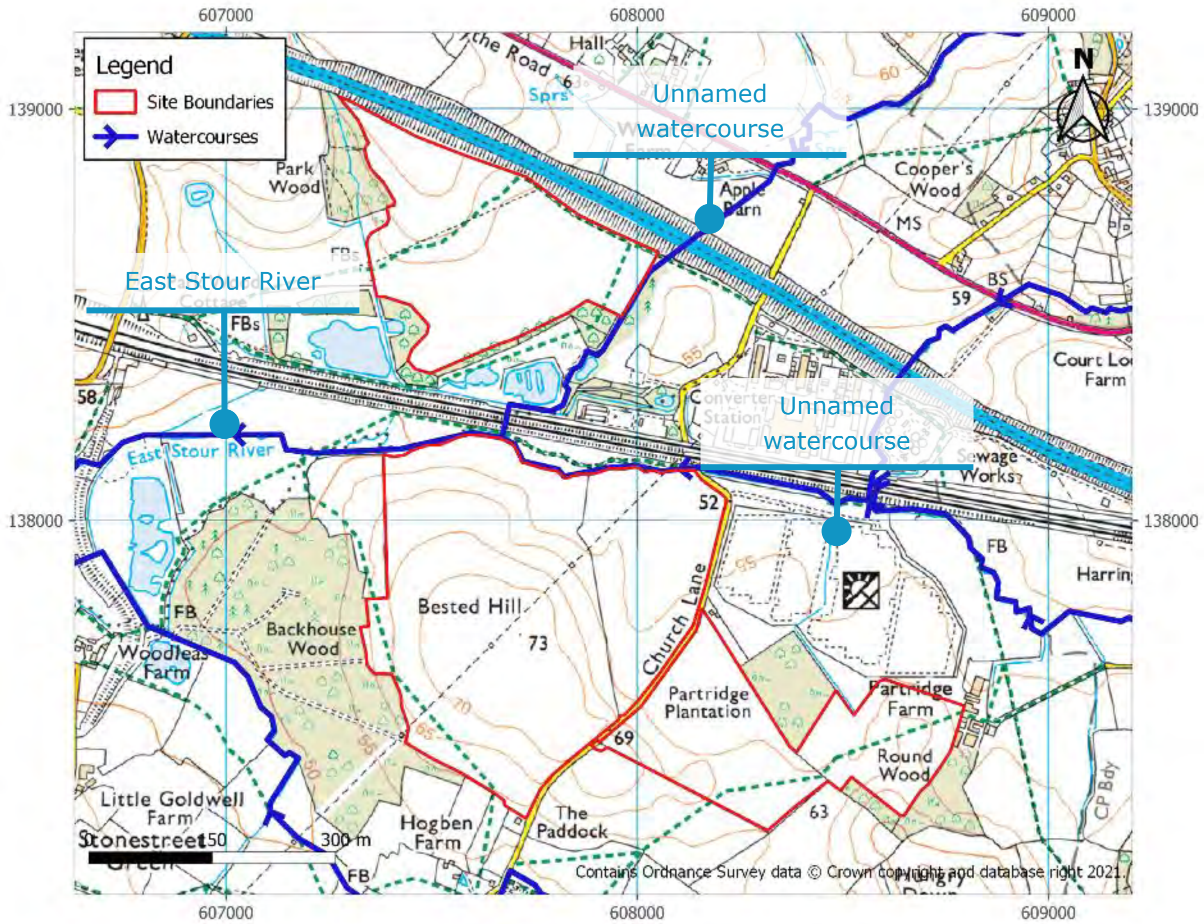

Figure 1- Site Location

2.2 Topography

LiDAR 1m Digital Terrain Model (DTM) data has been utilised to inform the topography of the site alongside 5m contour mapping. The northern site slopes in a south-easterly direction towards the unnamed watercourse, the southern site towards the north and south and the south-eastern site slopes mostly north and partially south. The elevation peaks at 72.9 mAOD and is lowest at 47.95 in the southern site. The highest elevation in the northern site is 69.25 and lowest at 49.56 mAOD. The elevations in the south-eastern site are highest at 72.13 and lowest at 54.68 mAOD. The site topography is shown in Figure 2 below.

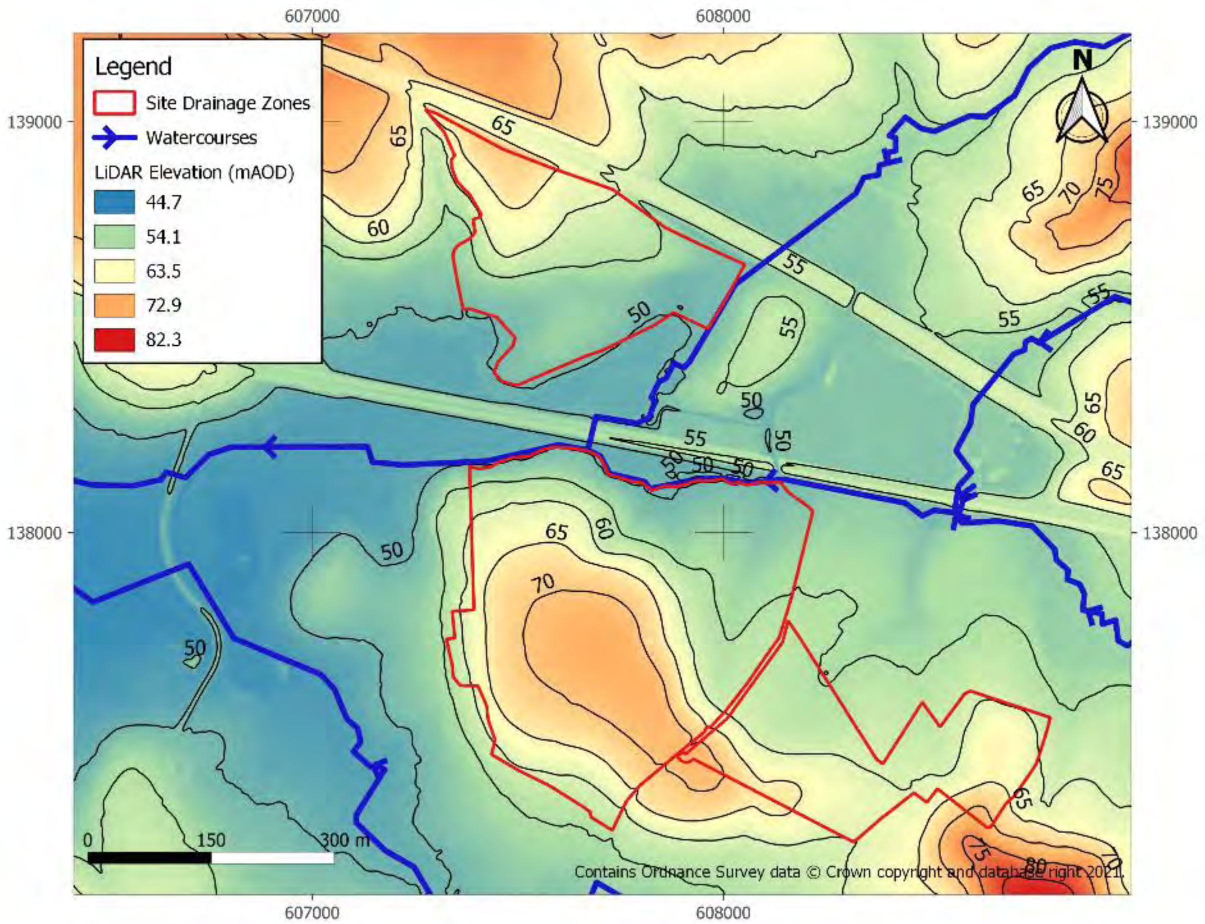

Figure 2- Site Topography

2.3 Existing flow routes

The existing flow routes are shown in Figure 3 below. The way the site drains has been categorised into 6 drainage zones. The northern site drains in a south easterly direction towards the unnamed watercourse and associated ponds to the south. The southern site has been split into two drainage zones, the first draining north towards the East Stour River and the second, southwest towards land drainage ditches that lead to an unnamed watercourse to the south. The south-eastern site drains north via land drainage ditches through Partridge farm to the East Stour River and a small area (zone 3) drains south.

The Bested Hill north drainage zone (south drainage zone 2) shows noticeably more significant flood risk and flow routing. It is adjacent to and drains to the south side of the railway line meaning the size of the buffer zone is limited. Therefore more extensive mitigations will be targeted in this zone.

