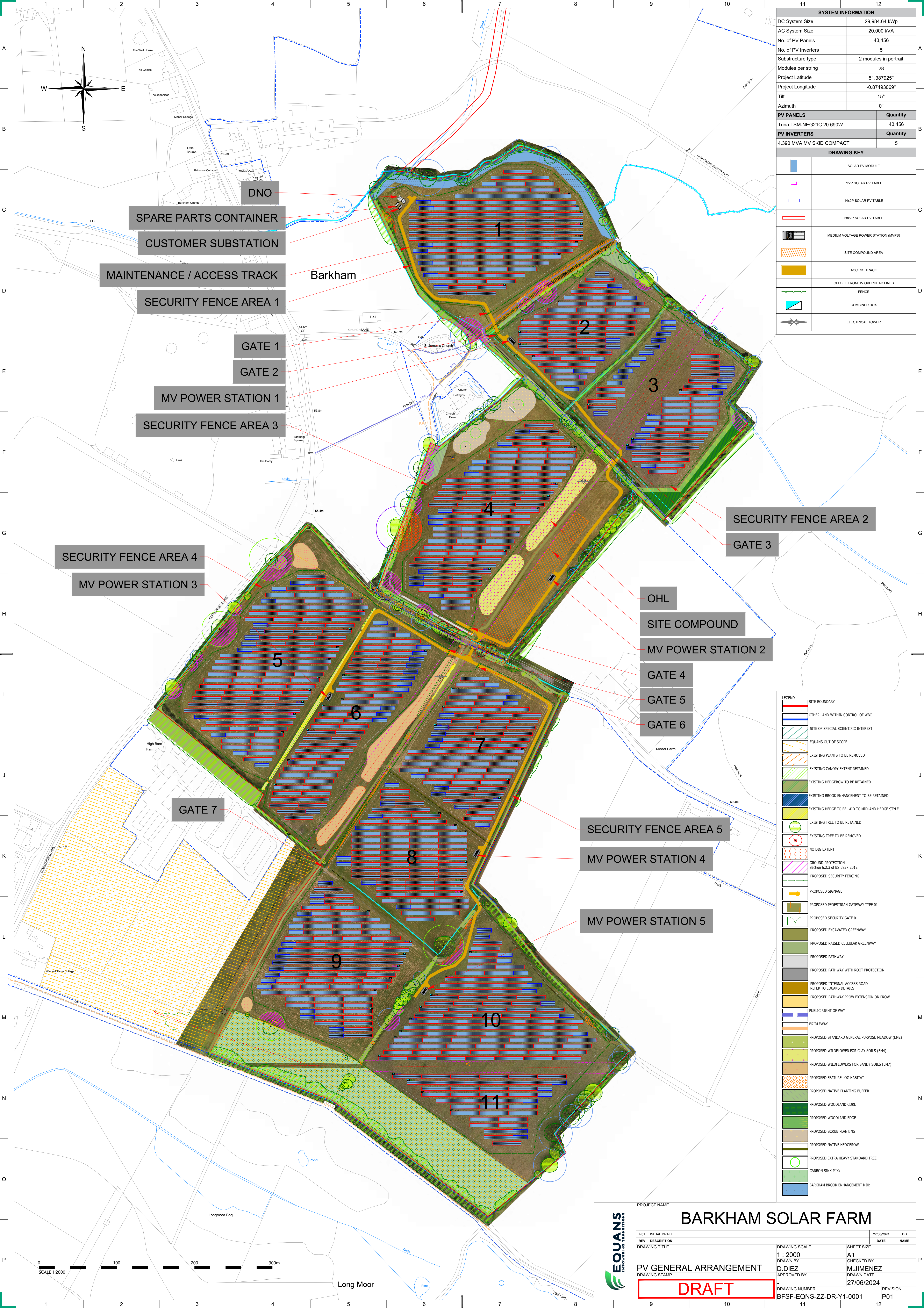




SYSTEM INFORMATION	
DC System Size	29,984.64 kWp
AC System Size	20,000 kVA
No. of PV Panels	43,456
No. of PV Inverters	5
Substructure type	2 modules in portrait
Modules per string	28
Project Latitude	51.387925°
Project Longitude	-0.87493069°
Tilt	15°
Azimuth	0°
PV PANELS	
Trina TSM-NEG21C.20 690W	Quantity 43,456
PV INVERTERS	
4.390 MVA MV SKID COMPACT	Quantity 5

DRAWING KEY	
	SOLAR PV MODULE
	7x2P SOLAR PV TABLE
	14x2P SOLAR PV TABLE
	28x2P SOLAR PV TABLE
	MEDIUM VOLTAGE POWER STATION (MVPS)
	SITE COMPOUND AREA
	ACCESS TRACK
	OFFSET FROM HV OVERHEAD LINES
	FENCE
	COMBINER BOX
	ELECTRICAL TOWER

LEGEND	
	SITE BOUNDARY
	OTHER LAND WITHIN CONTROL OF WBC
	SITE OF SPECIAL SCIENTIFIC INTEREST
	EQUANS OUT OF SCOPE
	EXISTING PLANTS TO BE REMOVED
	EXISTING CANOPY EXTENT RETAINED
	EXISTING HEDGEROW TO BE RETAINED
	EXISTING BROOK ENHANCEMENT TO BE RETAINED
	EXISTING HEDGE TO BE LAID TO MIDLAND HEDGE STYLE
	EXISTING TREE TO BE RETAINED
	EXISTING TREE TO BE REMOVED
	NO DIG EXTENT
	GROUND PROTECTION Section 6.2.3 of BS 5837:2012
	PROPOSED SECURITY FENCING
	PROPOSED SIGNAGE
	PROPOSED PEDESTRIAN GATEWAY TYPE 01
	PROPOSED SECURITY GATE 01
	PROPOSED EXCAVATED GREENWAY
	PROPOSED RAISED CELLULAR GREENWAY
	PROPOSED PATHWAY
	PROPOSED PATHWAY WITH ROOT PROTECTION
	PROPOSED INTERNAL ACCESS ROAD REFER TO EQUANS DETAILS
	PROPOSED PATHWAY PROW EXTENSION ON PROW
	PUBLIC RIGHT OF WAY
	BRIDLEWAY
	PROPOSED STANDARD GENERAL PURPOSE MEADOW (EM2)
	PROPOSED WILDFLOWER FOR CLAY SOILS (EM4)
	PROPOSED WILDFLOWERS FOR SANDY SOILS (EM7)
	PROPOSED FEATURE LOG HABITAT
	PROPOSED NATIVE PLANTING BUFFER
	PROPOSED WOODLAND CORE
	PROPOSED WOODLAND EDGE
	PROPOSED SCRUB PLANTING
	PROPOSED NATIVE HEDGEROW
	PROPOSED EXTRA HEAVY STANDARD TREE
	CARBON SINK MIX:
	BARKHAM BROOK ENHANCEMENT MIX:



PROJECT NAME

BARKHAM SOLAR FARM

P01	INITIAL DRAFT	27/06/2024	DD
REV	DESCRIPTION	DATE	NAME
DRAWING TITLE			
PV GENERAL ARRANGEMENT			
DRAWING STAMP			
DRAFT			
DRAWING SCALE		SHEET SIZE	
1 : 2000		A1	
DRAWN BY		CHECKED BY	
D.DIEZ		M.JIMENEZ	
APPROVED BY		DRAWN DATE	
-		27/06/2024	
DRAWING NUMBER		REVISION	
BFSF-EQNS-ZZ-DR-Y1-0001		P01	

D – Flood Risk Assessment



WOKINGHAM BOROUGH COUNCIL

WOKINGHAM-WKH-2021- BARKHAM FARM SOLAR FARM

Flood Risk Assessment





WOKINGHAM BOROUGH COUNCIL

**WOKINGHAM-WKH-2021- BARKHAM FARM
SOLAR FARM**

Flood Risk Assessment

REPORT (REVISION 1) PUBLIC

PROJECT NO. 70074897

DATE: MARCH 2021



WOKINGHAM BOROUGH COUNCIL

WOKINGHAM-WKH-2021- BARKHAM FARM SOLAR FARM

Flood Risk Assessment

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QUALITY CONTROL

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Prepared by	James Denny	James Denny		
Signature				
Checked by	Joao Gil	Joao Gil		
Signature				
Authorised by	Gemma Hoad	Gemma Hoad		
Signature				
Project number	70074897	70074897		
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CONTENTS

EXECUTIVE SUMMARY

1	INTRODUCTION	1
1.1	APPOINTMENT AND BRIEF	1
1.2	ADVISORY INFORMATION	1
2	SITE BACKGROUND	2
2.1	SITE DESCRIPTION	2
2.2	DEVELOPMENT PROPOSALS	2
2.3	TOPOGRAPHY	2
2.4	GEOLOGY AND HYDROGEOLOGY	2
2.5	IDENTIFICATION OF EXISTING WATERCOURSES	3
2.6	EXISTING SEWER AND DRAINAGE INFRASTRUCTURE	4
2.7	EXISTING FLOOD DEFENCES	4
3	POLICY AND CONSULTATION	6
3.1	CONSULTATION	6
3.2	POLICY AND GUIDANCE	6
3.3	CLIMATE CHANGE	7
4	OVERVIEW OF FLOOD RISK	8
4.1	DEFINITION OF FLOOD HAZARD	8
4.2	FLOODING FROM COASTAL AND TIDAL SOURCES	8
4.3	FLOODING FROM FLUVIAL SOURCES	8
4.4	FLOODING FROM PLUVIAL/OVERLAND FLOW SOURCES	8
4.5	FLOODING FROM GROUNDWATER SOURCES	9
4.6	FLOODING FROM SEWER AND DRAINAGE INFRASTRUCTURE	9

4.7	FLOODING FROM ARTIFICIAL SOURCES	10
5	SEQUENTIAL AND EXCEPTION TEST SUMMARY	11
5.1	INTRODUCTION	11
5.2	VULNERABILITY CLASSIFICATION	11
5.3	FLOOD ZONE DEFINITION	11
5.4	COMPATIBILITY TEST	11
5.5	CONCLUSION ON THE SEQUENTIAL AND EXCEPTION TEST	11
6	FLOOD RISK MITIGATION MEASURES	13
6.1	INTRODUCTION	13
6.2	MITIGATION MEASURES	13
	PLUVIAL/OVERLAND FLOW FLOOD RISK MANAGEMENT	13
6.3	SAFE ACCESS AND EGRESS	13
7	SURFACE WATER DRAINAGE STRATEGY	14
7.1	EXISTING SURFACE WATER DRAINAGE REGIME	14
7.2	PROPOSED SURFACE WATER FLOW MANAGEMENT	14
	DESIGN CRITERIA	15
	REQUIRED ATTENUATION VOLUMES	15
	EXCEEDANCE FLOW ROUTES	16
7.3	PROPOSED WATER QUALITY MANAGEMENT	16
7.4	MAINTENANCE AND ADOPTION	16
8	CONCLUSIONS	17

TABLES

Table 3-1 – Summary of Correspondence	6
Table 5-1 - Flood risk and vulnerability and flood zone compatibility (PPG Table 3)	11

APPENDICES

APPENDIX A	SITE LOCATION PLAN
APPENDIX B	TOPOGRAPHIC PLAN AND SURVEY
APPENDIX C	BGS MAPPING
APPENDIX D	FLOOD MAP PACK
APPENDIX E	CORRESPONDENCE EMAILS
APPENDIX E.1	THE ENVIRONMENT AGENCY
APPENDIX E.2	THAMES WATER
APPENDIX E.3	WOKINGHAM BOROUGH COUNCIL
APPENDIX F	EA MAPPING
APPENDIX G	SITE VISIT DRAINAGE PLAN, DRAINAGE GENERAL ARRANGEMENT AND CONSTRAINTS PLAN

EXECUTIVE SUMMARY

WSP has been appointed by Wokingham Borough Council to undertake a Flood Risk Assessment for a proposed development on a mixed greenfield and brownfield site located 5km to the south west of Wokingham. This report has been written in accordance with the requirements of the National Planning Policy Framework and other relevant national and local policy guidance documents.

The development proposals consist of a solar farm, with approximately 72,000 solar photovoltaic panels and associated infrastructure. The Proposed Development also plans to incorporate a grid connection route which will be provided underground between the site boundary and point of connection at Wokingham sub-station and will be classified as Essential Infrastructure.

The flood risk has been assessed through the use of publicly available data and consultation with the appropriate flood risk management authorities, the findings of which are summarised below.

The site covers an area of approximately 52ha, is located mostly within Flood Zone 1 and would be considered at very low risk from fluvial sources. The main risk of flooding to the Proposed Development is from pluvial sources.

The baseline risk to the Proposed Development from Coastal, Fluvial, Groundwater, Sewers and Drainage Infrastructure and Artificial Sources are all between low and negligible and therefore require no mitigation measures.

Mitigation measures for this risk have been provided in the form of a surface water drainage strategy. The proposed surface water drainage strategy demonstrates that the Proposed Development can be drained using SuDS techniques for events up to the 1% annual probability storm event, including an allowance for climate change (40% increase on peak rainfall intensity).

It is required that the levels within the areas associated with the overland flow route (i.e. at risk of surface water flooding up above the 0.1% AEP) across the Application Site are not altered to ensure flood risk is not increased elsewhere. It is recommended that the areas below and around the solar panels are kept vegetated both during construction and on a post-development stage to reduce erosion at the foot of the mounting frame and avoid formation of grooves that could potentiate the concentration of runoff.

Based on findings of this Flood Risk Assessment, the requirements of the National Planning Policy Framework have been achieved with respect to flooding.

1 INTRODUCTION

1.1 APPOINTMENT AND BRIEF

- 1.1.1. Wokingham Borough Council Development Team have commissioned WSP to undertake a Flood Risk Assessment (FRA) in support of a 52ha, solar farm development with grid connection (hereafter referred to as the 'Proposed Development') located 5km to the south west of Wokingham. (the 'Application Site').
- 1.1.2. The FRA has been produced in line with the requirements of the National Planning Policy Framework (NPPF), the Environment Agency's Standing Advice, and the site-specific flood risk assessment checklist given in the Flood Risk and Coastal Change Planning Practice Guidance (PPG).
- 1.1.3. The aim of this FRA is to support the full planning application for the major development proposed at the Application Site and has been produced in consultation with Wokingham Borough Council (as Lead Local Flood Authority (LLFA), the Environment Agency, and Thames Water (Sewer Authority).
- 1.1.4. The FRA investigates flood risk near the Application Site and establishes the mitigation measures required, where necessary, to ensure the sustainability and safety of the Proposed Development over its lifetime. This includes the presentation of a conceptual surface water drainage strategy with an allowance for the anticipated climate change predictions over the lifetime of the Proposed Development.