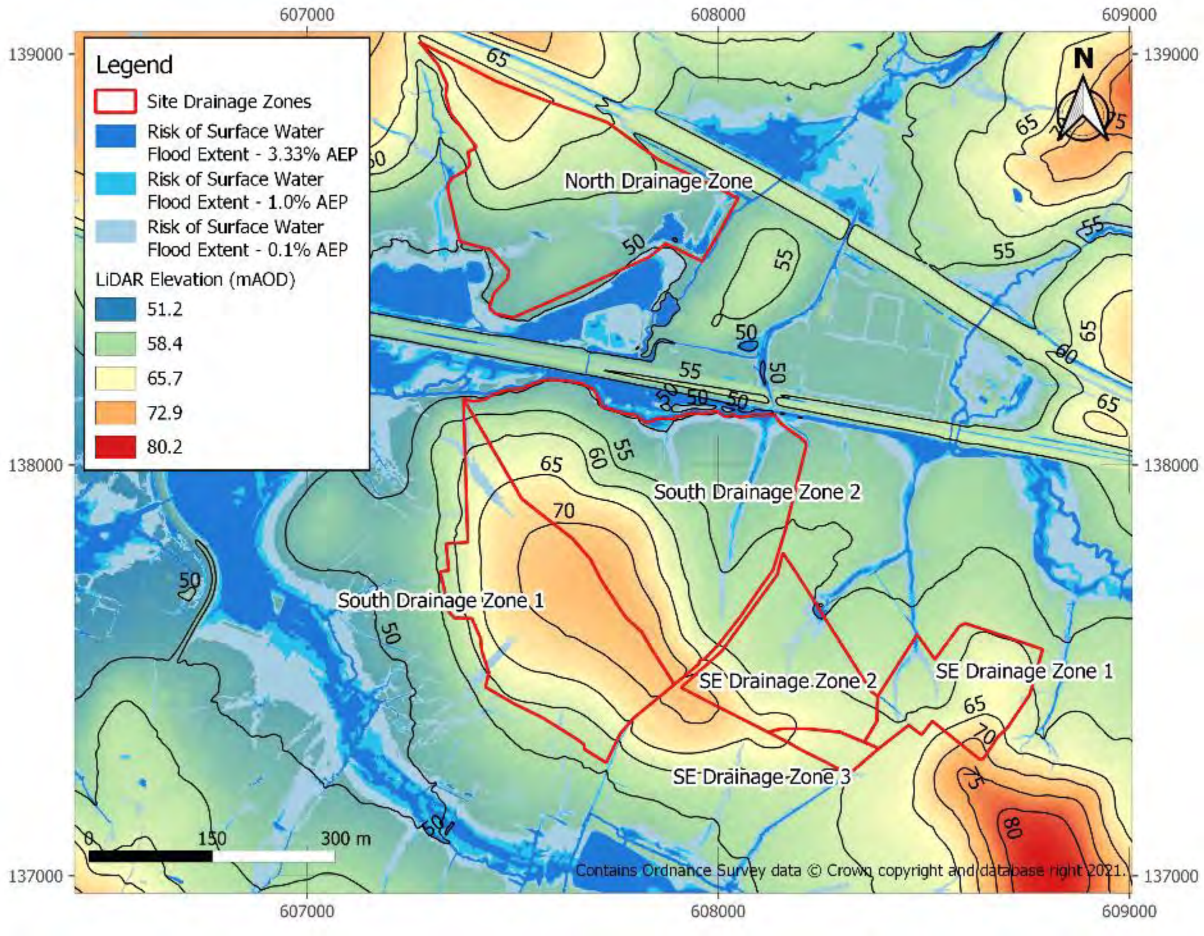

Figure 3- Existing surface water flow routes

2.4 Proposed Development

The proposed development is for a solar farm with a capacity of up to 50MW. The site will include the construction of a maintenance/ access track, perimeter stock proof post and wire fencing, trenching, ducting and installation of underground cables, 1 Spare building, 1 Store building, 1 Welfare block, installation of panel frames and ground anchors, 20 Inverter units and habitat enhancement measures. The solar panels are anticipated to have a tilt angle of approximately 20°. The site plan is shown in Figure 4 below, and available in Appendix 1.

Figure 4: Proposed development

3 Flood Risk

3.1 Fluvial Flood Risk

Flood risk to the proposed development site has been assessed initially by reviewing the Environment Agency's (EA) online flood maps. Reviewing the flood maps indicated that Flood Zone 2 has been drawn inaccurately for these site areas as it is shown to encompass areas of much higher elevation, particularly for the southern site, see Figure 5. The embankment of the Aldington FSA downstream of the site forms a dam across the East Stour Valley, the level of this embankment is 51.2m AOD and the spillway is 50.2m AOD. The FSA is designed such that water backs up behind the embankment and discharges at a constant rate downstream using a flow control device. The lower levels of the southern and northern sites are within this FSA. Therefore, on consultation with the EA, it was confirmed that a level of 51.3mAOD should be used to provide an exclusion zone for all of the infrastructure on the site. This exclusion zone is derived from 5m grid LiDAR data by the client and can be seen in Figure 6.

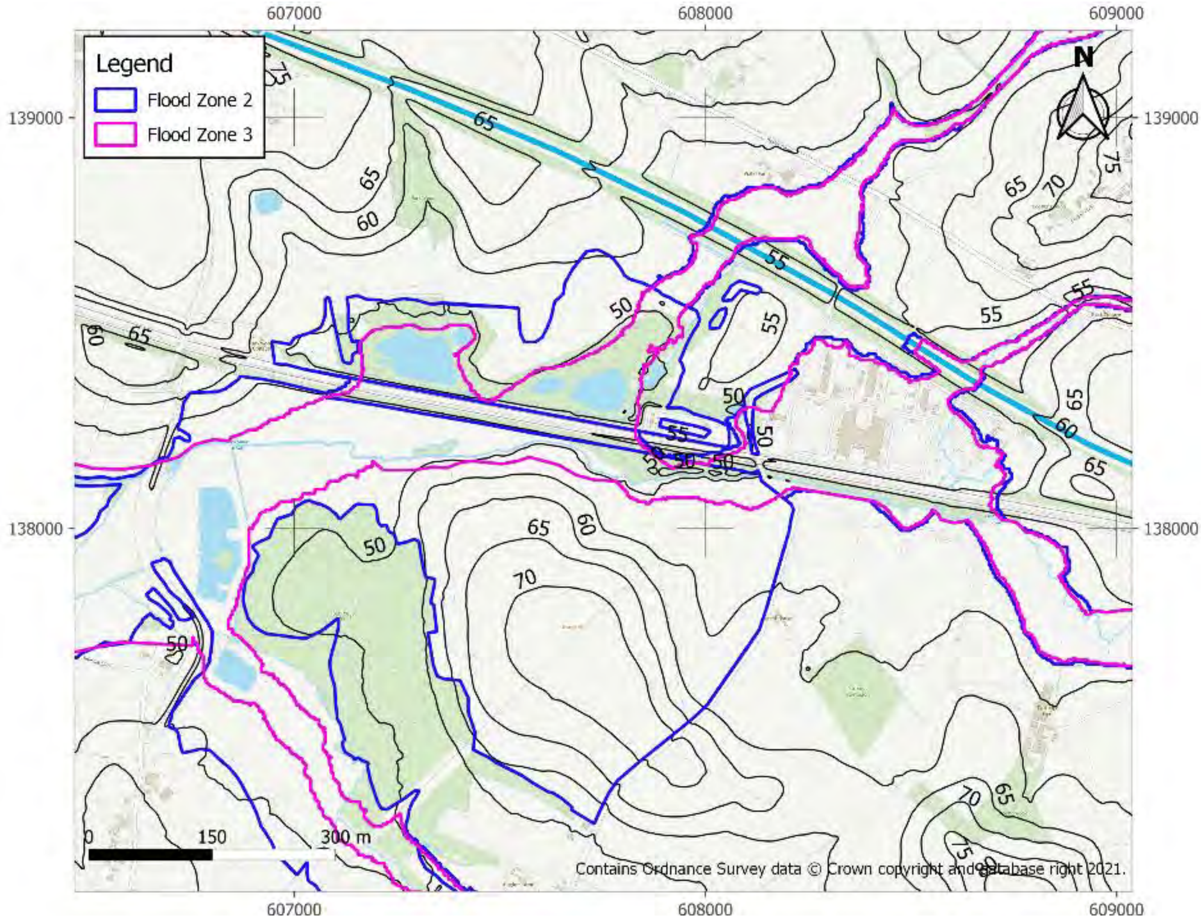

Figure 5: Flood map for planning - zone 2 and 3.

A level of 51.3m AOD was suggested by the EA as this was the design crest level for the FSA embankment. The 0.1% AEP flood event was assessed to be 50.49mAOD at the embankment by

Halcrow Group Ltd in 2010 during reservoir spillway investigations[4]. Flood levels at the site will be slightly higher than at the embankment, due to it being approximately 700m upstream. However, we consider that given there is 0.81m freeboard during this extreme fluvial event (51.3 – 50.49m AOD), the infrastructure of the site will not be at risk for the lifetime of the development up to at least the 0.1% AEP flood event. Although it should be noted that an allowance for climate change has not directly been accounted for within the design of the flood storage area. The only feature to be constructed in the exclusion zone is the access track which will follow the natural topography to prevent an increase in flood risk off site.

Due to the LiDAR used to assess the 51.3m AOD contour line being relatively low resolution, we recommend that a topographic survey is undertaken during detailed design post consent to determine accurate ground levels in the vicinity of the proposed 51.3m AOD contour exclusion zone. This will ensure that there are no panels placed within this flood exclusion zone where there could be standing water. The south-eastern site does not fall within fluvial flood zone extents due to its elevation and so is low risk, however surface water risk will be assessed for this site. The fluvial flood exclusion zone is shown in Figure 6 below.