1.2 ADVISORY INFORMATION

- 1.2.1. Third party data / reports have not been validated by WSP and have been relied on as supplied and have been assumed fit for purpose.
- 1.2.2. WSP has prepared this report in accordance with the instructions of their client, Wokingham Borough Council Development Team, for their sole and specific use relating solely to the above site. Any person who uses any information contained herein does so at their own risk and shall hold WSP harmless in any event.
- 1.2.3. Whilst this report was prepared using reasonable skill and care ordinarily exercised by engineers practicing under similar circumstances and reasonable checks have been made on data sources and the accuracy of the data, WSP accepts no liability in relation to the report should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP. In any event, WSP shall not be liable for any loss or damages arising under or in connection to the use of this report.

2 SITE BACKGROUND

2.1 SITE DESCRIPTION

- 2.1.1. The Application Site is located 5km to the south west of Wokingham. The Ordnance Survey grid reference for the Application Site is SU 78352 66032 and the nearest postcode is RG40 4EU. The Application Site covers approximately 52ha and is currently a mixed greenfield and brownfield site. Refer to Drawing No. 4897-LOC-001 in Appendix A for the Site Location plan.
- 2.1.2. The Application site is broadly bisected by Barkham Ride in two parts, hereafter described as the 'southern' and 'northern' sections.

2.2 DEVELOPMENT PROPOSALS

- 2.2.1. The key elements of the 47.6ha solar farm consist of approximately 72,000 solar photovoltaic panels and associated infrastructure, which is proposed to generate energy outputs up to a 32.5MW peak (MWp). Approximately 4.4ha of the Site in the south is proposed for tree planting for carbon sequestration, with the remainder being used for landscaping and access tracks. The Proposed Development also plans to incorporate a grid connection route which will be provided underground between the site boundary and point of connection at Wokingham Sub-station.

2.3 TOPOGRAPHY

- 2.3.1. The Environment Agency LiDAR 2m Digital Terrain Model (DTM) shows a maximum existing ground level within the Application Site of 75.6m AOD located approximately 490m from the northern tip of the site on Barkham Road. The Application Site falls away from this point to both the north and the south. A minimum level of 49.6m AOD is found at the corner of the Application Site close to Barkham Brook. Approximately 225m from southern boundary there is a level of 64.8m AOD, which is the maximum existing ground level for the part of the Site associated with the solar farm itself. The LiDAR indicates the Application Site ground level falls away from this point both towards the south and north, with a steeper decline to the south. Refer to Drawing No. 4897-TOP-001 in Appendix B.
- 2.3.2. WSP completed a topographic survey in November 2020. The survey levels generally correspond with the LiDAR data, although there is no survey data for the route of the grid connection. The topographic was able to indicate some water features which weren't picked up within the LiDAR data. Refer to the topographic survey in Appendix B.

2.4 GEOLOGY AND HYDROGEOLOGY

- 2.4.1. British Geological Survey (BGS) 1:50,000 scale On-Shore Digital Mapping (British Geological Survey, 2020) shows the south of the Application Site is underlain by the Bagshot formation (sand), while the northern section of the Application Site is underlain by the London Clay Formation (clay, silt and sand). The northern part of the Application Site associated with the grid connection is underlain by Bagshot formation. A small section of the site associated with the grid connection at the north is underlain by London Clay Formation. An extract of the BGS bedrock geology mapping is provided on Drawing No. 4897-BGS-001 in Appendix C for reference.

- 2.4.2. There is a small section of Superficial deposits running from east to west at the centre of the Application Site, these are Alluvium (clay, silt, sand and gravel). An extract of the BGS superficial geology mapping is provided on Drawing No. 4897-BGS-002 in Appendix C for reference.
- 2.4.3. Borehole record SU76NE227, located approximately 300m to the east of the Application Site indicates Bagshot Beds: light grey, very silty fine sand to a depth of 6.6m along with a standing water level 1.17m below the surface.
- 2.4.4. At the time this report was written there had been no site-specific ground investigations. It is therefore recommended that a site-specific ground investigation is undertaken at the detailed design stage.
- 2.4.5. The greenfield part of the site drains mostly via natural infiltration and localised overland runoff into field ditches, with the ditches to the north of Barkham Ride eventually flowing into Barkham Brook.
- 2.4.6. DEFRA's Magic Map shows the Bagshot Formation bedrock along with the Alluvium deposits to be classified as a Secondary A Aquifer. These are '*permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.*' The London Clay Formation is classified as an Unproductive Aquifer. These are rocks with essentially no groundwater.
- 2.4.7. The Flood Map Pack, included in Appendix D for reference, indicates there are no source protection zones within 500m of the Application Site.
- 2.4.8. According to DEFRA Magic Map, the Application Site lies within Barkham Brook Nitrate Vulnerable Zone (ID S449).
- 2.4.9. DEFRA Magic Map also shows The Application Site to fall within areas of high, low and unproductive groundwater vulnerability. The parts of the site underlain by Bagshot Formation are identified to lie within a high groundwater vulnerability zone. The parts of the site underlain by London Clay are associated with the unproductive groundwater vulnerability, while the area covered by Alluvium superficial deposits is classified as a low groundwater vulnerability zone. Highly vulnerable groundwater areas are defined as areas '*able to easily transmit pollution to groundwater. They are characterised by high leaching soils and the absence of low permeability superficial deposits*', while lowly vulnerable groundwater areas '*provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of low permeability superficial deposits.*'

2.5 IDENTIFICATION OF EXISTING WATERCOURSES

- 2.5.1. There is a collection of small ditches which run across the Application Site in multiple locations. In the southern section of the site, there is a network of ditches which appear to drain existing paths and tracks. The northern section of the site also includes a network of ditches, which ultimately flow into Barkham Brook at the boundary.
- 2.5.2. Barkham Brook flows along the northern boundary of the southern section of the Application Site, crossing the section of the application site associated with the grid connection before reaching the western boundary of the Application Site where it there begins to follow the boundary towards the south west.
- 2.5.3. An area of the Application Site associated with the grid connection crosses Barkham Brook and a ditch as it leaves the solar farm and travels north towards Edneys Hill.

- 2.5.4. From the point it crosses Barkham Street, approximately 160m to the west of the centre of the Application Site, Barkham Brook becomes an Environment Agency designated main river which flows in a south west direction.

2.6 EXISTING SEWER AND DRAINAGE INFRASTRUCTURE

- 2.6.1. The Application Site is classified as a mixture of greenfield and brownfield land. The greenfield areas currently drain via infiltration and natural overland runoff towards field ditches and Barkham Brook, while the brownfield areas, mostly associated with Barkham Road and Barkham Ride, drain into highway carrier drains.
- 2.6.2. Thames Water Asset Plans, provided in Appendix E.2 show that there are public surface and foul water sewers crossing the Application Site. All bar one of these sewers crosses the area of the Application Site to the north associated with the grid connection. A 450mm foul sewer crosses the main body of the application site from east to west. A 225mm foul and a 900mm surface water trunk sewer, flow towards the south through the application site between Barkham Brook and Edge Hill. In addition to this there is a 150mm foul water sewer which flows towards the south west on Barkham Road.

2.7 EXISTING FLOOD DEFENCES

- 2.7.1. The Environment Agency's Flood Map for Planning indicates that the Application Site does not benefit from any fluvial defences. Refer to Drawing No. 4897-EA-001 in Appendix F for reference.

2.8 SITE VISIT

- 2.8.1. A site visit was undertaken on the 15th March 2021 to verify the location and condition of onsite watercourses. The weather was generally dry, with a few showers between 10am and 11am – refer to drawing WSP-70074897-SIT-001 (Appendix G) for photos of the water features inspected. A brief overview for each picture is detailed below:
- A – Ditch entering the Application Site, approximately 500mm deep and 2m wide. Dry at time of visit, small debris, twigs and leaves at base.
 - B – Ditch flowing to the north, approximately 200mm deep, 2m wide. Areas of standing water at time of visit. Thick vegetation on banks including tree growth, large debris within channel.
 - C – Connection between ditches. Shallow channel with lots of sedimentation causing blockages in surrounding pipes.
 - D – Barkham Brook flowing along the site boundary. Historic evidence on vegetation suggest flows may break the banks.
 - E – Ditch (Same as that in B) flowing to the north, approximately 200mm deep, 2m wide. Areas of standing water at time of visit. Thick vegetation on banks, including tree growth, large debris within channel.
 - F – Convergence of 2 ditches. Approximately 700mm deep, 3m wide. Flowing at the time of visit, Vegetation, grass at the base of the channel.
 - G – Ditch flowing to the north, approximately 500mm deep, 2.5m wide. Flowing to the north at time of visit, base of channel covered in vegetation, grass.
 - H – Pipe connection under ditch crossing. Poor condition, pipe cover level above the surface, likely to have reduce capacity due to silt. Limited flow upstream.
 - I – Ditch flowing west towards Barkham Brook, approximately 700mm deep, 3m wide. Small volumes of water in channel.

- J – Connection between ditch (I) and Barkham Brook at the West of the site. Ditch surrounded by vegetation.
- K – Ditch to the south of Barkham Ride, not shown in topography survey. Approximately 1m wide, depth unknown. Densely vegetated, poorly maintained, contained water at time of visit.
- L – Ditch immediately to the south of Application boundary. Approximately 750mm wide, depth unknown. Water at time of visit. Mixed vegetation.
- M – Ditch flowing to the South approximately 800mm deep and 2m wide. Ends at location of photo, although obscured by vegetation. Dry at time of visit.
- N – Ditch Running towards east, approximately 500mm deep, 1.5m wide. Connectivity to ditch flowing to the south (M) via pipe. Dry at time of visit, light vegetation.

The overall perception of the site visit was that water conveyance features were generally poorly maintained, with dense vegetation along their base and debris partially blocking culverts. The vegetation strip running alongside ditches and watercourses was found to protect these features from any debris capable of increasing the risk of blockage, which will also be beneficial during construction and on a post-development stage. The soil was mostly noted as boggy throughout the whole site, indicating potential high ground water levels.

3 POLICY AND CONSULTATION

3.1 CONSULTATION

- 3.1.1. Consultation has been undertaken with regulatory bodies and third parties, during the preparation of this FRA, including:
- the Environment Agency;
 - Wokingham Borough Council; and,
 - Thames Water.
- 3.1.2. A summary of the pre-application correspondence undertaken with the flood risk stakeholders identified above is given in Table 3-1 with full copies provided in Appendix E for reference.

Table 3-1 – Summary of Correspondence

STAKEHOLDER	RESPONSE
Environment Agency	The Environment Agency confirmed they hold no records of historic flood events in this location. There are no formal Environment Agency flood defences in the areas. They do not have any ground water monitoring boreholes within 500m of the site.
Wokingham Borough Council	Wokingham Borough Council confirmed they hold no historic flood records at the Application Site.
Thames Water	Thames Water advised that there are no recorded incidents flooding related to surcharging of public sewers in the vicinity of the site. Asset plans confirmed the location of public networks within the area around the Application Site.

3.2 POLICY AND GUIDANCE

- 3.2.1. The report has been informed by, and makes reference to where appropriate, the following documents and policies:
- NPPF, Ministry of Housing, Communities & Local Government (2019);
 - NPPF Flood Risk and Coastal Change PPG, Ministry of Housing, Communities & Local Government (2016);
 - Non-Statutory Technical Standards for Sustainable Drainage Systems, DEFRA (2015);
 - The SuDS Manual (CIRIA C753), CIRIA (2015);
 - Design and Construction Guidance, Water UK (2020);
 - Flood Risk Assessments: Climate Change allowances, Environment Agency (2016, updated July 2020);
 - Thames River Basin Management Plan, Environment Agency (2015);
 - Thames Catchment Flood Management Plan, Environment Agency (December 2009);
 - Core Strategy Development Plan Document, Wokingham Borough Council (January 2010);

- Development Plan: Adopting Management Delivery Local Plan, Wokingham Borough Council (February 2014);
- Local Flood Risk Management Strategy, Wokingham Borough Council (2015);
- Strategic Flood Risk Assessment, Wokingham Borough Council (2020);
- Wokingham SuDS Strategy, Wokingham Borough Council (2016);
- Hydrologic Response of Solar Farms, Lauren M. Cook, Richard H. McCuen (2013).

3.3 CLIMATE CHANGE

- 3.3.1. The typical lifespan for a solar farm is 25 years however, to be on the conservative side of design, the site will be designed to the 100 year contingency allowances for climate change. Based on this, the contingency allowances for climate change that are potentially applicable to the Proposed Development are given below.
- Surface Water (peak rainfall intensity):
 - Upper End – 40% by 2115; and
 - Central – 20% by 2115.
- 3.3.2. The allowances adopted for the design of the proposed surface water drainage strategy are discussed in their respective sections.

4 OVERVIEW OF FLOOD RISK

4.1 DEFINITION OF FLOOD HAZARD

- 4.1.1. The following section provides an overview of flood risk at the Application Site, along with an assessment of flood risk to and arising from the Proposed Development. An assessment has been undertaken for each source that could affect the Proposed Development in accordance with the NPPF Flood Risk and Coastal Change PPG.
- 4.1.2. Flood risks have been qualitatively assessed on the following basis:
- Negligible risk (e.g. coastal flood risk posed to inland areas);
 - Very Low risk (e.g. Flood Zone 1 or <0.1% annual probability of flooding from surface water);
 - Low risk (e.g. Flood Zone 2 or between 0.1% and 1.0% annual probability of flooding from surface water);
 - Medium risk (e.g. Flood Zone 3a or between 1.0% and 3.3% annual probability of flooding from surface water); and,
 - High risk (e.g. Flood Zone 3b or >3.3% annual probability of flooding from surface water).

4.2 FLOODING FROM COASTAL AND TIDAL SOURCES

- 4.2.1. Tidal flooding occurs when sea levels rise above the level of the land or beyond the operational level of flood defences.
- 4.2.2. The Environment Agency's Flood Map for Planning, reproduced on Drawing No. 4897-EA-001 in Appendix F shows that the Application Site is not in proximity of a tidal section of watercourse or the coast; consequently, the risk of flooding posed to the Application Site and the Proposed Development from this source is considered to be **Negligible** and will not be considered further.

4.3 FLOODING FROM FLUVIAL SOURCES

- 4.3.1. Fluvial flooding occurs when flows within a watercourse exceed the capacity of the channel causing out of bank flows.
- 4.3.2. Barkham Brook follows the boundary of the Application Site in a westerly direction before crossing the Application Site. The Environment Agency's Flood Map for Planning, reproduced on Drawing No.7897-EA-001 in Appendix F shows the Application Site lies predominately within Flood Zone 1, with a small area at a boundary at the centre of the site being located in Flood Zone 2 associated with the floodplain of Barkham Brook.
- 4.3.3. The existing fluvial flood risk posed to the Application Site ranges is broadly assessed as **Very Low**, with a very small extent of **Low** risk areas located near Barkham Brook.

4.4 FLOODING FROM PLUVIAL/OVERLAND FLOW SOURCES

- 4.4.1. During extreme storms ground may become saturated and, in addition, blocked sewers/drains may not be able to accommodate overland flows that arise from such conditions. This may lead to surface water flooding.
- 4.4.2. The Environment Agency's Risk of Flooding from Surface Water mapping, reproduced on Drawing No. 4897-EA-002 in Appendix F, indicates that the main risk of flooding from surface water at the

Application Site is Very Low. Areas at Very Low risk of surface water flooding have an annual probability of flooding of less than 0.1%.

- 4.4.3. There are areas of High, Medium and Low risk of surface water flooding, with the vast majority being located north of Barkham Ride and associated with a network of field ditches across the site and the floodplain of Barkham brook.
- 4.4.4. There is one major overland flow route which travels north from Barkham Ride towards Barkham Brook, with drawing No. 4897-EA-002 in Appendix F showing areas at High, Medium and Low risk from surface water flooding. Another major flow route crosses the Application Site on Barkham Road flowing to the south before again crossing the Application Site prior to reaching Barkham Brook.
- 4.4.5. There are isolated areas of High, Medium and Low risk of surface water flooding within the area of the Application Site associated with the grid connection.
- 4.4.6. As a result, the existing flood risk from Pluvial/Overland flow sources at the Application Site ranges from **Very Low** to **High**.

4.5 FLOODING FROM GROUNDWATER SOURCES

- 4.5.1. Groundwater flooding occurs when water stored below ground reaches the surface. It is commonly associated with porous underlying geology, such as chalk, sands and gravels.
- 4.5.2. At the time this report was written no seasonal groundwater assessment had been undertaken. It is recommended that groundwater variability is assessed at the detailed design stage of the project.
- 4.5.3. British Geological Survey (BGS) 1:50,000 scale On-Shore Digital Mapping (British Geological Survey, 2020) shows a mix of impermeable and permeable bedrock on the Application Site. Borehole record SU76NE227, located approximately 300m to the east of the Application Site indicates a standing water level 1.17m below the surface.
- 4.5.4. The Local Flood Risk Management Strategy shows the Application Site to be in an area with a risk of groundwater flooding below 25%.
- 4.5.5. The SFRA doesn't mention any records of flooding nearby the Application Site. It also states that 'there is very low risk of groundwater flooding' in the Barkham Parish area.
- 4.5.6. As a result, the existing flood risk from groundwater sources at the Application Site is considered **Low**.

4.6 FLOODING FROM SEWER AND DRAINAGE INFRASTRUCTURE

- 4.6.1. Thames Water asset plans have confirmed there are multiple assets located within the Application Site, the vast majority of these are associated with the grid connection route which is proposed to run under Barkham Road. There is one foul water sewer which crosses the Application Site between Barkham Ride and Barkham Brook. The asset location plan also shows a number of sewers crossing the proposed grid connection section of the Application Site. These include 2 No foul sewers and 1 No. surface water sewer trunk to the north of Barkham Brook.
- 4.6.2. Thames Water hold no recorded incidents of sewer flooding related to surcharging at a nearby location.

- 4.6.3. Consequently, due to the fact that Thames Water holds no record of sewer flooding near the main body of the Application Site, and the underground grid connection won't be at risk of flooding from sewer and drainage infrastructure, the risk of flooding from this source is considered **Very Low**.

4.7 FLOODING FROM ARTIFICIAL SOURCES

- 4.7.1. The Environment Agency's Flood Risk from Reservoirs Mapping, reproduced on Drawing No. 7897-EA-003 in Appendix F indicates that most of the Application Site does not lie within the inundation area of any reservoirs. The only exception is the southern part of the site, which lies immediately adjacent to an inundation area, but where no development is proposed, apart from tree planting. The risk of flooding from this source to the Application Site, is considered to be **Very Low**.
- 4.7.2. Similarly, as there are no canals or other artificial water storage facilities nearby or proposed within the development, the Proposed Development cannot influence flooding from this source. Therefore, the risk of flooding from this source to the Application Site, is considered to be **Very Low**.

5 SEQUENTIAL AND EXCEPTION TEST SUMMARY

5.1 INTRODUCTION

- 5.1.1. The purpose of the NPPF Sequential Test is to ensure that land use planning takes due regards of flood risks, to ensure that areas at low or no risk of flooding are developed in preference to areas at higher risk.

5.2 VULNERABILITY CLASSIFICATION

- 5.2.1. Vulnerability classifications are defined within Table 3 of the PPG Flood Risk and Coastal Change. The purpose of the vulnerability classification is to identify appropriate land use activities relative to the level of flood risk.
- 5.2.2. Within Table 2 (Flood Risk Vulnerability Classification) of the NPPF Planning Practice Guidance, the Proposed Development is classified as 'Essential Infrastructure' as it provides electricity generation.

5.3 FLOOD ZONE DEFINITION

- 5.3.1. According to the Environment Agency's Flood Map for Planning, the Proposed Development is located mostly within Flood Zone 1 with a section alongside Barkham Brook being located within Flood Zone 2.

5.4 COMPATIBILITY TEST

- 5.4.1. The Flood and Coastal Change PPG identified different land use vulnerabilities that are appropriate within each of the Flood Maps for Planning flood risk classification, see Table 5-1.

Table 5-1 - Flood risk and vulnerability and flood zone compatibility (PPG Table 3)

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate	Development is appropriate
Zone 2	Development is appropriate	Exception test required	Development is appropriate	Development is appropriate	Development is appropriate
Zone 3A	Exception test required	Development should not be permitted	Exception test required	Development is appropriate	Development is appropriate
Zone 3B	Exception test required	Development should not be permitted	Development should not be permitted	Development should not be permitted	Development is appropriate

5.5 CONCLUSION ON THE SEQUENTIAL AND EXCEPTION TEST

- 5.5.1. Table 5-1 shows that Essential Infrastructure development (i.e electricity generation) is considered appropriate in Flood Zone 1 and 2. The development is mostly located within Flood Zone 1 with a small section at the centre of the Application Site in Flood Zone 2. In addition to this there is very

little risk posed to the development or the surrounding area as all solar panels, including the panels constructed in Flood Zone 2 are located a minimum of 680mm off the ground, minimising the interference with any flood water and debris. As a result, the Sequential Test is satisfied, and the Exception Test is not required.

6 FLOOD RISK MITIGATION MEASURES

6.1 INTRODUCTION

- 6.1.1. Following a review of the flood risk to, and arising from, the Proposed Development the following section discusses the mitigation measures necessary to ensure the Proposed Development remains safe over its lifetime and does not exacerbate flood risk to neighbouring properties.

6.2 MITIGATION MEASURES

- 6.2.1. The risk posed to the Proposed Development, or of the Proposed Development exacerbating risk within the catchment from tidal / coastal, fluvial, sewer and drainage infrastructure, groundwater and artificial sources to neighbouring properties is assessed to be Low or Negligible, provided that adequate mitigation measures and drainage strategy are followed.

PLUVIAL/OVERLAND FLOW FLOOD RISK MANAGEMENT

- 6.2.2. The existing flood risk from Pluvial/Overland flow sources at the Application Site ranges from Very Low to High.
- 6.2.3. The proposed surface water drainage strategy, detailed in Section 7, demonstrates that the Proposed Development can be drained using SuDS techniques for events up to the 1% annual probability storm event, including an allowance for climate change (40% increase on peak rainfall intensity).
- 6.2.4. It is required that the levels within the areas associated with the overland flow route (i.e. at risk of surface water flooding up above the 0.1% AEP) across the Application Site are not altered to ensure flood risk is not increased elsewhere.
- 6.2.5. It is recommended that the areas below and around the solar panels are kept vegetated both during construction and on a post-development stage to reduce erosion at the foot of the mounting frame and avoid formation of grooves that could potentiate the concentration of runoff.
- 6.2.6. The surface water drainage strategy will only look at areas of the Application Site associated with above ground development. The proposed grid connection cable to connect the solar farm to the national grid will be underground and therefore have no effect on surface water flooding.
- 6.2.7. It is proposed that a 5m protection buffer to the banks of watercourses and ditches is kept unchanged, to prevent debris being carried into the water features, which could exacerbate the risk of flooding – WSP-70074897-DR-001 in Appendix G.
- 6.2.8. As per Thames Water's guidance, any works undertaken within 3m of a public sewer will require approval. Although some of the works related to the construction of access tracks and grid connection to Wokingham Substation are proposed within 3m from public sewers, all solar panels have been kept at least 3m away from public sewers – refer to WSP-70074897-DR-001 in Appendix G.

6.3 SAFE ACCESS AND EGRESS

- 6.3.1. Safe access and egress will be provided via Barkham Ride which runs across the Application Site. Barkham Ride lies fully within Flood Zone 1 and is located towards the top of the catchment.

7 SURFACE WATER DRAINAGE STRATEGY

7.1 EXISTING SURFACE WATER DRAINAGE REGIME

- 7.1.1. The Application Site is currently classified as a mixed greenfield and brownfield site. The pre-development greenfield part of the site drains mostly via natural infiltration and localised overland runoff into field ditches, with the ditches to the north of Barkham Ride eventually flowing into Barkham Brook. The area of the Application Site classified as brownfield is believed to drain by means of gullies into a highway carrier drain.

7.2 PROPOSED SURFACE WATER FLOW MANAGEMENT

- 7.2.1. Part H of the Building Regulations: Drainage and Waste Disposal establishes a hierarchy for surface water disposal, which encourages a SuDS approach. This hierarchy stipulates that surface water runoff not collected for reuse must be discharged to one or more of the following in order of priority:
- Ground (infiltration); or, where not reasonably practicable,
 - Surface water body; or, where not reasonably practicable,
 - Surface water sewer, highway drain, or another drainage system; or, where not reasonably practicable,
 - Combined sewer.
- 7.2.2. As discussed in Section 2.4 the Application Site is underlain by Bagshot and London Clay Formations.
- 7.2.3. The only relevant impermeable areas associated with the development are formed by a main building (60m²) within the substation perimeter and an ancillary container (30m²), both lying on top of the London Clay Formation. The remaining areas within the perimeter of the substation are formed by granular materials, therefore not contributing to an increase in surface water runoff.
- 7.2.4. There are 6 No. transformers located within the Application Site with individual footprints of 17.5m². No formal drainage will be provided for these transformers due to their small footprint. The conservative approach undertaken for the design of the substation (i.e. providing the full volume for the 1%AEP CC rainfall event) will balance out any increase in run off generated by the transformers.
- 7.2.5. According to Cook & McCuen (2013)¹, modelling showed that the solar panels themselves did not have a significant effect on the runoff volumes, peaks or times to peaks. However, if the ground cover under the panels is gravel or bare ground, owing to design decisions or lack of maintenance, the peak discharge may increase significantly with storm-water management needed. The following surface water drainage strategy therefore assumes that the Application site will remain vegetated during construction and throughout the life of the development.

¹ Hydrologic Response of Solar Farms, Lauren M. Cook, Richard H. McCuen (2013)

- 7.2.6. The area of the Application Site associated with the grid connection has not been considered within this surface water drainage strategy as it is proposed to be made of underground cables and therefore will not influence the risk of surface water flooding.
- 7.2.7. Besides the low natural drainage capacity of soils underlain by the London Clay Formation, BGS borehole records have also shown high groundwater levels in the vicinity of the site – approximately 1.17m BGL. It is therefore believed that infiltration into the ground is not a viable way to manage surface water runoff on its own. This assumption should however be confirmed with site specific ground investigations at the detailed design stage of the project.
- 7.2.8. In line with the drainage hierarchy set out in the Building Regulations, the proposed drainage strategy will seek to discharge attenuated runoff to the local existing network of ditches within the Application Site, while at the same time taking advantage of any small natural infiltration capacity of soils. The relatively small extent of the impermeable areas of the development (90m²) make it however unviable to restrict runoff to pre-development rates by means of standard flow controls (i.e. office plates, hydro-brakes etc.). The philosophy of the current design is therefore to design any attenuation features for the whole runoff volume of the design rainfall event, allowing runoff to slowly infiltrate into the local soils. An overflow pipe located at the downstream section of the swale will allow discharge of any exceedance runoff into the local network of ditches – refer to drawing WSP-70074897-DR-002 in Appendix G for more details.
- 7.2.9. The area associated with the substation main building and ancillary container will be managed by a 3.5m wide and 55m long open swale, with 1 in 3 side slopes and an overall depth not exceeding 500mm. The base of the swale will include check dams along its length to encourage infiltration of runoff into the soil. The overflow linked to the existing ditch 250m to the north of the substation area via a 150mm overflow pipe which in exceedance events will discharge from the swale into the field ditch – refer to drawing WSP-70074897-DR-002 in Appendix G for more details.
- 7.2.10. Runoff generated by the network of access tracks within the Application Site will be managed by self-draining permeable surfaces. Any aggregate layers forming part of the structure of the access tracks should therefore include open graded aggregate mixtures, with low contents of fines, which will allow runoff to reach natural soils.