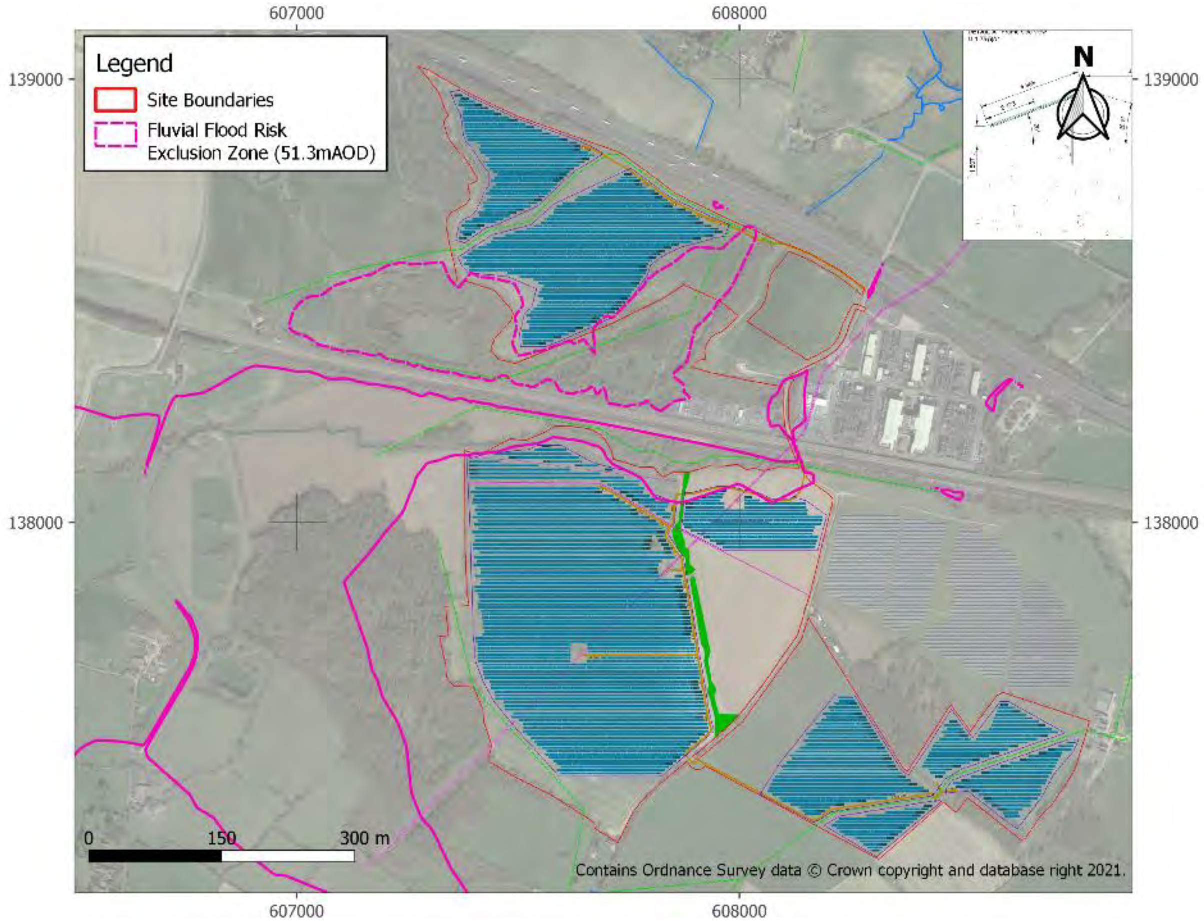

Figure 6 - Fluvial flood risk (overlayed on proposed development)

[4] Halcrow Ltd (2010) Reservoir Spillway Investigations

3.2 Surface Water Flood Risk

A review of the EA surface water flood risk map indicates that the majority of the site is at low risk of surface water flooding, with a chance of flooding of less than 0.1% across almost the entire site, see Figure 7. There are no inverters or welfare units of high vulnerability which are placed in surface water flow routes. There are some key locations of surface water flood risk within the site boundaries where panels are proposed. In order to understand risk to the panels surface water depths are stated below which are for the 0.1% AEP flood event. In the northern site there are areas with an estimated maximum depth of between 300 and 600mm.

In the southern site there is a well-defined surface water flow route at the east of the site flowing northwards, a depth of between 150 and 300mm is estimated for this route. There are other areas with depths estimated to be no greater than 150mm in this site. The south-eastern site has one main flow route and an area of surface water accumulation. The eastern flow route and western accumulation area both have an estimated depth of between 150 and 300mm.

The proposed solar panel layout places some panels within the surface water flood zones. The flood depths predicted on the site are relatively shallow and would be below the underside of the solar panels (minimum of 800mm above ground). Therefore, it would be possible to place panels in these areas, given the large freeboard between the panels and predicted water levels and the limited impeding of flows by the panel supports.

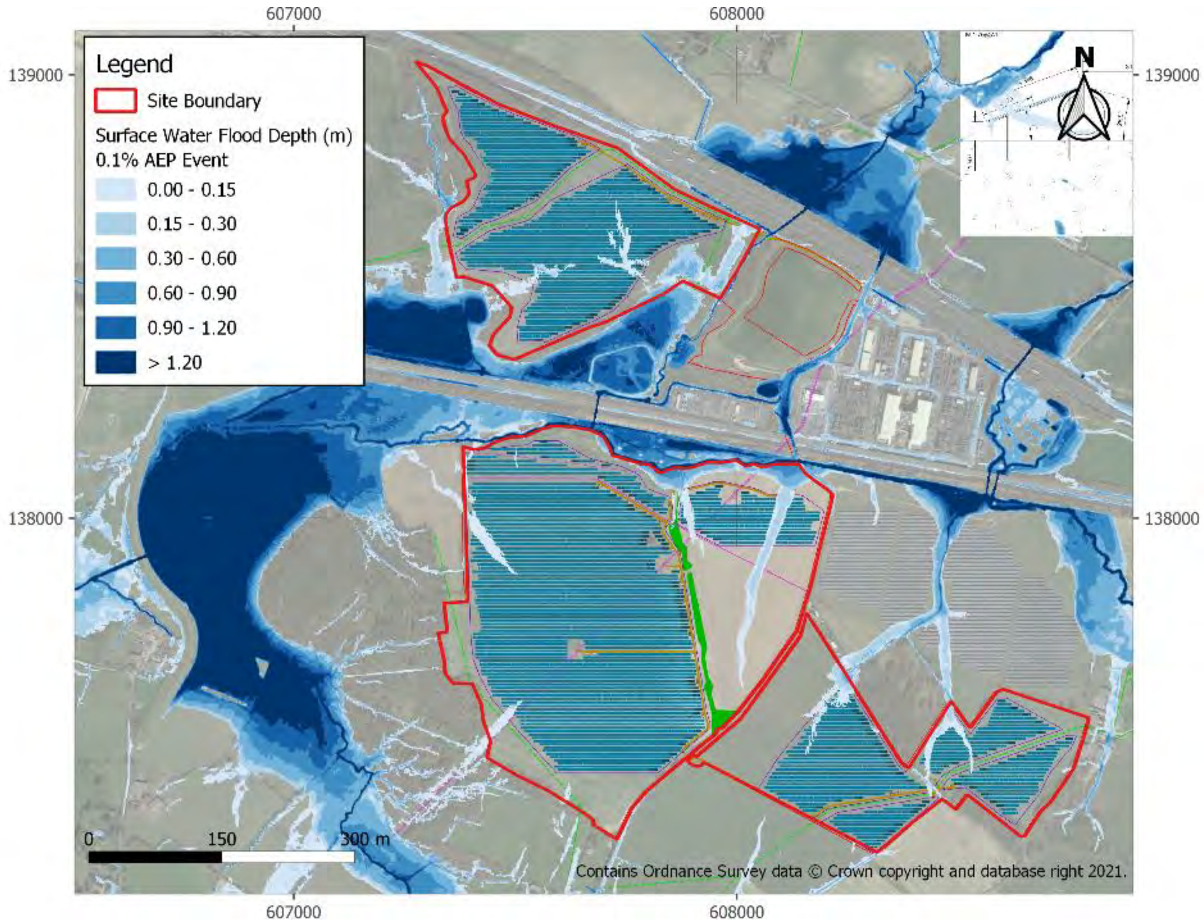

Figure 7- EA Surface Water Flood Depth Map – 0.1% AEP Event (overlayed on proposed development)

3.3 Other Sources of Flood Risk

The site is not at risk of tidal flooding due to its distance from the sea.

There is no risk of reservoir flooding to the site.

The soil type across the majority of the site is slowly permeable and seasonally wet with a small area in the north of the northern site with freely draining soil.[5] Using the BGS online borehole mapping[6], a borehole within the site boundary was drilled down to 10m depth and water was not struck at that depth. This indicates that shallow groundwater does not occur in this area and groundwater flooding which would affect the site is unlikely.

3.4 Historical Flooding

The EA historic flood map indicates historic flood events within the entirety of the southern site and the south-eastern area of the northern site. However, the agreed exclusion zone indicates that the historical flood extents recorded are inaccurate and the exclusion zone should be used as a worse case scenario for fluvial flooding. On consultation the EA confirmed that there have been two times the spillway has overtopped. Flooding in November 2000, which was assessed to be a 3.3% AEP event, flooded the areas adjacent to the river, but outside of the planned infrastructure areas. In February 2014 there was further flooding in the area, with the maximum flood level recorded at 50.31m AOD at the embankment, with an AEP of 25% as reported by the EA[7].

4 Management of Surface Water Run-off

4.1 Correspondence with Kent County (KCC) and Ashford Borough Council (ABC)

To determine the requirements for surface water management, the local councils were contacted as part of the pre-application advice stage of the project. ABC did provide general guidance policy documents on planning for flood risk and how to design SuDS. The County Council advised to follow their guidance documents and that specific pre-app advice would need to be paid for. Given the conservative nature of the drainage design this was not considered necessary at this stage in the process. Broadly, the outline drainage strategy does follow principles based on SuDS.

4.2 Planning requirements

4.2.1 National

Based upon guidance set out in the National Planning Policy Framework (NPPF), any development should include measures to manage post development surface water run-off rates. The assessment seeks to comply with the principles of SuDS presented in DEFRA's non-statutory technical standards for SUDS.