DESIGN CRITERIA

- 7.2.11. The proposed swale along the perimeter of the substation has been designed for the 1% AEP, 360 minute rainfall event, with a 40% allowance in climate change.
- 7.2.12. The FSR method was adopted to represent the pluvial patterns within the site. However, the overall depth of rainfall depth considered for the design of attenuation features was factored by 1.18 to account for the FEH/FSR ration in the local area.

REQUIRED ATTENUATION VOLUMES

- 7.2.13. The proposed drainage system has been designed to manage events up to the 1% annual probability rainfall event with an additional 40% climate change allowance.
- 7.2.14. The attenuation volume to manage runoff generated within the impermeable areas of the development will be provided by a swale along part of the perimeter of the substation. A total effective volume of 46m³ is provided within the total length of 55m of the swale – refer to drawing WSP-70074897-DR-002 in Appendix G for more details.

EXCEEDANCE FLOW ROUTES

- 7.2.15. The proposed swale associated with drainage of the substation is located to the north of Barkham Ride. Any exceedance flows from the swale will be conveyed, by means of an overflow pipe, to an existing ditch located within the Application Site.

7.3 PROPOSED WATER QUALITY MANAGEMENT

- 7.3.1. Table 26.2 of the CIRIA C753 SuDS Manual identifies that the pollution hazard level associated with the land uses within the development as being 'low', although in reality the Application Site will see very low levels of traffic during the operational phase and as a result see very low levels of pollution.
- 7.3.2. According to Table 26.2 of the CIRIA C753 SuDS Manual, pollution hazard indices of low trafficked roads are estimated as 0.5, 0.4 and 0.4 for TSS, metals and hydro-carbons, respectively.
- 7.3.3. Although relatively low, the source of pollution with the highest pollution risk in the development is considered to be the access tracks. Flows will filter through and be treated by the aggregate layers within the structure of the access tracks themselves. It is however highly encouraged that the vegetation on the site is enhanced and vegetation strips are kept around watercourses/ditches to reduce the extent of pollutants entering these features.
- 7.3.4. Table 26.3 of the CIRIA C753 SuDS Manual shows mitigation indices of 'permeable paving' to be equal or higher than the hazard indices states in 7.3.2. Although permeable paving is not being used in the structure of the access tracks, the aggregate layers within its composition are believed to have the same effect in terms of pollutants removal.
- 7.3.5. Any surface water run off generated within the roofs of the main building and container within the substation is classed to have a pollution hazard level of 'low' with pollution hazard indices of 0.3, 0.2 and 0.05 for metals and hydro-carbons, respectively.
- 7.3.6. Table 26.3 of the CIRIA C753 SuDS Manual shows mitigation indices of 'swales' to be equal or higher than the hazard indices states in 7.3.5.
- 7.3.7. The 5m protection buffer around ditches and watercourses will reduce the impact of any pollution and sedimentation during the construction and operational phase. As described in 2.8, the existing vegetation alongside the majority of the existing conveyance ditches will also prevent debris from increasing the risk of blockage in the features.
- 7.3.8. It is recommended that silt barriers are used during the construction stage to reduce any pollution impacts on the watercourses and ditches. As described in 2.4, soils with high contents of clay are expected to be found on site. Therefore it is also recommended that the site remains vegetated throughout the construction phase to reduce the washout of fine clay particles into existing water features.

7.4 MAINTENANCE AND ADOPTION

- 7.4.1. Regular inspection and maintenance are required to ensure the effective long-term operation of SuDS. These requirements are detailed in the SuDS Manual CIRIA 753.
- 7.4.2. The general maintenance obligations associated with swales are included in Table 17.1 of the SuDS Manual (2015) C753. This includes regular inspections to outlets and inlets, removal of litter and management of vegetation. On top of this, a dedicated regular inspection of the filter material running along the bottom of the swale is advisable.

8 CONCLUSIONS

- 8.1.1. WSP has been appointed by Wokingham Borough Council Development Team to undertake a flood Risk Assessment and full Surface Water Drainage Strategy in support of a 52ha mix of greenfield and brownfield development located 5km to the south west of Wokingham.
- 8.1.2. The Proposed Development consists of solar farm of approximately 47.6ha, with approximately 72,000 solar photovoltaic panels and associated infrastructure, which is proposed to generate energy outputs up to a 32.5MW peak (MWp). Approximately 4.4ha of the Application Site in the south are proposed for tree planting for carbon sequestration, with the remainder being used for landscaping and access tracks. The Proposed Development also plans to incorporate a grid connection route which will be provided underground between the northern site boundary and the point of connection at Wokingham Sub-station.
- 8.1.3. Barkham Brook flows along an Application Site boundary before crossing the site at the western boundary. The brook then flows in a south westerly direction where it becomes classified as an Environment Agency Main River, approximately 160m away.
- 8.1.4. The Environment Agency's published mapping shows that the majority of the Application Site lies within Flood Zone 1 of Barkham Brook, with a small part of the site located within Flood Zone 2 at the northern boundary.
- 8.1.5. The sequential approach has been adopted and nearly all of the development is located within Flood Zone 1, apart from a small number of panels located within Flood Zone 2 at the northern boundary of the site. This is however believed to carry little risk to any developments as the solar panels will be raised to a minimum of 680mm above ground level.
- 8.1.6. The Environment Agency's published mapping shows the majority of the Application Site to be subject to an annual probability of surface water flooding of less than 0.1% and consequently subject to a very low risk of flooding from this source. It is required that levels within the overland flow path crossing the centre of the Application Site are not modified as this may increase flood risk elsewhere.
- 8.1.7. A desktop study has shown soils with little capacity for natural infiltration and high groundwater levels. It is however recommended that site-specific ground investigation testing is undertaken prior at the detailed design stage of the project.
- 8.1.8. The proposed surface water drainage strategy demonstrates the main building and container within the substation can be drained using attenuation SuDS features up to the 1% AEP 40%CC rainfall event, without increasing flood risk to the proposed development and to any downstream existing structures.
- 8.1.9. All other potential sources of flood risk have been considered and are found to range from negligible to low.
- 8.1.10. Based on the findings of this Flood Risk Assessment, the requirements of the National Planning Policy Framework are considered to be met with respect to flooding.



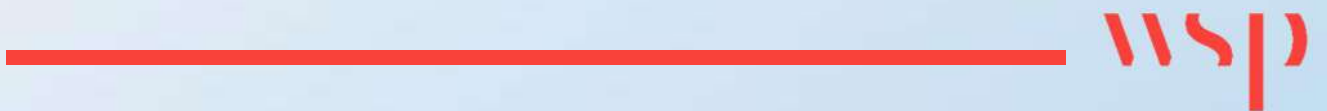
Mountbatten House
Basing View
Basingstoke, Hampshire
RG21 4HJ

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PUBLIC

Appendix D

FLOOD MAP PACK





FLOOD RISK PACK



Client:
Wokingham Borough Council

Project Reference:
70074897 - Barkham Farms Solar Farm

Site Reference:
70074897 - Barkham Farms

Site Location
478383, 165999

Site Area:
53.92 hectares

Map Scale:
1:20000

CONTENTS:

Page 1 - Site Location

Page 2 - Flood Map for Planning

Page 3 - Risk of Flooding from Rivers and the Sea

Page 4 - Risk of Flooding from Surface Water

Page 5 - Risk of Flooding from Reservoirs

Page 6 - Risk of Flooding from Multiple Sources

Page 7 - Historic Flood Map

Page 8 - Source Protection Zones

Page 9 - Aquifer Designation

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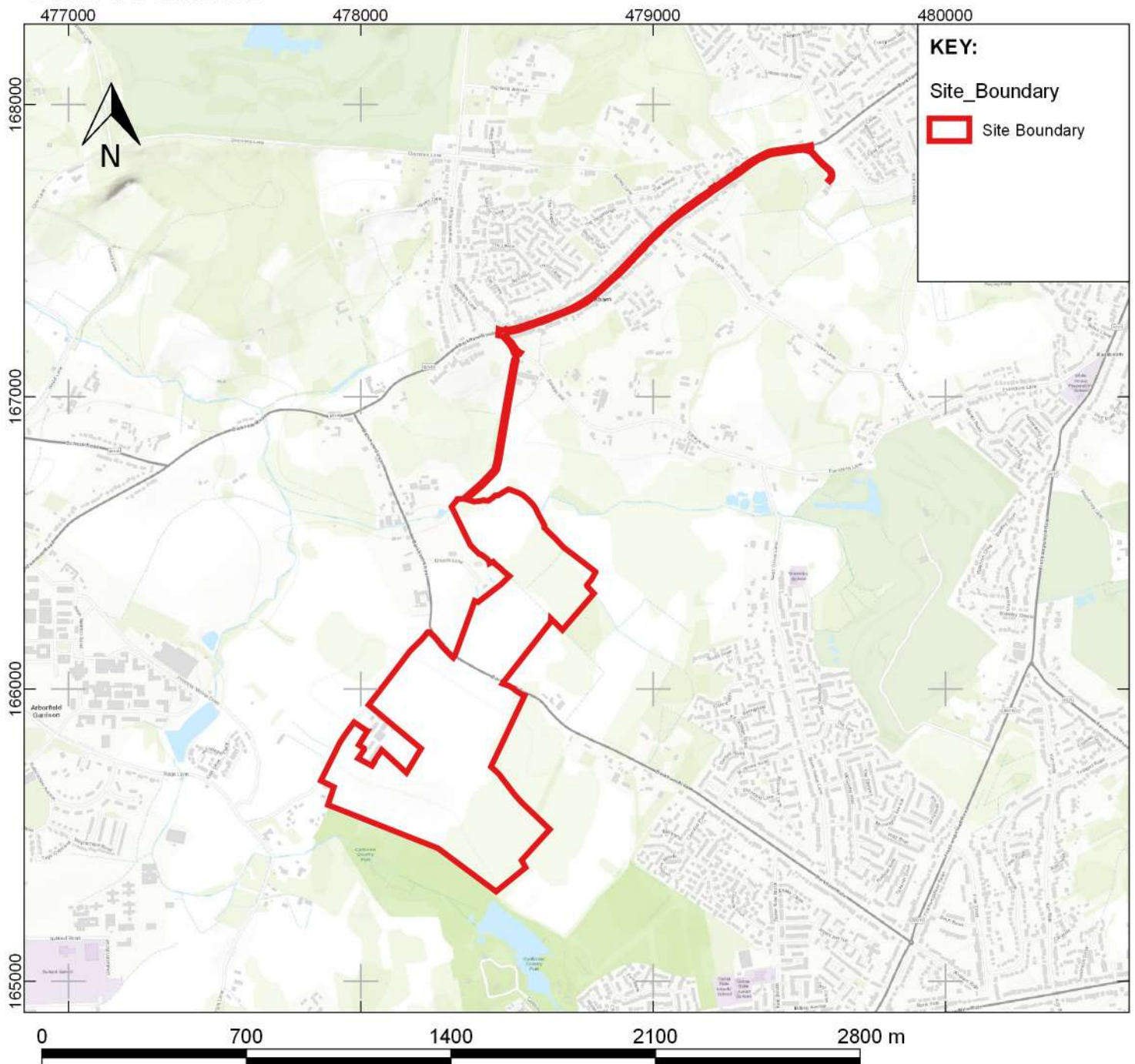
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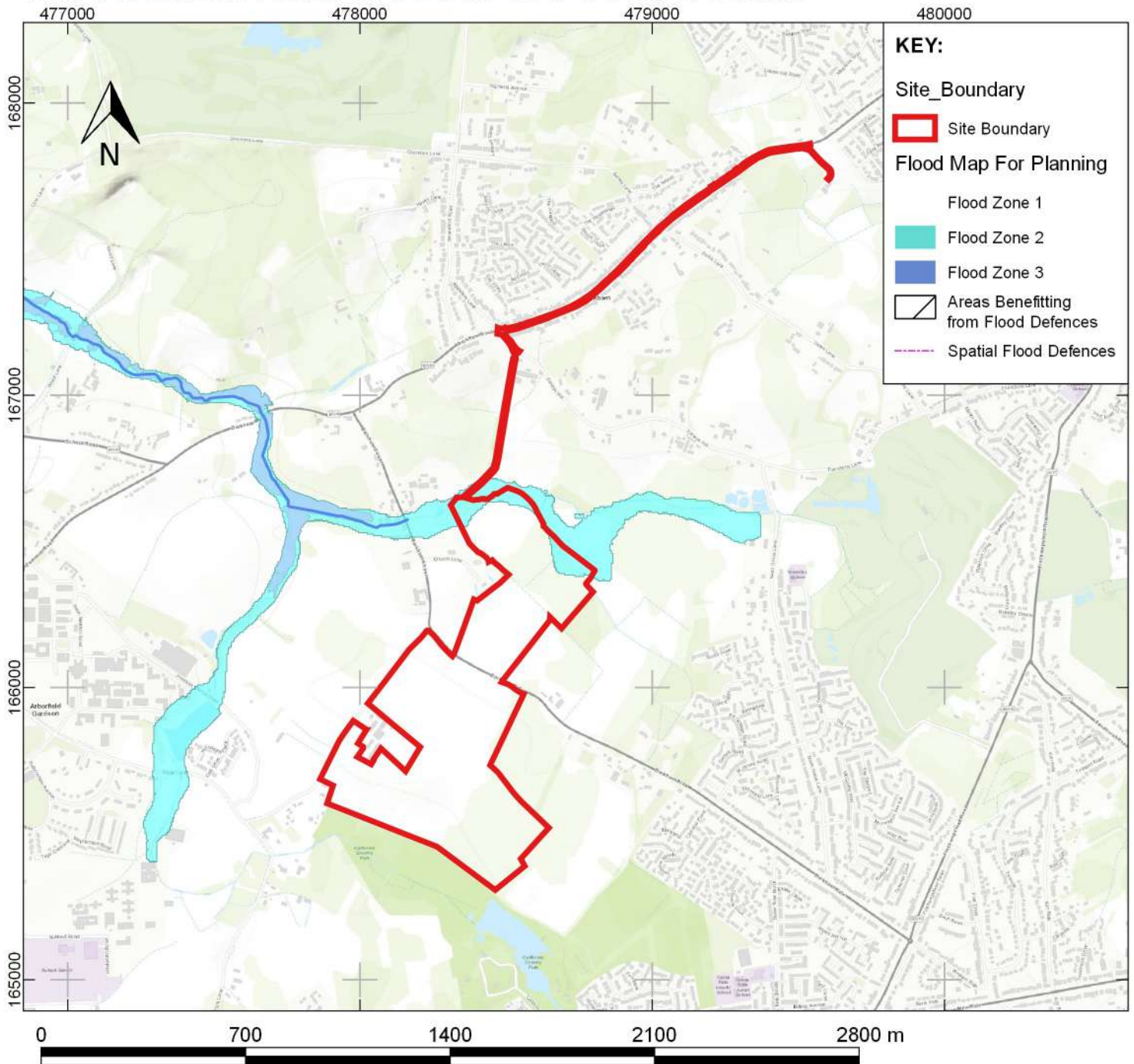
SITE LOCATION



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ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING



Flood zone maps are modelled using local and national river and sea data. This information provides an indication of the likelihood of flooding and is intended for planning use only.

Flood Zone 1 - Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).

Flood Zone 2 - Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)

Flood Zone 3 - Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)

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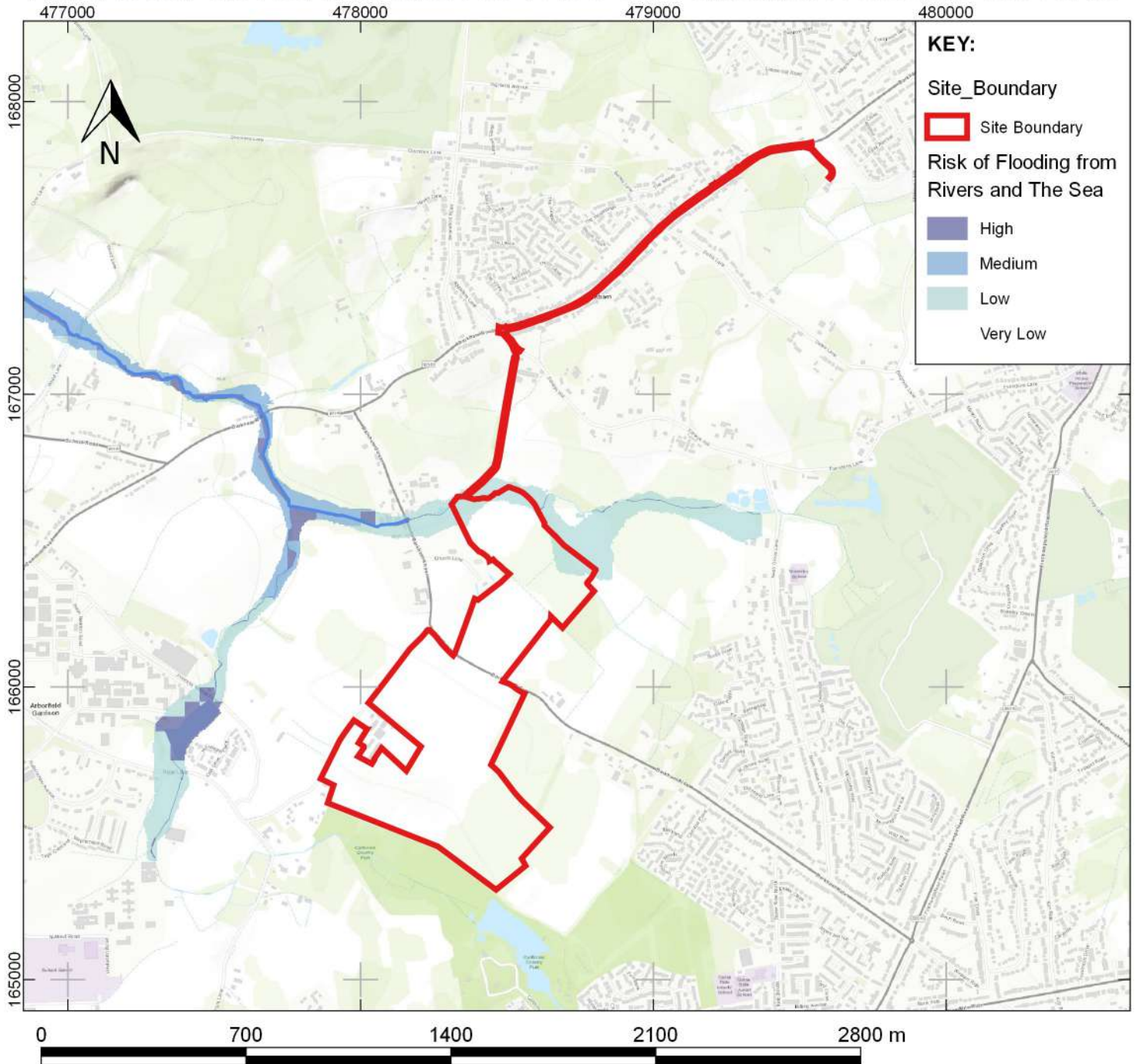
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ENVIRONMENT AGENCY RISK OF FLOODING FROM RIVERS AND THE SEA



High risk means that each year this area has a chance of flooding of greater than 3.3%.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.

Very low risk means that each year this area has a chance of flooding of less than 0.1%.

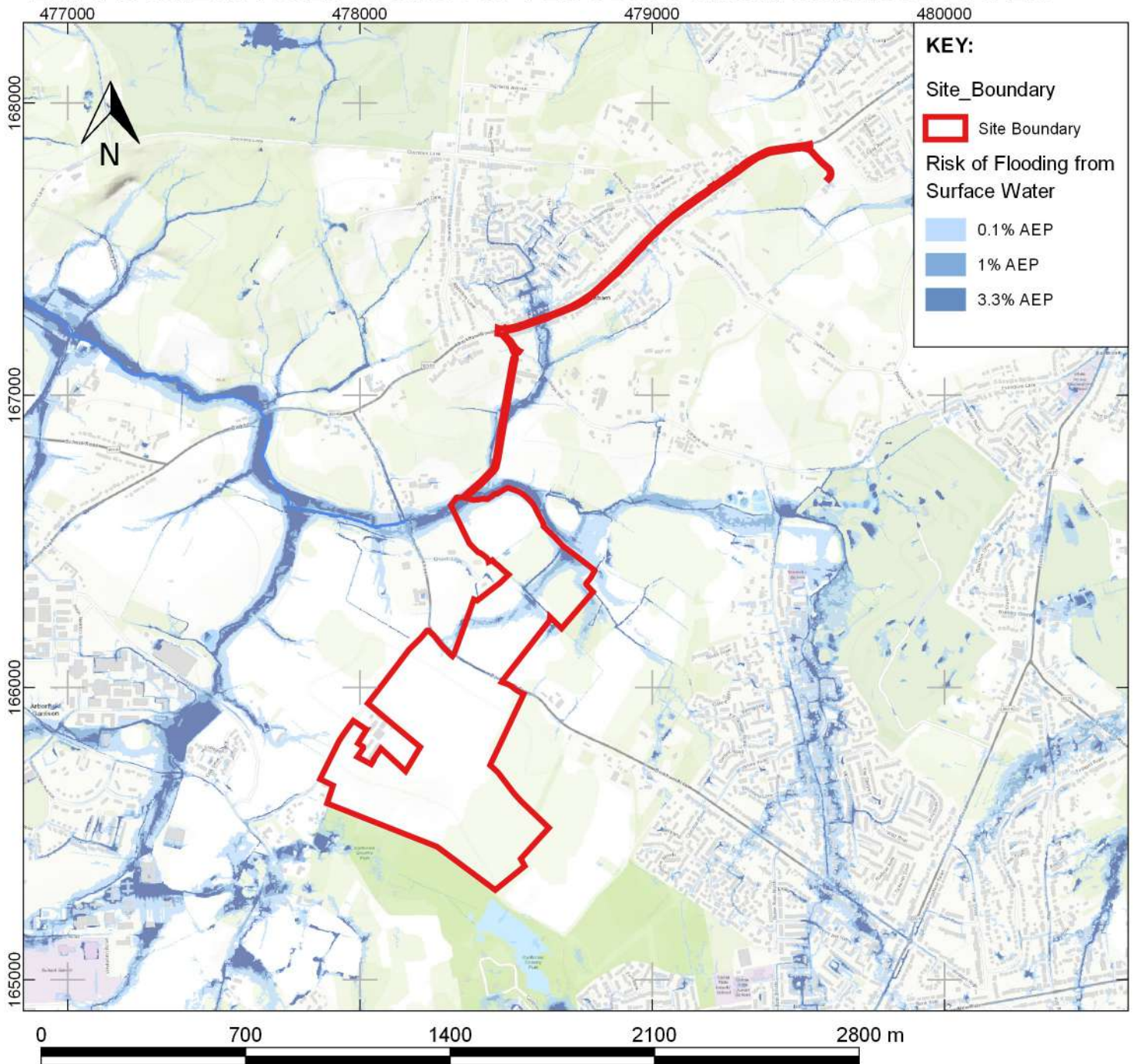
This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

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ENVIRONMENT AGENCY RISK OF FLOODING FROM SURFACE WATER



High risk means that each year this area has a chance of flooding of greater than 3.3%.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.

Very low risk means that each year this area has a chance of flooding of less than 0.1%.

Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

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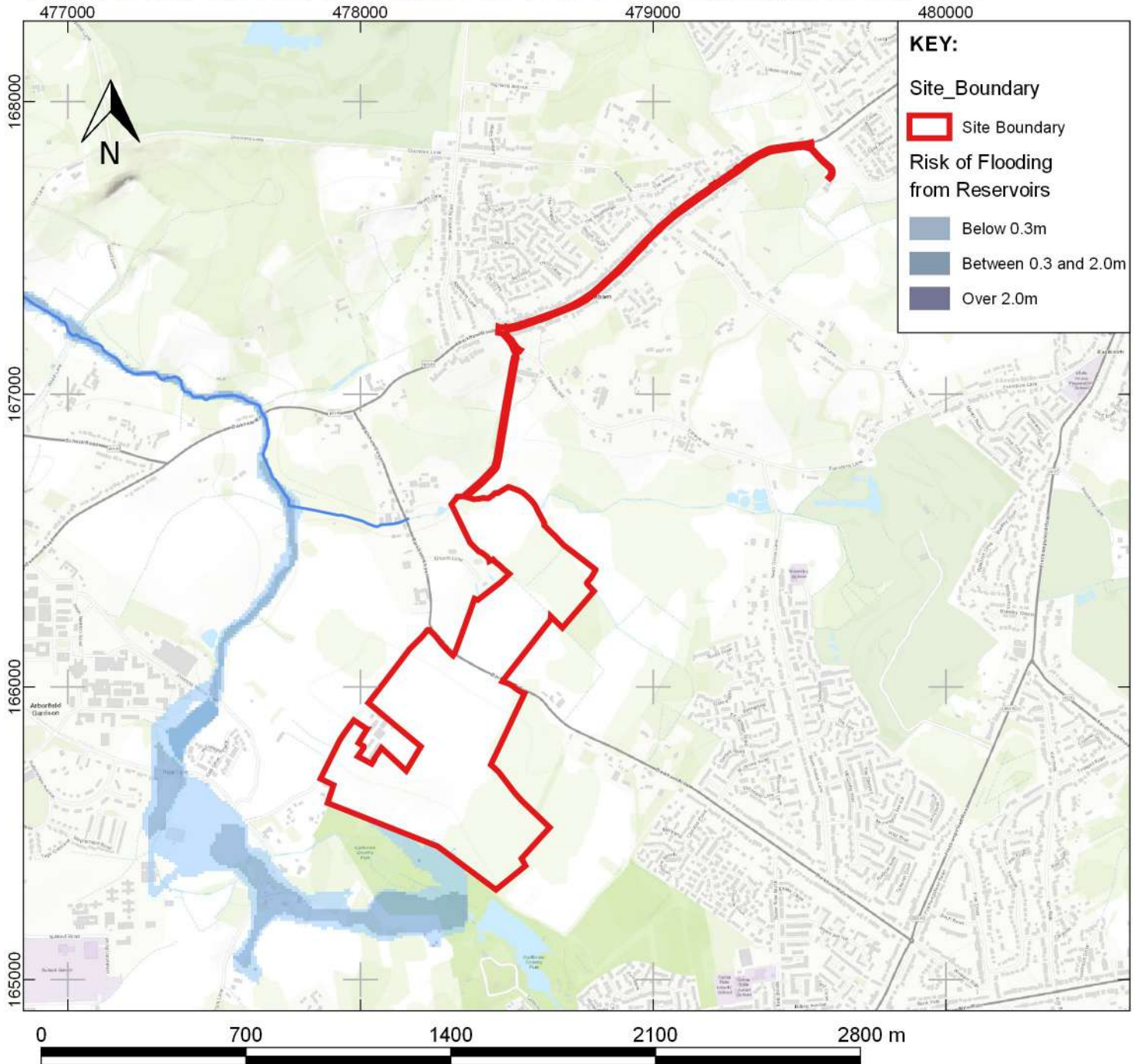
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ENVIRONMENT AGENCY RISK OF FLOODING FROM RESERVOIRS



If a location is at risk, flooding from reservoirs is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925.