4.2.2 Regional

KCC drainage and planning policy requires that runoff rates mimic existing greenfield runoff rates for the 1:1 year, 1:30 year and 1:100 year storm events as long as long term storage is utilised for flow

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[5] Cranfield Soil and Agrifood Institute Soilscapes map viewer, accessed April 2021, [Soilscapes soil types viewer - National Soil Resources Institute. Cranfield University (landis.org.uk)]

[6] British Geological Survey, Geology of Britain Viewer, accessed April 2021, via: https://mapapps.bgs.ac.uk/geologyofbritain/home.html

[7] JBA Consulting, Dec 2014. 2013-14 Post Flood Analysis: Kent & South London Area. Environment Agency.

volumes in excess of the greenfield volume. The long-term storage volume must discharge at a rate no greater than 2 l/s/ha and the total flow rate must not exceed the 1:100-year greenfield flow rate.

4.2.3 Local

The ABC Sustainable Drainage Supplementary Planning Document provided general guidance for drainage rather than specific advice for solar farms. The guidance encourages developments to achieve 4 l/s/ha as far as possible, but must avoid any run-off rate in excess of existing greenfield rate for the site.

The following sections describe how any changes in the surface water run-off regime on site will be sustainably managed to meet the council's requirements and provides details on the current greenfield run-off rates.

4.3 Greenfield Run-off Rates

To estimate run-off and determine the drainage requirements for the site, greenfield runoff rates have been calculated. Based upon guidance set out in NPPF the drainage system should be designed for a range of storms up to and including the 1 in 100 year event plus an allowance for climate change. Runoff rates for the existing greenfield land have been calculated using ReFH2, which is the current recommended method outlined in the CIRIA SUDS manual. The hydrological analysis has been estimated for the greenfield site area of 98ha of a total 104ha which includes the grid connection areas.

Table 1 below presents the greenfield runoff rates as the unit rate per hectare. The associated calculations are provided in Appendix 2. Note that the total change anticipated for the upper end scenario has been conservatively taken as 40% ('2080s') as the lifetime of the scheme would imply a '2050s' and consequently a 20% allowance for climate change.

Table 1: Greenfield Runoff Rates – updated.

Return Period	Greenfield Runoff Rate (l/s/ha)
1 in 2	4.98
1 in 30	12.35
1 in 100	16.23
1 in 100 + 20% CC	19.48
1 in 100 + 40% CC*	22.72
1 in 1000	29.21

*Climate change allowance of 40% as per the Upper end estimate for peak rainfall intensity allowance in small and urban catchments by the Environment Agency.[8]

The runoff rates in Table 1: Greenfield Runoff Rates are based on a total area of 98.7ha, a Standard Average Annual Rainfall (SAAR) of 744, a base flow index (BFIHOST) of 0.32 and a proportion of time soils are wet (PROPWET) of 0.34.

[8] The Environment Agency, Flood risk assessments: Climate change allowances. Peak rainfall intensity allowance in small and urban catchment, Accessed via: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

4.4 Post Development runoff mitigation

The proposed development is for solar panels which will sit on frames that are pile driven, leaving the natural ground surface below the panels. The amount of permeable land on site is expected to only slightly reduce during operation of the solar farm compared to pre-development.

The solar panels will intercept rainwater and shed it onto the ground on the lower edge of each array, referred to as the drip line. Gaps within the centre of the panels act to reduce this concentration of water flow towards the drip line providing another route for rainwater to reach the ground. Whilst the panels would result in a concentration or rainwater along the drip-line of each row and in the centre of the panels, water would be intercepted by the vegetation growing in-between and underneath the panels. Some of which will infiltrate into the underlying soils, and, for more extreme events, some of which will run-off through the vegetation. It is likely that the vegetation across the site when developed will be denser than the existing agricultural use, hence providing greater attenuation of runoff.. Planting of new hedge rows and native woodland on the southern site will provide further attenuation.

A study[9] on the hydrological implications of solar farms confirmed this to be the case. 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. The study accounted for changes in soil type, slope angle and rainfall intensity, before concluding that ground cover has the most significant impact on runoff rates. On this basis, providing that vegetation cover beneath the solar arrays is maintained, no significant increase in surface water runoff is anticipated as a result of the solar array.

5 Drainage Strategy

Although the solar farm is not anticipated to significantly increase run-off rates and is situated in a rural location, an unconnected cut-off swale is proposed as a precautionary measure to store some of the run-off volume. Due to the soil type of the site it is unlikely that infiltration will be possible through the proposed swale, see Section 3.3 on soil type.

As part of the scheme, extensive planting is to be incorporated below and around the arrays. The location of the planting is displayed below in Figure 8 and Appendix 3. The existing, largely arable farm land will be replaced with a mix of wildflowers, grassland and mixed riparian planting. A review of aerial imagery shows existing flow routes and land drainage in the ploughed fields which will concentrate the surface water flow whilst providing limited water treatment benefits. Replacing this with wildflower planting will improve water quality and flow distribution.

New hedgerows and improvements to existing ones are also proposed which will act as buffers to the surface water. The vegetated buffers in the northern and eastern portions of the site in addition to the south side of Bested Hill are already extensive, which the hedgerows will reinforce further. This will slow the surface water and provide further treatment. The northern section of the site drains to the reservoirs where there is already a significant buffer zone, therefore no further mitigations are considered necessary beyond the wildflower planting. At the south side of the scheme, an area of native tree planting is also specified.

The drainage zone on the north side of Bested Hill as identified by the surface water flood map has the largest flow routes and the narrowest buffer zone adjacent to the existing railway, therefore

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

additional conservative mitigations are proposed beyond those already stated. Swales are proposed as a precautionary measure to capture runoff in that zone and will reinforce the buffer zone.

5.1 Long Term Storage Volume Calculations

To size the swale, the long-term storage equation was applied to conservatively assess a nominal volume running off from the Bested Hill north drainage zone due to the impermeable area of the infrastructure associated with the solar panels, but not the area of solar panels themselves. The access track is to be constructed from permeable materials, however the tracks are conservatively assessed as impermeable to conservatively size the swale.

The majority of the swales proposed are within the fluvial flood exclusion zone. We consider this to be acceptable as in the event of extreme fluvial flooding, storage will be utilised by either surface water or fluvial.

The storage volume was calculated for the 100yr rainfall event, including a 40% allowance for climate change. The 100 year, 6hr rainfall depth was used in the calculation, this was taken as 72.04mm (101mm including climate change) taken from ReFH calculations. The required drainage volume for the Bested Hill north drainage zone is based on an impermeable area of 0.61 ha present in that zone.

The storage calculations ensure sufficient storage is provided to retain and provide betterment for existing runoff volumes as a precautionary measure in this zone. The swales have been sized to provide practical dimensions and additional capacity above what has been estimated by the long term storage equation.

The outline drainage is shown below in Figure 8, which includes the environmental mitigations and swale placements in relation to the infrastructure. To examine this at a larger scale see Appendix 3.

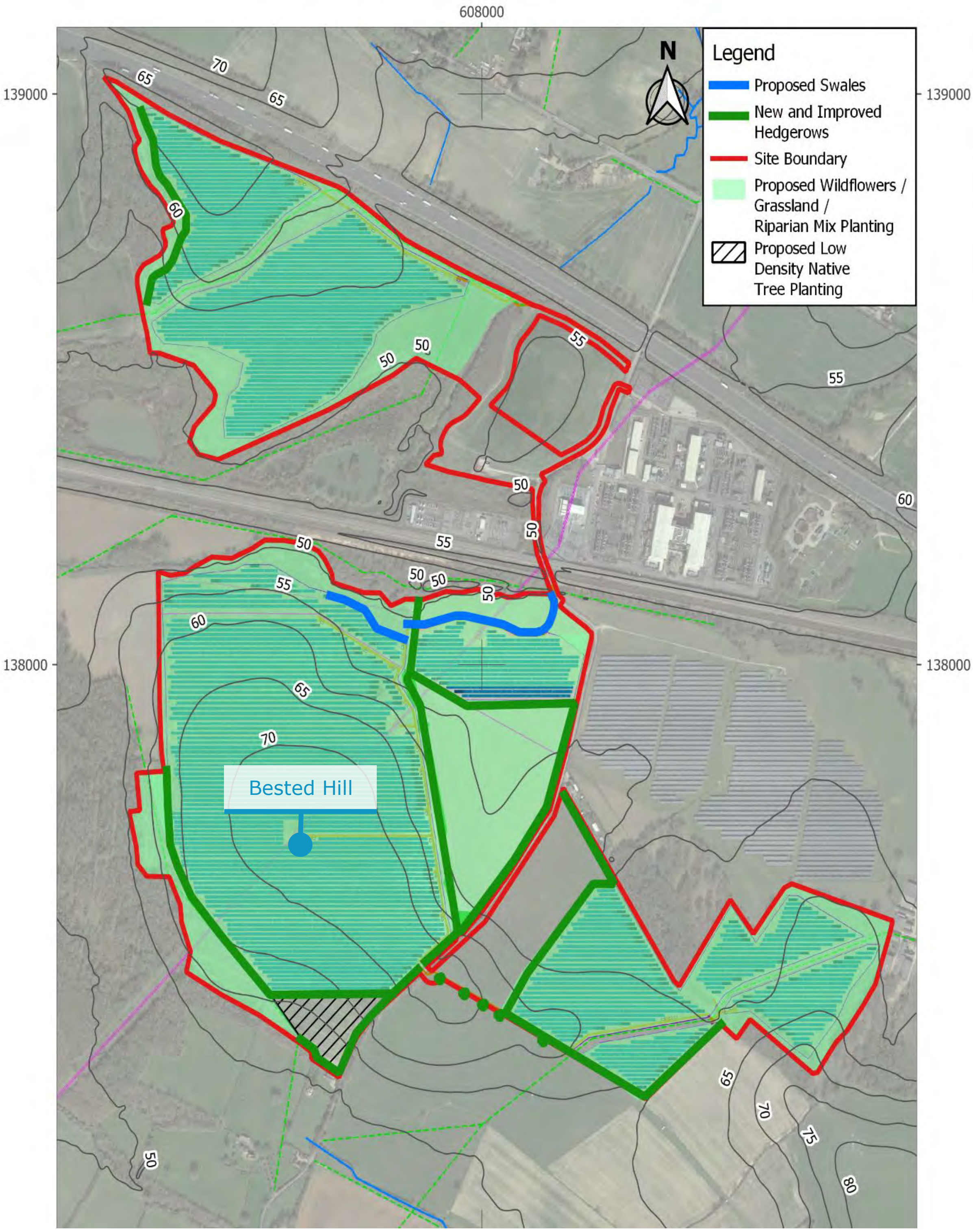


Figure 8: Drainage zones with swales located in key areas

5.2 Bested Hill northern drainage zone

The swales have been proposed as a precautionary and conservative measure to capture runoff only from the impermeable areas, including permeable tracks, as the solar farm is not expected to significantly alter existing site drainage. There are large buffer zones around the site perimeter and there are no direct vulnerable receptors of surface water runoff adjacent to the site.