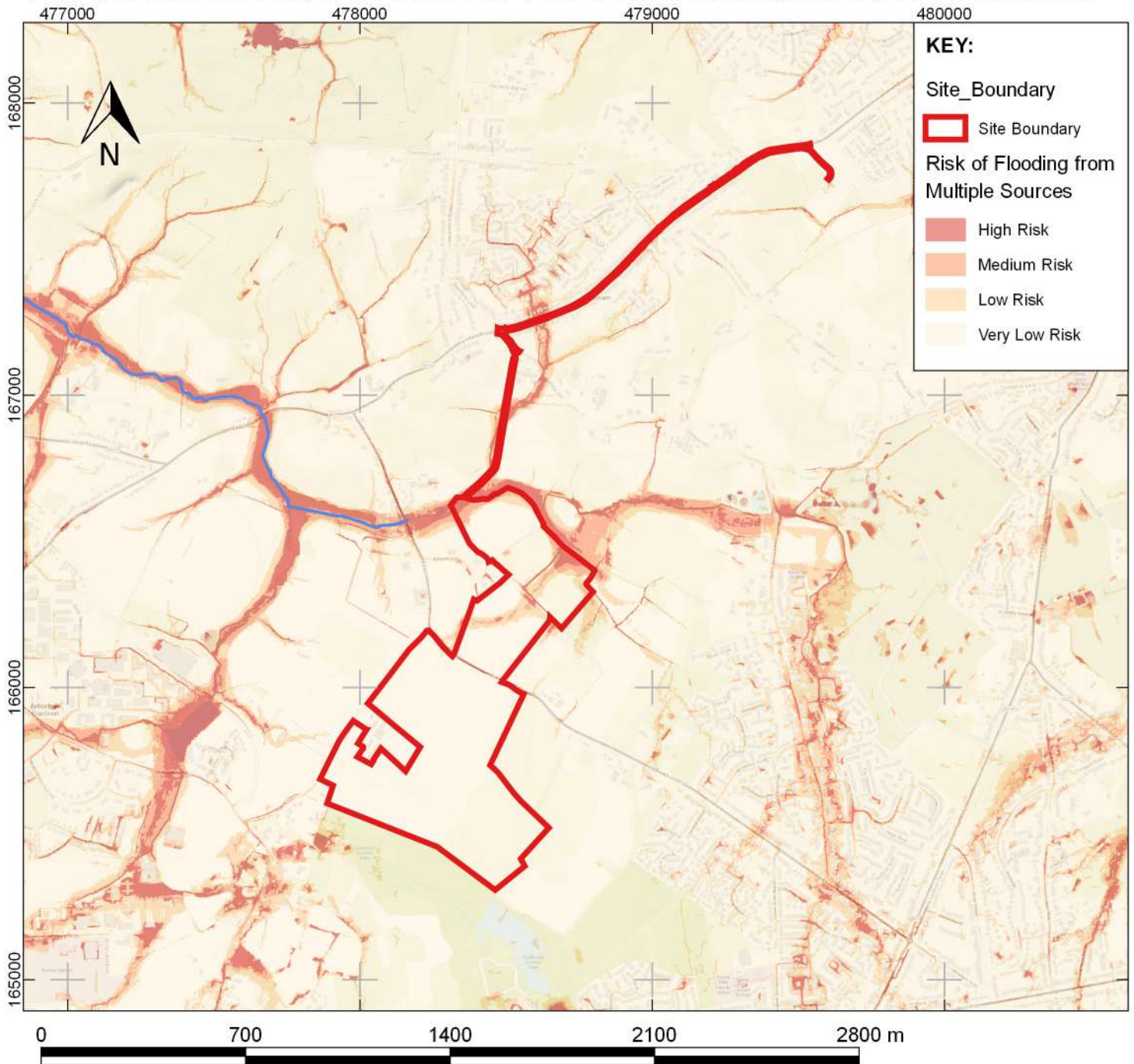
An area is considered at risk if peoples' lives could be threatened by an uncontrolled release of water from a reservoir.

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ENVIRONMENT AGENCY RISK OF FLOODING FROM MULTIPLE SOURCES



High risk means that each year this area has a chance of flooding of greater than 3.3%.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.

Very low risk means that each year this area has a chance of flooding of less than 0.1%.

This dataset is not suitable for identifying whether an individual property will flood. The Risk of Flooding from Multiple Sources (RoFMS) information is a national scale assessment. It gives an indication of what areas of land may be at risk of flooding from more than one source. This first version of the assessment considers flooding from rivers, the sea and surface water.

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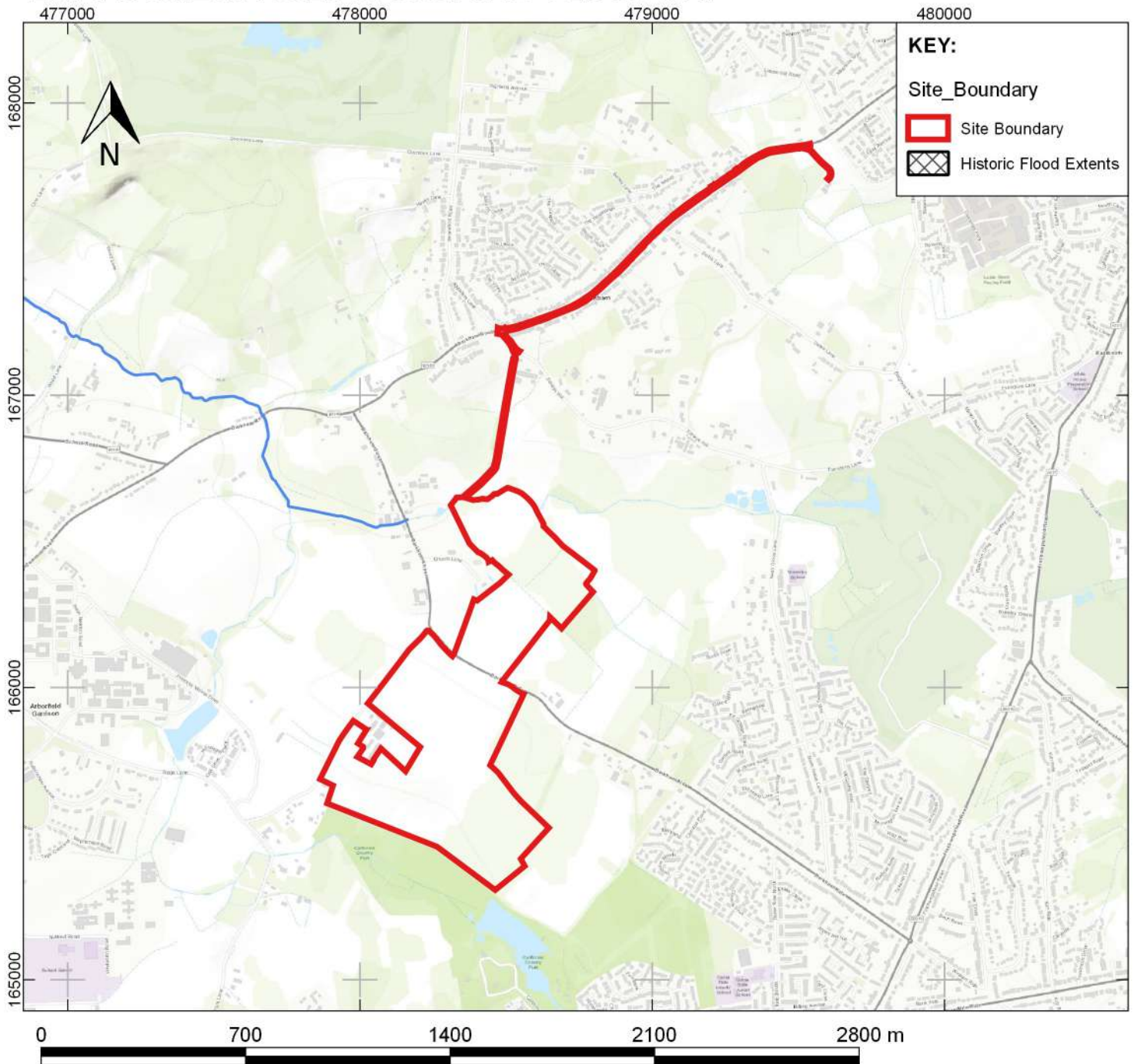
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ENVIRONMENT AGENCY HISTORIC FLOOD MAP



The Historic Flood Map is a GIS layer showing the maximum extent of all individual Recorded Flood Outlines from river, the sea and groundwater springs and shows areas of land that have previously been subject to flooding in England. Records began in 1946 when predecessor bodies to the Environment Agency started collecting detailed information about flooding incidents, although limited details may be held about flooding incidents prior to this date.

The absence of coverage by the Historic Flood Map for an area does not mean that the area has never flooded, only that we do not currently have records of flooding in this area. It is also possible that the pattern of flooding in this area has changed and that this area would now flood under different circumstances. The Historic Flood Map will take into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding. It will include flood extents that may have been affected by overtopping, breaches or blockages. Flooding shown to the land and does not necessarily indicate that properties were flooded internally.

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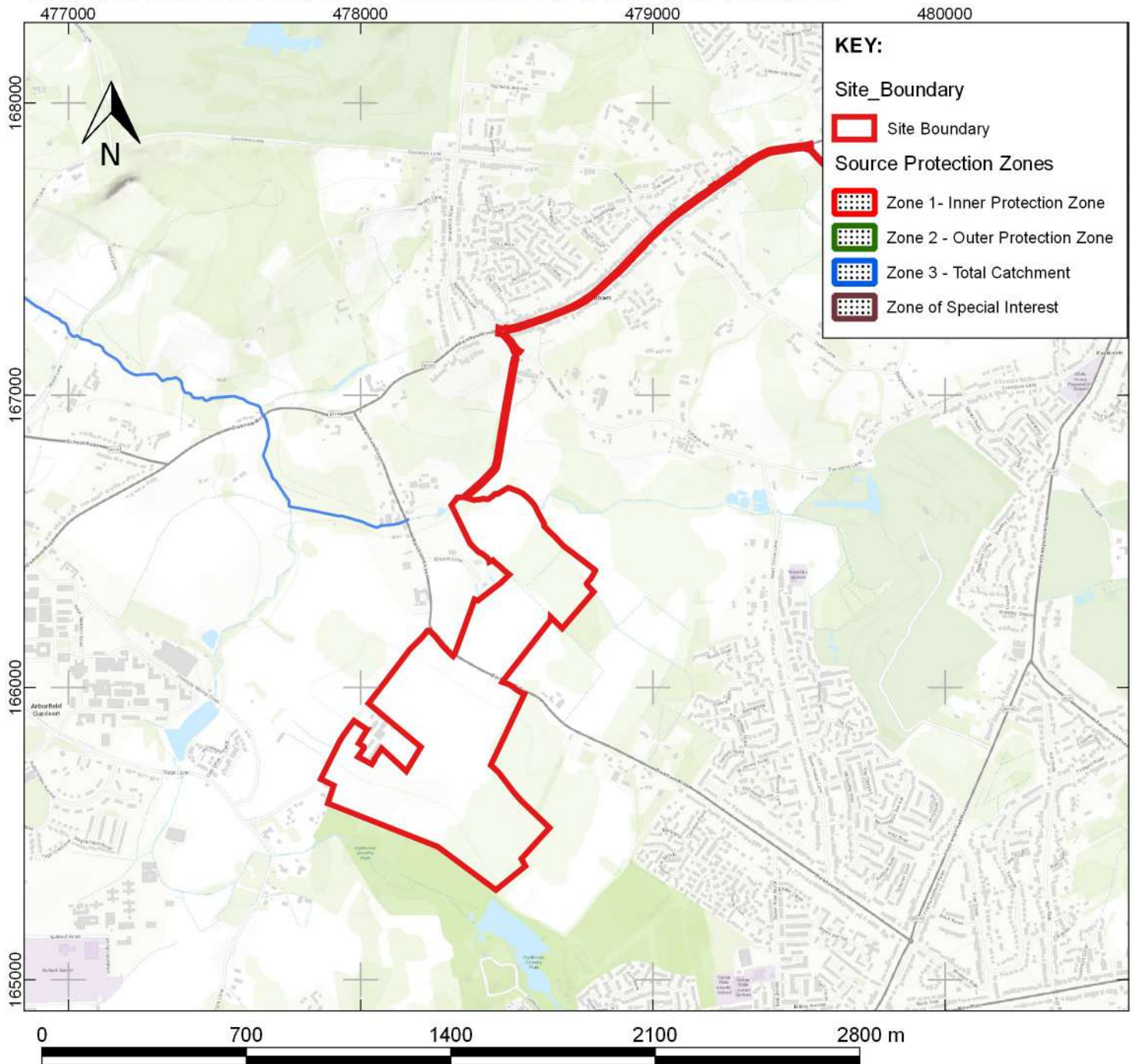
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Registered in England and Wales No. 01383511

ENVIRONMENT AGENCY SOURCE PROTECTION ZONES



Inner zone (Zone 1) - Defined as the 50 day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres;

Outer zone (Zone 2) - Defined by a 400 day travel time from a point below the water table. The previous methodology gave an option to define SPZ2 as the minimum recharge area required to support 25 per cent of the protected yield. This option is no longer available in defining new SPZs and instead this zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction;

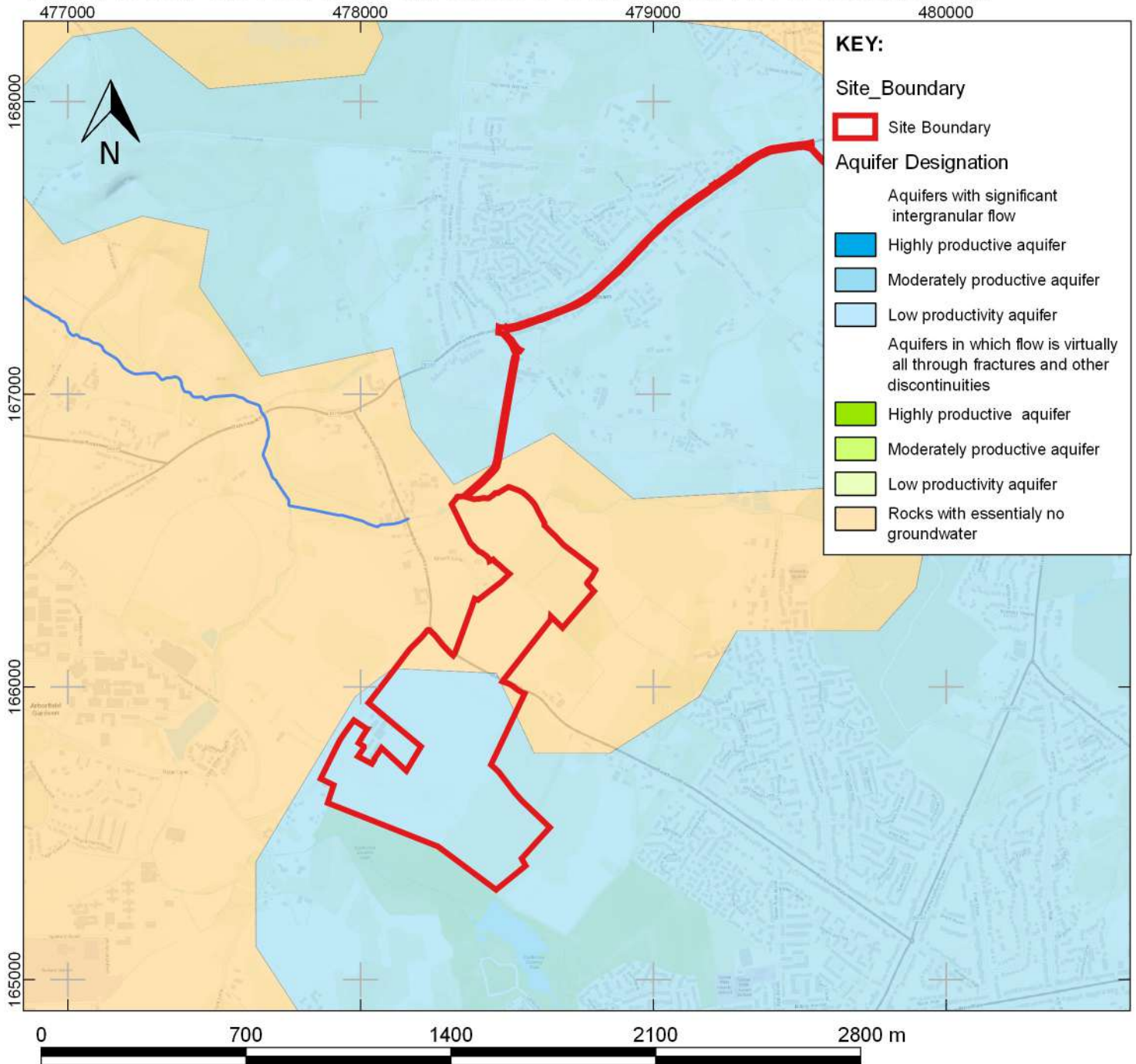
Total catchment (Zone 3) - Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.

Special interest (Zone 4) - A fourth zone SPZ4 or 'Zone of Special Interest' was previously defined for some sources. SPZ4 usually represented a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream).

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ENVIRONMENT AGENCY 1:625,000 SCALE AQUIFER DESIGNATION



The hydrogeological map indicates aquifer potential in generalised terms using a threefold division of geological formations:

1. those in which intergranular flow in the saturated zone is dominant
2. those in which flow is controlled by fissures or discontinuities
3. less permeable formations including aquifers concealed at depth beneath covering layers

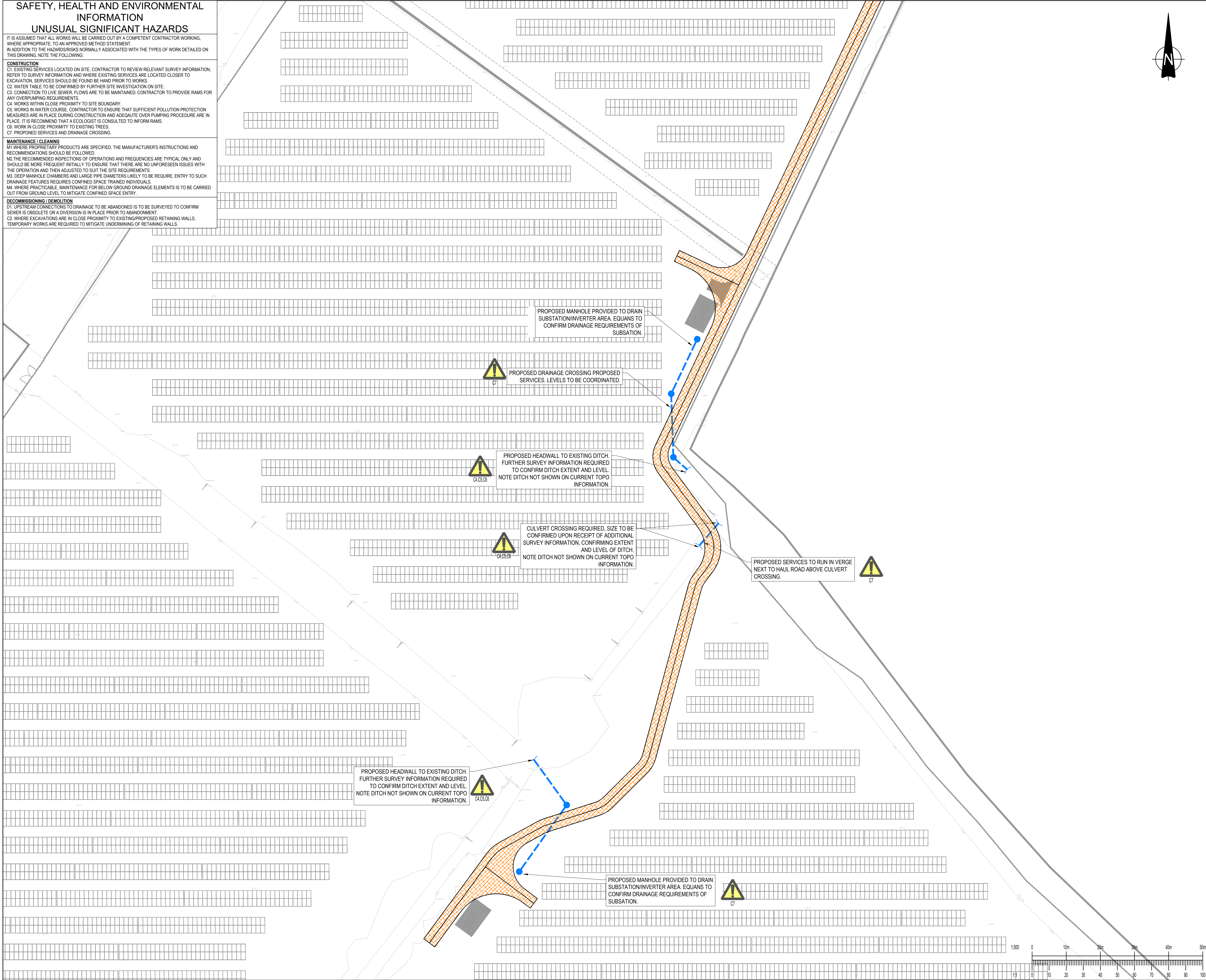
Highly productive aquifers are distinguished from those that are only of local importance or have no significant groundwater. Within each of these classes the strata are grouped together according to age or lithology.

The 1:625 000 scale data may be used as a guide to the aquifers at a regional or national level, but should not be relied on for local information.

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E – Proposed Drainage General Arrangement Drawings



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

UNUSUAL SIGNIFICANT HAZARDS

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT. IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

CONSTRUCTION

C1. EXISTING SERVICES LOCATED ON SITE. CONTRACTOR TO REVIEW RELEVANT SURVEY INFORMATION. REFER TO SURVEY INFORMATION AND WHERE EXISTING SERVICES ARE LOCATED CLOSER TO EXCAVATION. SERVICES SHOULD BE FOUND BE HAND PRIOR TO WORKS.

C2. WATER TABLE TO BE CONFIRMED BY FURTHER SITE INVESTIGATION ON SITE.

C3. CONNECTION TO LIVE SEWER. FLOWS ARE TO BE MAINTAINED; CONTRACTOR TO PROVIDE RAMS FOR ANY OVERPUMPING REQUIREMENTS.

C4. WORKS WITHIN CLOSE PROXIMITY TO SITE BOUNDARY.

C5. WORKS IN WATER COURSE. CONTRACTOR TO ENSURE THAT SUFFICIENT POLLUTION PROTECTION MEASURES ARE IN PLACE DURING CONSTRUCTION AND ADEQUATE OVER PUMPING PROCEDURE ARE IN PLACE. IT IS RECOMMEND THAT A ECOLOGIST IS CONSULTED TO INFORM RAMS.

C6. WORK IN CLOSE PROXIMITY TO EXISTING TREES.

C7. PROPOSED SERVICES AND DRAINAGE CROSSING.

MAINTENANCE / CLEANING

M1. WHERE PROPRIETARY PRODUCTS ARE SPECIFIED, THE MANUFACTURERS INSTRUCTIONS AND RECOMMENDATIONS SHOULD BE FOLLOWED.

M2. THE RECOMMENDED INSPECTIONS OF OPERATIONS AND FREQUENCIES ARE TYPICAL ONLY AND SHOULD BE MORE FREQUENT INITIALLY TO ENSURE THAT THERE ARE NO UNFORESEEN ISSUES WITH THE OPERATION AND THEN ADJUSTED TO SUIT THE SITE REQUIREMENTS.

M3. DEEP MANHOLE CHAMBERS AND LARGE PIPE DIAMETERS LIKELY TO BE REQUIRE. ENTRY TO SUCH DRAINAGE FEATURES REQUIRES CONFINED SPACE TRAINED INDIVIDUALS.

M4. WHERE PRACTICABLE, MAINTENANCE FOR BELOW GROUND DRAINAGE ELEMENTS IS TO BE CARRIED OUT FROM GROUND LEVEL TO MITIGATE CONFINED SPACE ENTRY.

DECOMMISSIONING / DEMOLITION

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C2. WHERE EXCAVATIONS ARE IN CLOSE PROXIMITY TO EXISTING/PROPOSED RETAINING WALLS, TEMPORARY WORKS ARE REQUIRED TO MITIGATE UNDERMINING OF RETAINING WALLS.

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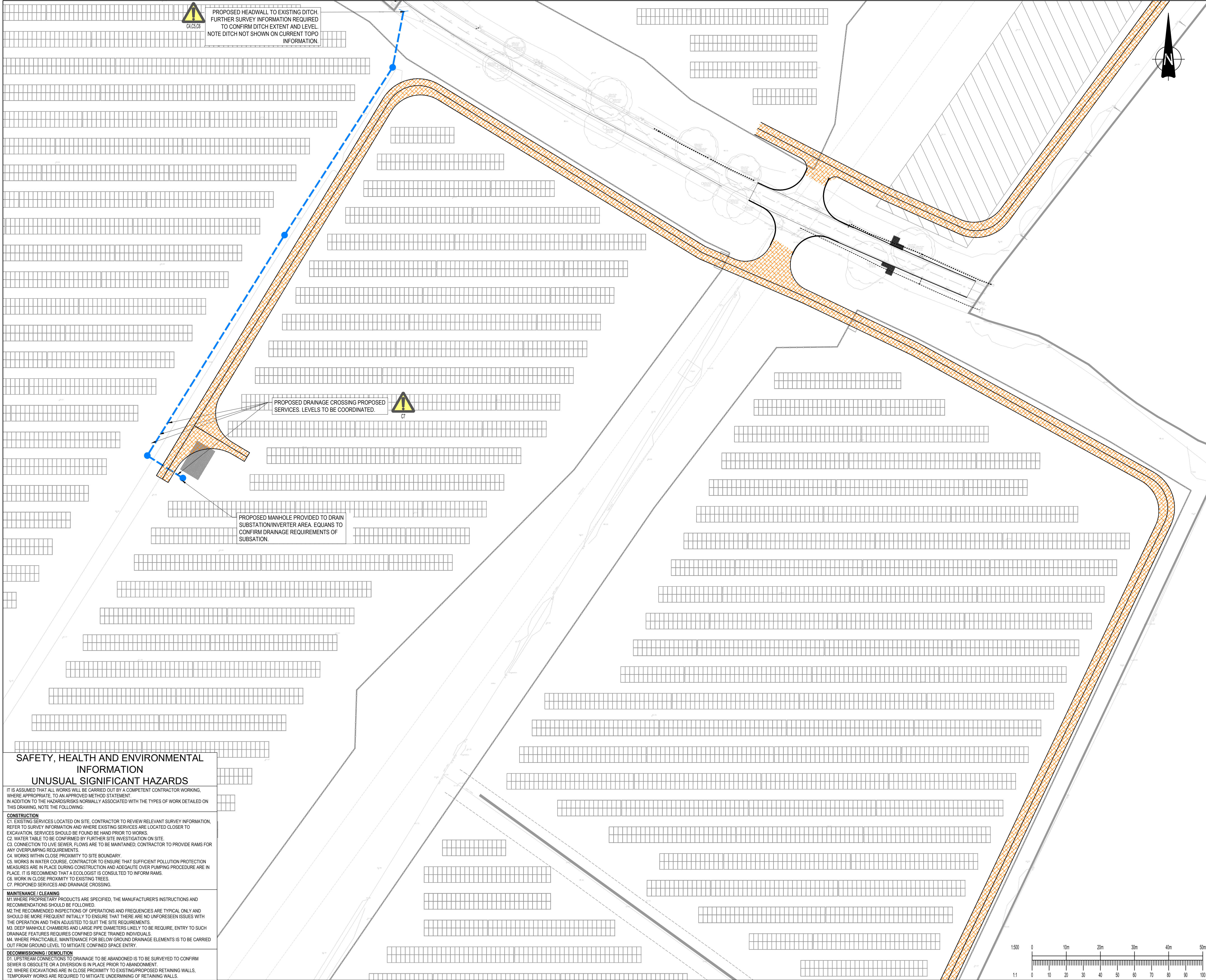
DESIGN RISKS

- HEADWALL LOCATIONS SUBJECT TO APPROVAL OF OWCS.
- HAUL ROADS ASSUMED TO DRAIN VIA GRAVEL BUILD UP AS PER WSP APPROVED DRAINAGE STRATEGY, BRE INFILTRATION TESTING YIELDED LIMITED INFILTRATION AS SUCH RISK OF LLFA REQUESTING TRADITIONAL PIPED NETWORK.
- REVISED HAUL ROAD ALIGNMENTS SUBJECT TO ACCEPTANCES FROM DESIGN TEAM.
- NO LEVEL INFORMATION DITCHES PROVIDED ON TOPO, DOSING SUBJECT TO CHANGE UNTIL DITCH LEVELS CONFINED.