The swales will provide a safeguard to manage the runoff volume during both the construction and operational phases of the project. The swales have been designed in accordance with the CIRIA SUDS manual[10] using the long-term storage equation, which specifically addresses the additional runoff caused by a development. Due to unverified infiltration rates at the site, the swale has been sized to capture and store all the additional runoff from the site, assuming no infiltration.

At detailed design stage, it is recommended that 3m easements are provided surrounding the swales in line with the SUDS manual. As the swales are designed to store a nominal surface water runoff volume as a precautionary measure with no proposed formal drainage outfall, continuing the existing overland flow regime, it is deemed unnecessary to apply for consents with the LLFA.

The long-term storage calculation equation is shown below for drainage zone 2 within the proposed development site.

$$Vol = 101 \times 34.1 \times 10 \left[\frac{1.8}{100}(1 \times 1) + \left(1 - \frac{1.8}{100}\right)(1 \times 0.3) - 0.3\right]$$

A total runoff volume of 308m^3 has been calculated for this drainage zone due to the impermeable area of 0.61ha. The impermeable area is represented in the equation as a percentage of the total area, 1.8% in this case. As in the previous catchments, a vegetated swale is proposed to manage the runoff. Two swales are proposed along the northern boundary of the site. The swales will have lengths of 167m and 346m, with a total capacity of 308m^3. This is based upon a swale with a cross sectional area of 0.60 m^2 with a geometry of 0.4m depth, a base of 0.3m and 1 in 3 side slopes as indicated in Figure 10 below. The proposed swale location is shown in the drainage strategy drawing available in Appendix 3. The swales will follow existing contour lines where possible but in steeper areas it is proposed to utilise a stepped swale connected by stone weirs in order to capture the surface water flows.

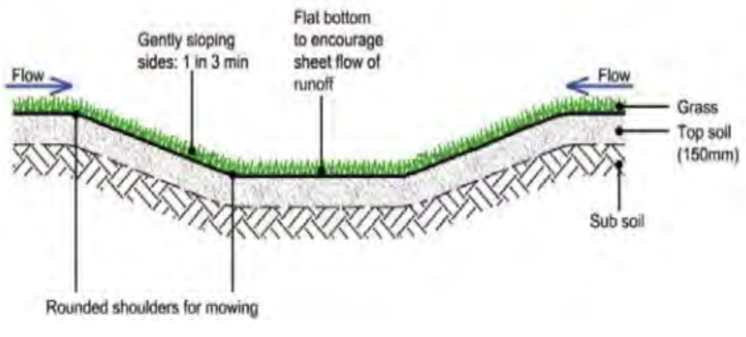


Figure 9: Typical Swale Cross Section

[10] CIRIA SuDS Manual 2015

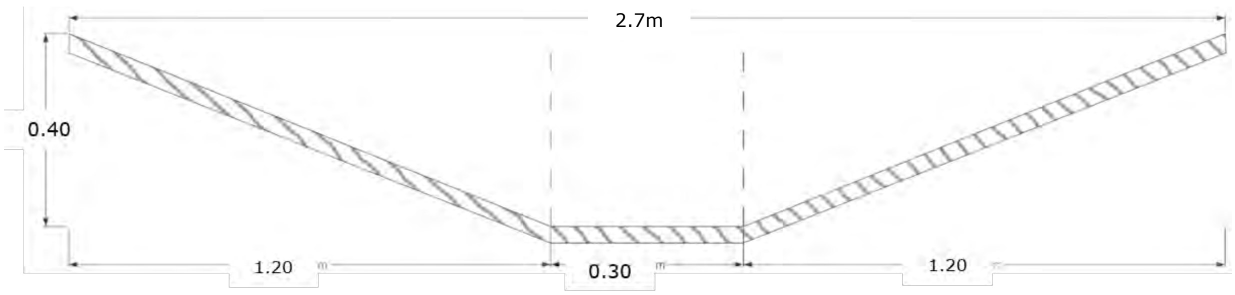


Figure 10: Southern drainage zone 2 proposed swale geometry

5.3 Swale Maintenance

This section has been produced as per the guidance provided in the CIRIA SuDS manual[5].

Swales will require regular maintenance to ensure continuing operation to design performance. Swale maintenance is relatively straight forward and typically, only a small amount of extra work is required over and above the requirements for standard open public space, therefore having only marginal cost implications, assuming that landscape management is already carried out. Adequate access should be provided to all swale areas for inspection and maintenance. Litter and debris removal should be undertaken regularly to ensure that the swale is fully operational. The main requirement for dry swales is mowing. Grass lengths should be retained to 75-150mm to assist in filtering pollutants and retaining sediments. These grass lengths will also reduce the risk of the flattening during runoff events. All grass clippings should be disposed of away from the swale to remove any nutrients or potential pollutants. Any sediment deposits within the swale that exceed 25mm should be removed, however this can be minimised by ensuring that upstream areas are stabilised.

6 Conclusions and Recommendations

The proposed development has areas which form part of the Aldington Flood Storage Area, as such are at high risk of fluvial flooding. Hence infrastructure has been located outside of the flood exclusion zone which has been calculated as the 51.3m AOD contour line across the site upon recommendation from the EA. It is recommended that a higher accuracy method is used to delineate the 51.3mAOD exclusion zone than the current method using DTM data, such as commissioning a topographic survey of the relevant areas of the site.

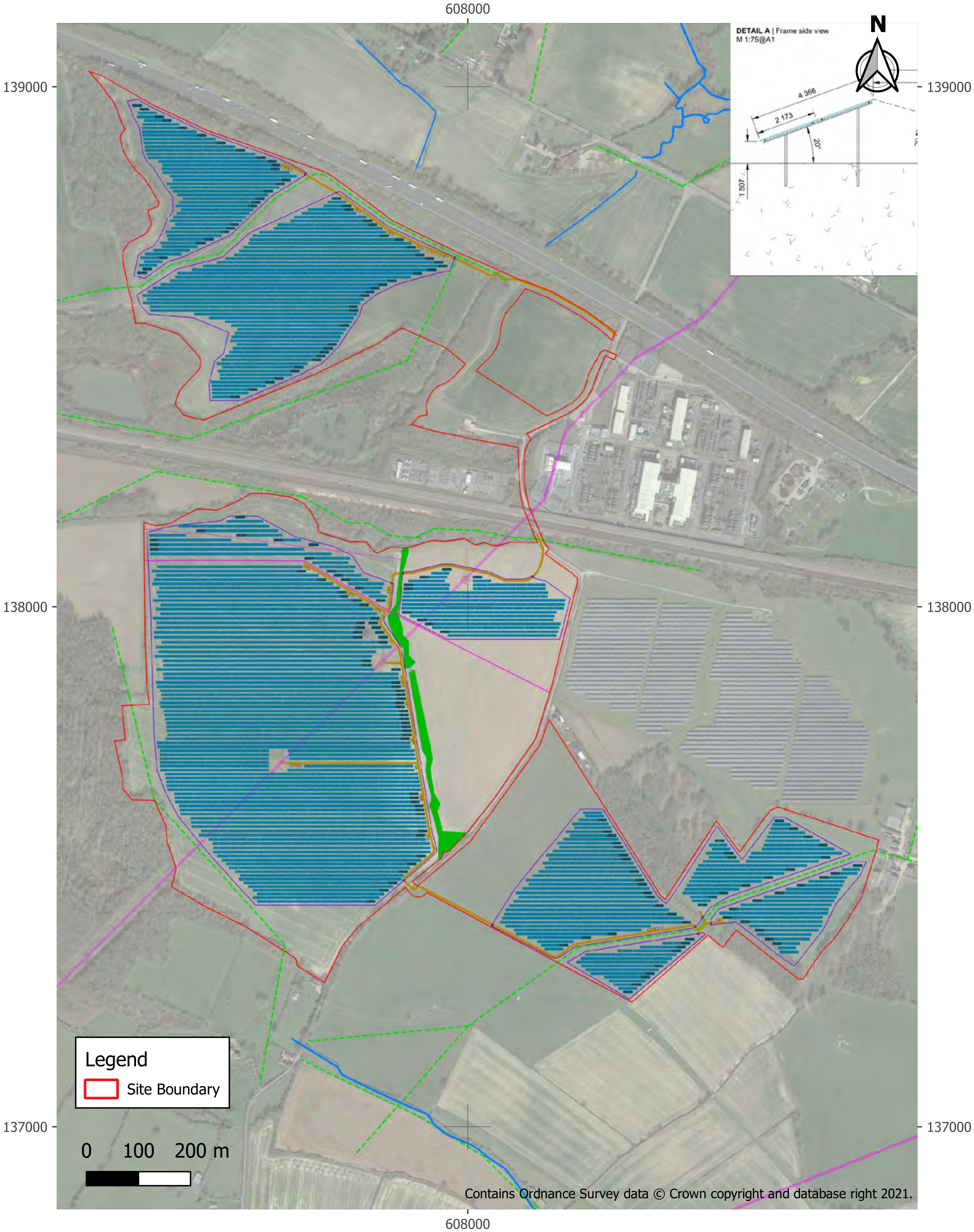
There are areas of shallow surface water flow routes on the site in which panels and access tracks are proposed. The access tracks will have no impact on the flows, the panel frames have limited surface area in contact with the ground and the panels are planned to be a minimum of 800mm above ground level. We consider that flow routes will not be impeded across the site and the panels placed in these areas are not at risk.