LEGEND

- PROPOSED SW DRAIN
- PROPOSED SW MANHOLE
- PROPOSED HEADWALL
- PROPOSED PERMEABLE HAUL ROAD

P01	WIP ISSUE	13/09/24	EB	MM	
Rev:	Description:	Date:	By:	Chkd:	
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Status:	WORK IN PROGRESS			S0	
Project:	BARKHAM SOLAR FARM				
Orig Title:	PROPOSED DRAINAGE GENERAL ARRAIGNMENT - SHEET 1				
Drawn By	EB	Designed By	MM	Checked By	MM
		Date	13/09/24	Scales @ A1	1:500
Project No - Originator - Function - Spatial - Form - Discipline - Number					Revision
BFSF -CURT- XX - DR - C - 9290					P01



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

UNUSUAL SIGNIFICANT HAZARDS

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C4. WORKS WITHIN CLOSE PROXIMITY TO SITE BOUNDARY.

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C7. PROPNED SERVICES AND DRAINAGE CROSSING.

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- TOPOGRAPHICAL SURVEY RECEIVED FROM EQUANS.. DRAWING REF 230633-CAT-XX-XX-M3-G-00001

DESIGN RISKS

- HEADWALL LOCATIONS SUBJECT TO APPROVAL OF OWCS.
- HAUL ROADS ASSUMED TO DRAIN VIA GRAVEL BUILD UP AS PER WSP APPROVED DRAINAGE STRATEGY, BRE INFILTRATION TESTING YIELDED LIMITED INFILTRATION AS SUCH RISK OF LLFA REQUESTING TRADITIONAL PIPED NETWORK.
- REVISED HAUL ROAD ALIGNMENTS SUBJECT TO ACCEPTANCES FROM DESIGN TEAM.
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LEGEND

- PROPOSED SW DRAIN
- PROPOSED SW MANHOLE
- PROPOSED HEADWALL
- PROPOSED PERMEABLE HAUL ROAD

P01	WIP ISSUE	13/09/24	EB	MM
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Status:

WORK IN PROGRESS

S0

Project:

BARKHAM SOLAR FARM

Dwg Title:

PROPOSED DRAINAGE
GENERAL ARRAIGNMENT -
SHEET 2

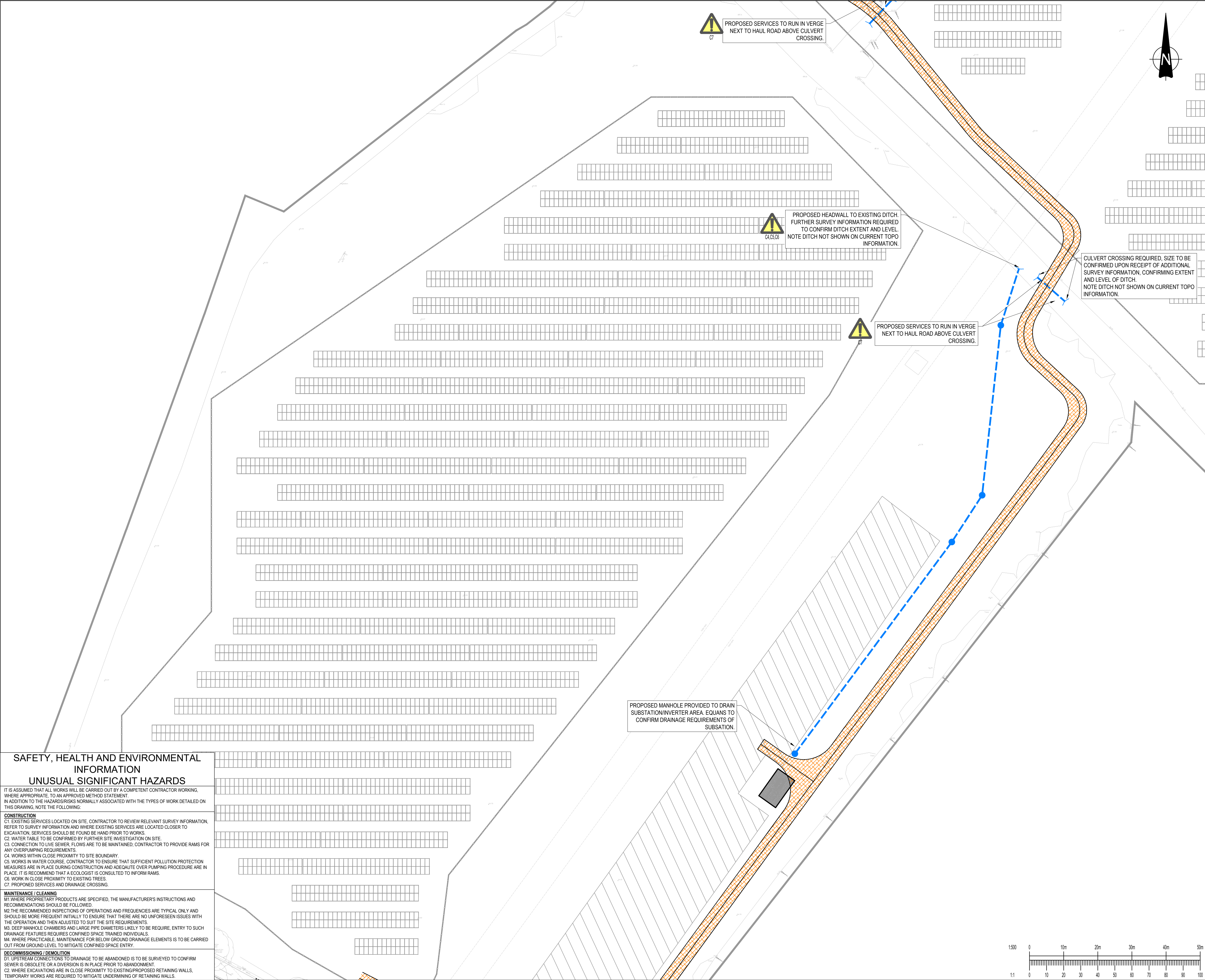
Drawn By	Designed By	Checked By
EB	MM	MM
	Date	Scales @ A1
	13/09/24	1:500

Project No - Originator - Function - Spatial - Form - Discipline - Number

BFSF -CURT- XX - DR - C - 9201

Revision

P01



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LEGEND

---●---

PROPOSED SW DRAIN

---●---

PROPOSED SW MANHOLE

PROPOSED HEADWALL

PROPOSED PERMEABLE HAUL ROAD

P01	WIP ISSUE	13/09/24	EB	MM	
Rev:	Description:	Date:	By:	Chkd:	
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Status:	WORK IN PROGRESS			S0	
Project:	BARKHAM SOLAR FARM				
Dwg Title:	PROPOSED DRAINAGE GENERAL ARRAIGNMENT - SHEET 3				
Drawn By	EB	Designed By	MM	Checked By	MM
		Date	13/09/24	Scales @ A1	
		1:500			
Project No - Originator - Function - Spatial - Form - Discipline - Number					Revision
BFSF -CURT- XX - DR - C - 9292					P01

SAFETY, HEALTH AND ENVIRONMENTAL
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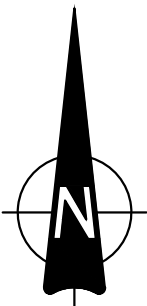
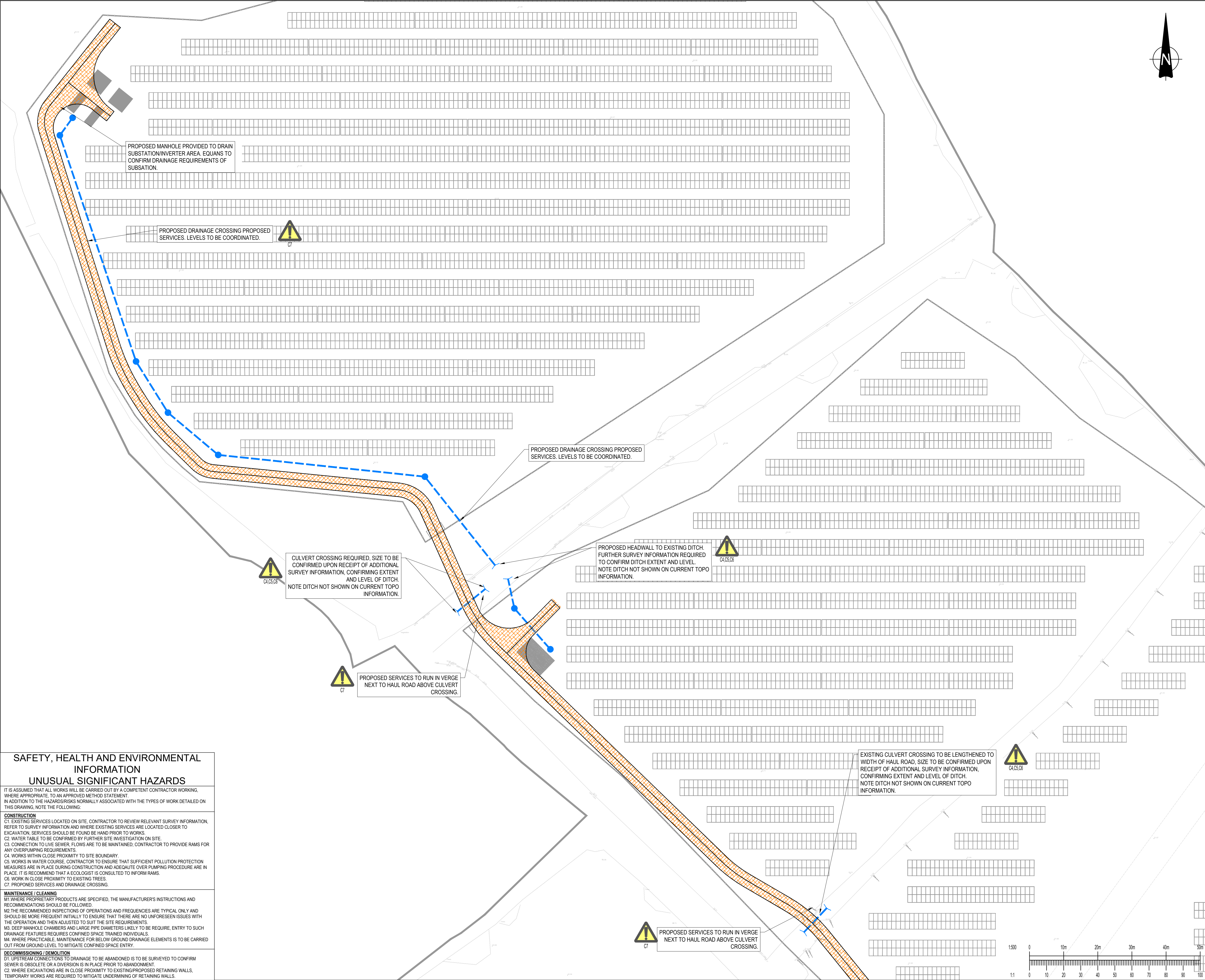
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- HEADWALL LOCATIONS SUBJECT TO APPROVAL OF OWCS.
- HAUL ROADS ASSUMED TO DRAIN VIA GRAVEL BUILD UP AS PER WSP APPROVED DRAINAGE STRATEGY. BRE INFILTRATION TESTING YIELDED LIMITED INFILTRATION AS SUCH RISK OF LLFA REQUESTING TRADITIONAL PIPED NETWORK.
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LEGEND

- PROPOSED SW DRAIN
- PROPOSED SW MANHOLE
- PROPOSED HEADWALL
- PROPOSED PERMEABLE HAUL ROAD

SAFETY, HEALTH AND ENVIRONMENTAL
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EXISTING CULVERT CROSSING TO BE LENGTHENED TO WIDTH OF HAUL ROAD, SIZE TO BE CONFIRMED UPON RECEIPT OF ADDITIONAL SURVEY INFORMATION, CONFIRMING EXTENT AND LEVEL OF DITCH. NOTE DITCH NOT SHOWN ON CURRENT TOPO INFORMATION.

PROPOSED SERVICES TO RUN IN VERGE NEXT TO HAUL ROAD ABOVE CULVERT CROSSING.

PROPOSED SERVICES TO RUN IN VERGE NEXT TO HAUL ROAD ABOVE CULVERT CROSSING.

CULVERT CROSSING REQUIRED. SIZE TO BE CONFIRMED UPON RECEIPT OF ADDITIONAL SURVEY INFORMATION, CONFIRMING EXTENT AND LEVEL OF DITCH. NOTE DITCH NOT SHOWN ON CURRENT TOPO INFORMATION.

PROPOSED DRAINAGE CROSSING PROPOSED SERVICES. LEVELS TO BE COORDINATED.

PROPOSED DRAINAGE CROSSING PROPOSED SERVICES. LEVELS TO BE COORDINATED.

PROPOSED MANHOLE PROVIDED TO DRAIN SUBSTATION/INVERTER AREA. EQUANS TO CONFIRM DRAINAGE REQUIREMENTS OF SUBSATION.

P01	WIP ISSUE	13/09/24	EB	MM
Rev:	Description:	Date:	By:	Chkd:

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Status: **WORK IN PROGRESS** **S0**

Project: **BARKHAM SOLAR FARM**

Orig Title: **PROPOSED DRAINAGE
GENERAL ARRAIGNMENT -
SHEET 4**

Drawn By EB	Designed By MM	Checked By MM
Date 13/09/24	Scales @ A1 1:500	Revision

Project No -	Originator -	Function -	Spatial -	Form -	Discipline -	Number	Revision
BFSF	-CURT-XX-DR-C	-9293					P01

F – Operations and Maintenance Manual

Barkham Solar Farm

DRAINAGE OPERATIONS AND MAINTENANCE MANUAL

Curtins Ref: BFSF-CURT-XX-RP-C-9202

Revision: P01

Issue Date: 27 September 2024

Rev	Description	Issued by	Checked	Date
P01	Preliminary Issue	CRR	MS	27.09.2024

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Author	Signature	Date
Charlie Ryder Richardson BEng (Hons) Civil Engineer		27/09/2024

Reviewed	Signature	Date
Michael Smith Meng (Hons) CEng MICE Associate		27/09/2024