It is recommended that any vegetation removal during the construction phase is replaced on site as soon as possible and is maintained correctly to promote natural infiltration, in line with the literature surrounding solar farm hydrology[11]. In this case, the solar farm is not anticipated to lead to a significant increase in surface water run-off rates.

Extensive planting has been proposed across the site to replace the existing arable land. This in turn will improve existing runoff conditions as well as reinforce buffer zones where hedgerows are proposed. Swales have been proposed in the Bested Hill north drainage zone as a precautionary approach due to the more limited vegetated buffer zone. The tracks will be constructed from permeable materials, which results in very limited actual impermeable areas, however our conservative approach considers them impermeable in the calculations. Stepped swales should be used where required based upon the ground topography. It has therefore been demonstrated that surface water at the site can be managed appropriately by adopting a sustainable and conservative approach.

We consider that this strategy meets the requirements for the national, regional and local planning policies.

[11] Cook L.M. and McCuen R.H (2013) Hydrologic response of Solar Farms. Journal of Hydrologic Engineering 18:
pp 536-541



Appendix 1 - Proposed Development

ReFH2 Greenfield Runoff Estimate
Appendix 2

Site Name	East Stour Solar Farm
Site Location	Sellindge
X (Eastings)	607755
Y (Nothings)	138128
Engineer	Alex Garratt
Checked by	Daniel Hamilton
Reference	WHS 1861
Revision	1
Date	16-Dec-21

Site Description

Total Area (ha)	98.7
Existing Developed area (ha)	0
SAAR (mm)	744
PROPWET(mm)	0.34
BFIHOST19	0.32

Rainfall Parameters

Duration (hh:mm:ss)	03:30:00
Timestep (hh:mm:ss)	00:30:00
SCF (Seasonal correction factor)	0.67
ARF (Areal correction factor)	1 [0.98]
Seasonality	Winter

Loss Model Parameters

Cini (mm)	128.32
Cmax (mm)	254.59

Routing Parameters

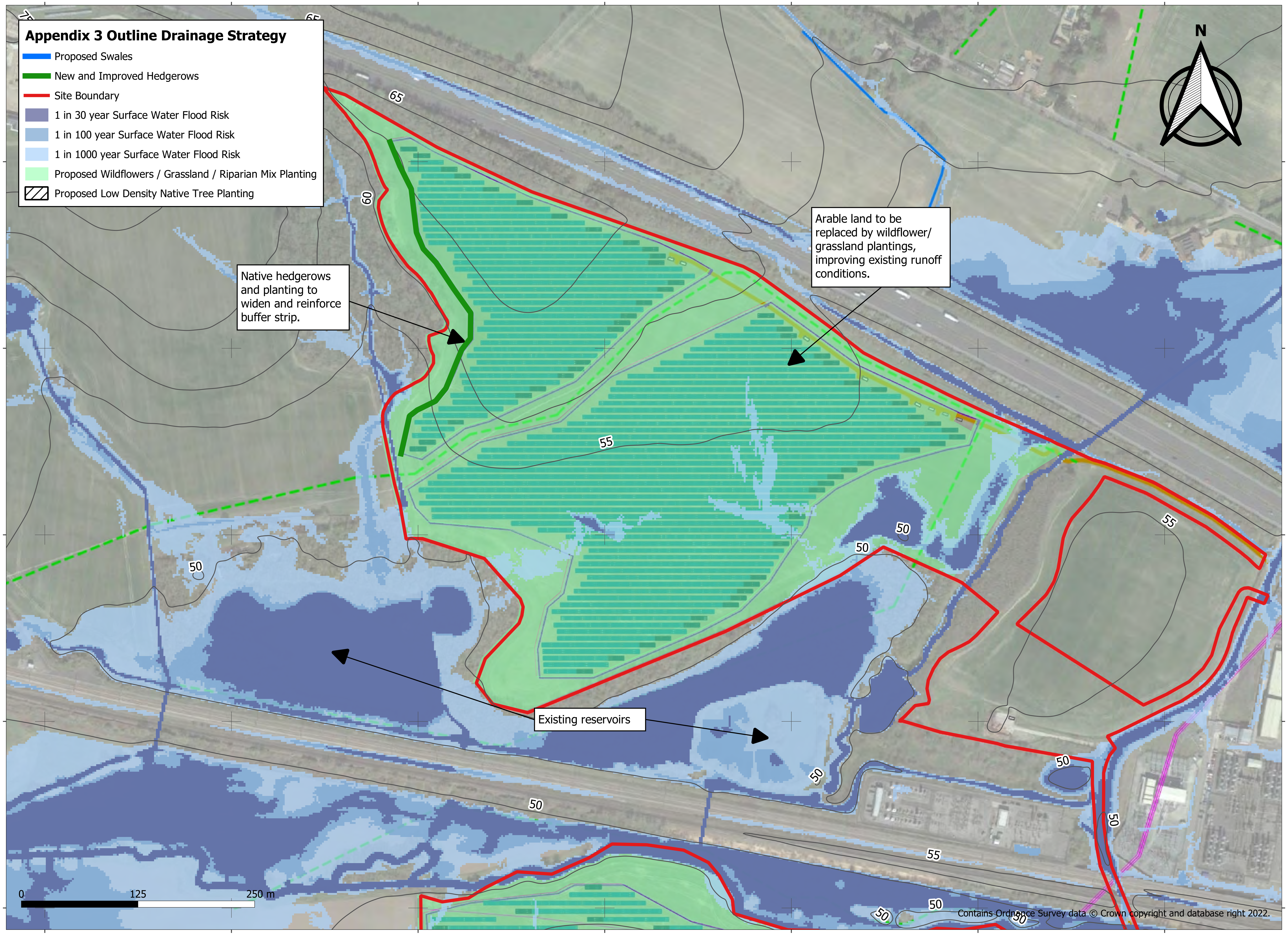
Tp (hr)	2.25
Up	0.65
Uk	0.8

Baseflow Parameters

BF0 (m^3/s)	0.05
BL (hr)	31.04
BR	0.72

Growth Curves and Discharge rates

Event	*Q/Qmed*	*Q (l/s)*	*Q (l/s/ha)*
Q1	**-**	**491.78**	**4.98**
Q2	1.00	559.37	**5.67**
Q30	**2.18**	**1219.14**	**12.35**
Q100	**2.86**	**1602.28**	**16.23**
Q200	3.40	1900.42	19.25
Q1000	5.15	2882.64	29.21


Appendix 3 Outline Drainage Strategy
Proposed Swales
New and Improved Hedgerows
Site Boundary
1 in 30 year Surface Water Flood Risk
1 in 100 year Surface Water Flood Risk
1 in 1000 year Surface Water Flood Risk
Proposed Wildflowers / Grassland / Riparian Mix Planting
Proposed Low Density Native Tree Planting
Native hedgerows and planting to widen and reinforce buffer strip.
Arable land to be replaced by wildflower/ grassland plantings, improving existing runoff conditions.
Existing reservoirs
N
606975
607175
607375
607575
607775
607975
608175
138950
138750
138550
138350
138150
65
60
55
50
0
125
250 m
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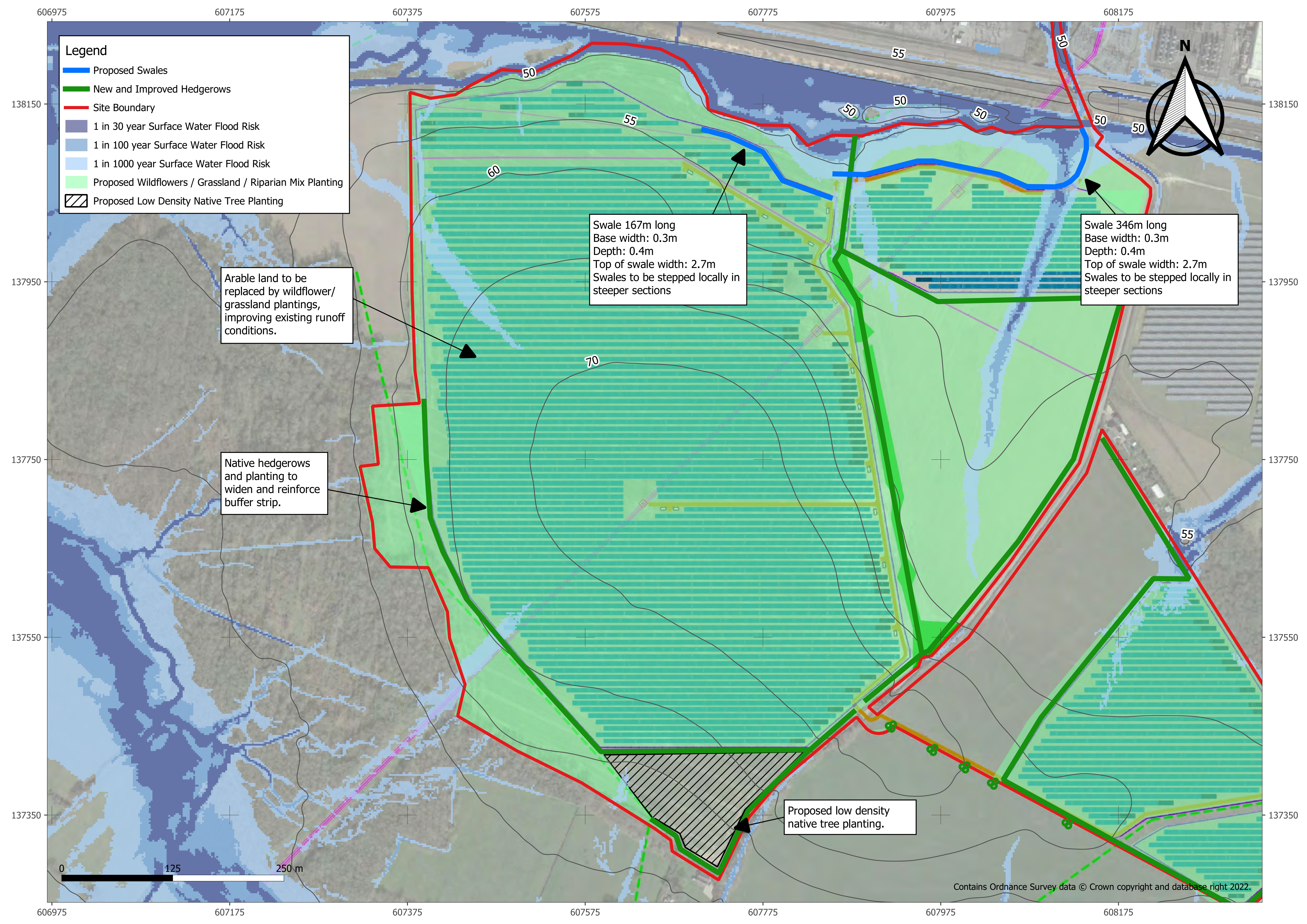

Legend
Proposed Swales
New and Improved Hedgerows
Site Boundary
1 in 30 year Surface Water Flood Risk
1 in 100 year Surface Water Flood Risk
1 in 1000 year Surface Water Flood Risk
Proposed Wildflowers / Grassland / Riparian Mix Planting
Proposed Low Density Native Tree Planting
Swale 167m long
Base width: 0.3m
Depth: 0.4m
Top of swale width: 2.7m
Swales to be stepped locally in steeper sections
Swale 346m long
Base width: 0.3m
Depth: 0.4m
Top of swale width: 2.7m
Swales to be stepped locally in steeper sections
Arable land to be replaced by wildflower/ grassland plantings, improving existing runoff conditions.
Native hedgerows and planting to widen and reinforce buffer strip.
Proposed low density native tree planting.
N
606975
607175
607375
607575
607775
607975
608175
138150
137950
137750
137550
137350
50
55
60
70
0
125
250 m
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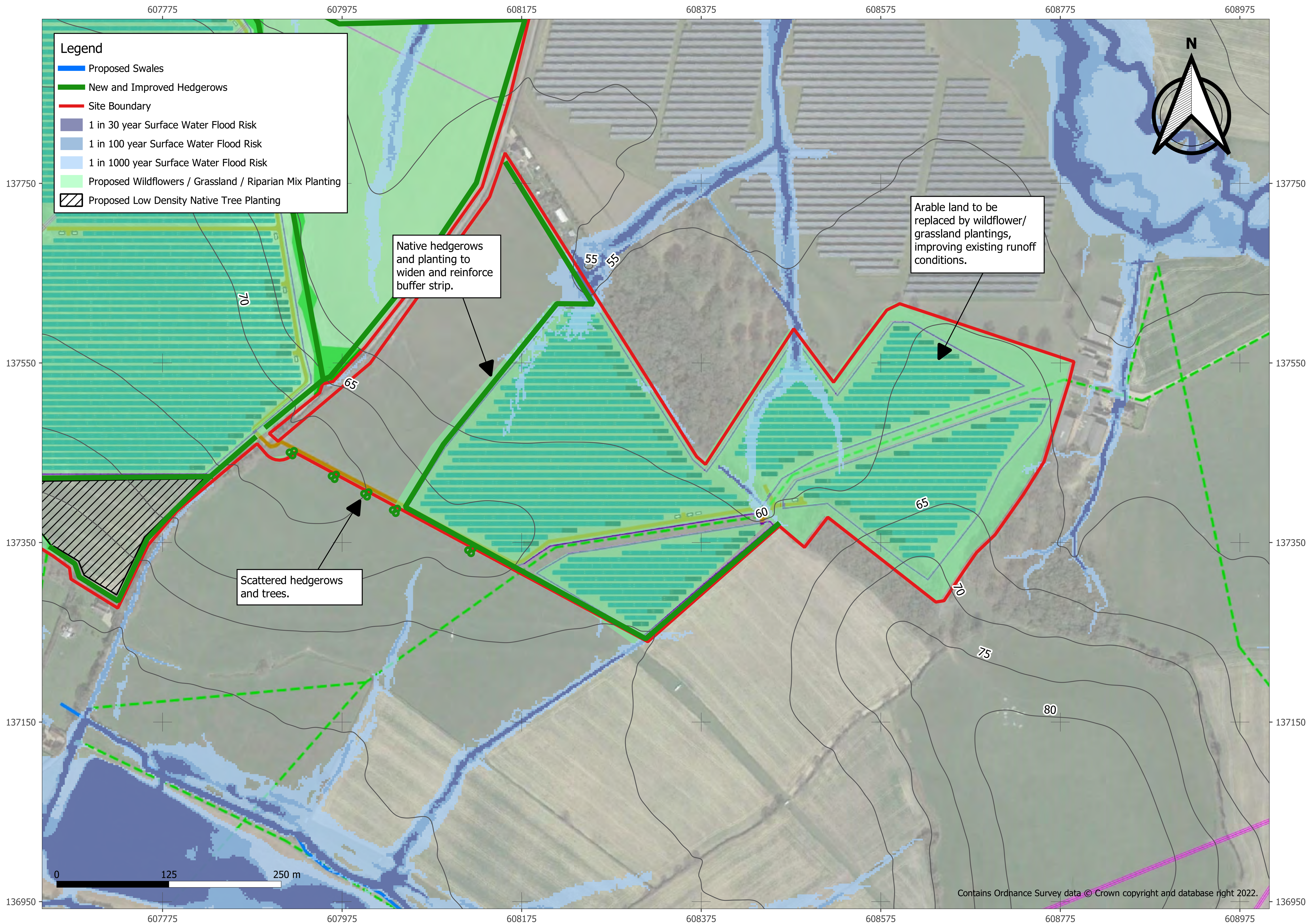

Legend
Proposed Swales
New and Improved Hedgerows
Site Boundary
1 in 30 year Surface Water Flood Risk
1 in 100 year Surface Water Flood Risk
1 in 1000 year Surface Water Flood Risk
Proposed Wildflowers / Grassland / Riparian Mix Planting
Proposed Low Density Native Tree Planting
N
Native hedgerows and planting to widen and reinforce buffer strip.
Arable land to be replaced by wildflower/ grassland plantings, improving existing runoff conditions.
Scattered hedgerows and trees.
607775
607975
608175
608375
608575
608775
608975
137750
137550
137350
137150
136950
55
60
65
70
75
80
0
125
250 m
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Appendix 4 - Correspondence with EA

Good morning Alex

I'm sorry for the delay in getting back to you but, as you can see below, the engineer has provided you with a detailed response.

> **When we are considering future flood risk in our EIA chapter, has the Aldington FSA crest level been designed to a certain return period event for the East Stour river?**
>
> The design crest level of 51.3 mAOD that we provided refers to the original design for the shoulders of the FSA embankment. The embankment also has a central spillway with a design crest level of 50.2 mAOD. The FSA was designed for floods in excess of the nominal 100-year event to overtop the embankment spillway crest in a controlled manner. The embankment shoulders were designed to contain the Probable Maximum Flood including a freeboard which reduces any wave overtopping to an acceptable level.
>
> Reservoir spillway investigations by Halcrow Group Ltd in 2010 assessed the Probable Maximum Flood level just upstream of the embankment to be 50.78 mAOD (50.85 mAOD for the 2009 Reservoir Inspection). The 1000 year return period (0.1% AEP) flood level was assessed to be 50.49 mAOD. These exclude any adjustments for climate change.
>
> There have been two events where the spillway crest has been overtopped:-
>
> <u>5-8 November 2000</u>
> In 2014 JBA assessed the November 2000 flood event as approximately a 1 in 30 year return period for the Upper Stour (see attached report). The attached aerial photographs taken 7 Nov 2000 show the flow passing over the spillway and the flood extent flooding Church Lane upstream. The flood extent may not be at the peak. The Historic Flood Map used for Flood Zone 2 should have been based on these November 2000 aerial photographs, but was not drawn accurately.
>
> <u>15 February 2014</u>
> The peak stage at the embankment from automatic 15min readings was 50.31 mAOD. JBA's attached report section 7.2 explains the potential range of return periods dependent on the methodology used.
>
> Flood levels upstream at your sites will be higher than these levels just upstream of the FSA embankment. The November 2000 aerial photographs could give an indication of the increase in flood levels upstream for that size of flood event.
>
> Once we have updated our fluvial flood risk model for the Upper Stour catchment, we will reassess flood risk in Ashford, including the effectiveness of the flood storage reservoirs at Hothfield and Aldington, and identify and appraise potential actions for flood risk in Ashford to keep pace with climate change. These may include modifications to the FSA arrangements.
>
> **The extent of the FSA seems to match the flood zone 3 outline near our site, does this indicate it is based on the 1.0% AEP event? With or with out climate change?**
>
> No, see above. Also it is worth noting that Flood Zone 3 in this location uses the 2004 national generalised modelling to produce catchment scale Flood Zones (using JFLOW modelling techniques) and includes the flood extent along some tributaries as well as main river.

I hope this answers your questions but if you have any further questions please feel free to contact me.

Regards

David Rich | FCRM Officer | Partnership & Strategic Overview - East Kent | Flood & Coastal Risk Management
Environment Agency | Orchard House | London Road | Addington | Maidstone | Kent | ME19 5SH
☎ Telephone: 020 8474 7253
☎ Mobile: 07768 802740

From: Alex Garratt [mailto:alex.garratt@hydrosolutions.co.uk]
Sent: 13 December 2021 12:10
To: KSL PSO East Kent <PSO.EastKent@environment-agency.gov.uk>
Subject: RE: KSL 226816 CM follow up - Flood risk data request for the East Stour River

Hi David,

Thank you for your reply on this work, when we are considering future flood risk in our EIA chapter, has the Aldington FSA crest level been designed to a certain return period event for the East Stour river?

The extent of the FSA seems to match the flood zone 3 outline near our site, does this indicate it is based on the 1.0% AEP event? With or with out climate change?

Many thanks,
Alex

Alex Garratt
Consultant

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Email : alex.garratt@hydrosolutions.co.uk
View our company page here
www.hydrosolutions.co.uk

From: KSL PSO East Kent <PSO.EastKent@environment-agency.gov.uk>
Sent: 17 August 2021 12:18
To: alex.garratt@hydrosolutions.co.uk
Subject: FW: KSL 226816 CM follow up - Flood risk data request for the East Stour River

Dear Alex

Thank you for your enquiry of 10 August 2021. As you can see below, our Customers and Engagement team have asked us to reply to you directly.

We have taken a look at the flood extents in this area and clearly the flood extent that covers Bested Hill is incorrect, rising as it does above the 70 metre gradient.

The problem with using the JFLOW modelled extents as you propose is that these extents were intended for the Flood Map for Planning, which only shows the undefended scenario. Your site is directly upstream of the Aldington Flood Storage Area and, if modelling was available that used a defended scenario with the flood storage area present, the flood extents would be greater. We are currently updating the Upper Stour model to include the East Stour as far as Stanford but that is not planned for completion by March 2023. In the meantime, with no further modelling available, you should consider taking a conservative approach. The Aldington FSA has a design crest level of 51.3 mAOD and we feel that it would be safer to use this contour line as the extent of the flood storage area and the consequent flood risk.

Upstream of this contour line it will be acceptable to use the undefended JFLOW modelling as you propose but be aware that it may underestimate the flood extents.

Regards

David Rich | FCRM Officer | Partnership & Strategic Overview - East Kent | Flood & Coastal Risk Management
Environment Agency | Orchard House | London Road | Addington | Maidstone | Kent | ME19 5SH
☎ Telephone: 020 8474 7253
☎ Mobile: 07768 802740

From: KSL Enquiries
Sent: 11 August 2021 08:56
To: KSL PSO East Kent <PSO.EastKent@environment-agency.gov.uk>
Subject: KSL 226816 CM follow up - Flood risk data request for the East Stour River

Hello team,

REFERRAL

Please see the enquiry below for your attention.

We have identified that this is not an information request or complaint, therefore we do not need to be involved further in the response. Please contact the customer directly.

Kind regards,

Claire McConchie
Customers & Engagement Officer
Kent, South London & East Sussex

Environment Agency | 0208 4746848 | Orchard House | Endeavour Park | London Road | West Malling | Kent | ME19 5SH

From: Alex Garratt [mailto:alex.garratt@hydrosolutions.co.uk]
Sent: 10 August 2021 16:24
To: KSL Enquiries <KSLE@environment-agency.gov.uk>
Subject: RE: KSL 226816 CM - Flood risk data request for the East Stour River

Dear Claire McConchie,

RE: KSL 226816 CM - Sellindge, Kent – Northern site – 607642, 138624. Southern site – 607772, 137771.

Thank you very much for your email, I note your comments that part of flood zone 2 is derived from historic flood extents, these extents are inaccurate and don't reflect the topography of the site. The whole of the southern site is within FZ2 which is a hill with 20m+ elevation from the East stour river.

Because of this inaccuracy in flood zone 2 for this site we are proposing to extract flood levels which can be used as part of our clients design for the solar farm which can inform the locations where infrastructure will be suitable. We would like to check with the EA whether our method for doing this would be acceptable when used as part of the planning application for the site.

Would you be able to forward this email on to the appropriate team to assess whether this is acceptable for this site.

Our Method

In close proximity to or within the site, where Jflow modelling flood zone extents are present we will sample the difference in elevation between the FZ2 and FZ3 extent using 1m LiDAR data. The largest difference in elevation will be used to plot a revised flood extent line for the 1000 year event (a proxy flood zone 2). This will be done by adding on the elevation difference previously mentioned onto the elevation at the extent of the FZ3 at the site. An extent line will then be plotted which more accurately represents FZ2 levels which can be used to site infrastructure out of this region.

We would appreciate you comments on this method, due to there being no existing flood model of the site, it would be a large financial burden for our client to instruct a bespoke model for this area. Therefore we would very much appreciate a workable solution that is on the same level of magnitude as our method outlined above.

Kind regards,
Alex

Alex Garratt
Consultant

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From: KSL Enquiries <KSLE@environment-agency.gov.uk>
Sent: 03 August 2021 09:02
To: 'alex.garratt@hydrosolutions.co.uk' <alex.garratt@hydrosolutions.co.uk>
Subject: KSL 226816 CM - Flood risk data request for the East Stour River

Dear Alex Garratt

RE: KSL 226816 CM - Sellindge, Kent – Northern site – 607642, 138624. Southern site – 607772, 137771.

Thank you for your enquiry which was received on 11 June 2021, we apologise for the delay in responding to you.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.
Please refer to the Open Government Licence which explains the permitted use of this information.

The Flood Map shows that the southern site and part of the northern site lie within the outline of Flood Zone 3 or Flood Zone 2.

Flood zone 3 comprises land assessed as having a 1 in 100 (1%) or greater annual probability of fluvial flooding or a 1 in 200 (0.5%) or greater annual probability of tidal flooding and

Flood zone 2 comprises land assessed as having between a 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of fluvial flooding or between a 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of tidal flooding.

These sites are located in areas of Flood Zone 3 and 2 where we do not have modelled flood levels.

Instead, this area is covered by national generalised modelling which is only suitable for Flood Zone extent visualisation, not levels or depths data.
In 2004 we completed national generalised modelling to produce catchment scale Flood Zones (using JFLOW modelling techniques), the calculation process produced water depths as a by-product. Since the modelling methods used were developed, tested and reviewed to produce Flood Zone extents only, we currently have no information on the accuracy of the depth data.

Alternatively some areas of flood zone 2 which are not modelled are derived from historic flood event maps.
We can confirm that flooding from rivers and/or the sea occurred in November 2000 and February 2001 for this location.

The Lead Local Flood Authority (Kent County Council) is responsible for surface water and groundwater water flooding issues. You can download surface water flood maps here

We recommend that you discuss your proposals with the Local Planning Authority at the earliest opportunity. They will be able to advise you on a wide range of planning matters in addition to flood risk.
http://www.environment-agency.gov.uk/research/planning/82584.aspx

You may be interested in the following guidance / information publically available:

• ‘Planning Practice Guidance’ - provides information about planning considerations in areas at risk of flooding. http://planningguidance.planningportal.gov.uk/
• ‘Planning applications: assessing flood risk’ - information about completing Flood Risk Assessments. https://www.gov.uk/planning-applications-assessing-flood-risk
• ‘Site specific flood risk assessment: Checklist’ – a checklist to help ensure you have considered all the relevant factors in your flood risk assessment. http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment-checklist/

- Historical flood map information is available on our website.
- The Flood Map for Planning is available to view and export maps for your site at: https://flood-map-for-planning.service.gov.uk/

If you have any further queries or if you'd 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 and we will do this for you.

Kind regards,

Claire McConchie
Customers & Engagement Officer
Kent, South London & East Sussex

Environment Agency | Orchard House | Endeavour Park | London Road | West Malling | Kent | ME19 5SH

From: Alex Garratt [mailto:alex.garratt@hydrosolutions.co.uk]
Sent: 11 June 2021 14:57
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Cc: Paul Blackman <paul.blackman@hydrosolutions.co.uk>
Subject: Flood risk data request for the East Stour River

Good afternoon,

We are conducting a flood risk assessment for a proposed solar farm in Sellindge, Kent. To aid this could I please request product 4 where available for this site?
I have attached a location plan, the site comprises two areas which can be seen in the plan. The NGR for the centre of each area is: Northern – 607642, 138624, Southern – 607772, 137771.

Kind regards,
Alex

Alex Garratt
Consultant

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