Planning Inspectorate Reference: EN010151

Appendix 11.1 Flood Risk Assessment

[Document Reference: ST19595-REP-002]

January 2024

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(q)

Revision History

Revision	Revision date	Details	Authorised	Name	Position
Draft	October 2023				
Final	January 2024				

List of Outstanding Issues and Information

Outstanding issue/info.	Section/Paragraph	Responsibility	Action

Table of Contents

Figures

Tables

Appendices

1. INTRODUCTION

1.1 General

1.1.1 This Flood Risk Assessment (FRA) Report forms a Technical Appendix to the Preliminary Environmental Information Report (PEIR) Chapter 11 (Water Resources and Flood Risk) and covers the construction, operation and maintenance and decommissioning of a proposed renewable energy generating project, incorporating ground-mounted solar photovoltaic (PV) arrays and an onsite battery energy storage system (BESS), with associated infrastructure and cable connection to the existing Bicker Fen Substation.

1.1.2 The FRA will be updated in due course to accompany the Environmental Statement (ES) that is to be submitted as part of the Development Consent Order (DCO) application for the Proposed Development.

1.1.3 The FRA has been carried out in accordance with guidance set out in the following:

- National Planning Policy Framework (NPPF), September 2023;
- Planning Practice Guidance (PPG): Flood Risk and Coastal Change, August 2023;
- Planning Practice Guidance (PPG): Water supply, wastewater and water quality, July 2019;
- Overarching National Policy Statement for Energy (EN-1), March 2023[1];
- National Policy Statement for Renewable Energy Infrastructure (EN-3), March 2023[2];
- National Policy Statement for Electricity Networks Infrastructure (EN5), March 2023[3];
- Central Lincolnshire Local Plan 2018 to 2040, adopted in April 2023:
  - Policy S21: Flood Risk and Water Resources; and
  - Policy S56: Development on Land Affected by Contamination Development.
- South East Lincolnshire Local Plan 2011-2036, adopted March 2019:
  - Policy 3: Design of New Development; and
  - Policy 4: Approach to Flood Risk.

[1] Available: https://assets.publishing.service.gov.uk/media/64252f3b60a35e00120cb158/NPS_EN-1.pdf Accessed December 2023
[2] Available: https://assets.publishing.service.gov.uk/media/64252f5f2fa848000cec0f52/NPS_EN-3.pdf Accessed December 2023
[3] Available: https://assets.publishing.service.gov.uk/media/64252f852fa848000cec0f53/NPS_EN-5.pdf Accessed December 2023

1.2 Methodology

1.2.1 The methodology for this FRA has comprised a desktop study and review of site information, and relevant local and national planning policy documents.

1.2.2 For the purposes of this FRA Report, three terminologies will be used:

- Proposed Development/the Site: all areas of the development including the PV solar panels, substation, associated infrastructure and the route of the cable connection to the Bicker Fen Substation;
- Solar Array Area: the main site area comprising the solar panels, substation and associated infrastructure (excluding the cable route); and
- Cable Route Corridor: the route of the cable connecting the Solar Array Area to the Bicker Fen Substation. This assessment assumes that the cable will be below ground as an above ground cable would have no impact on flood risk.
- Access Road: the proposed access track, approximately 3.5km in length extending between the western site boundary and Sleaford Road (A14).

1.2.3 It should be noted that, at the time of writing, the exact route of the cable has yet to be finalised and will be confirmed as part of future works. At this stage, the term Cable Route Corridor, therefore, refers to the redline boundary of the route.

1.2.4 Reference has been made to relevant plans and documents, including:

- Lincolnshire County Council (2011) Preliminary Flood Risk Assessment[4];
- Lincolnshire County Council (2017) Preliminary Flood Risk Assessment Addendum;
- North Kesteven District Council (2009) Strategic Flood Risk Assessment ('SFRA')[5];
- Central Lincolnshire (2015) Strategic Flood Risk Assessment[6]; and
- Central Lincolnshire (2015) Strategic Flood Risk Assessment[7].

[4]Available:https://www.lincolnshire.gov.uk/downloads/file/4382/preliminary-flood-risk-assessment-report Accessed: April 2023.
[5]Available:https://www.n-kesteven.gov.uk/sites/default/files/2023-01/Strategic%20Flood%20Risk%20Assessment%20Report.pdf Accessed: April 2023.
[6]Available:https://www.n-kesteven.gov.uk/central-lincolnshire/planning-policy-library Accessed September 2023.
[7]Available:https://www.n-kesteven.gov.uk/central-lincolnshire/planning-policy-library Accessed September 2023.

2. FLOOD RISK AND PLANNING POLICY

2.1 National Policy Statement for Energy

2.1.1 The 2023 NPS for Energy (EN-1) sets out the national planning policy for Nationally Significant Infrastructure Projects (NSIPs), specifically energy infrastructure. Section 5.8 of NPS EN-1 refers to flood risk, with paragraph 5.7.4 outlining the need for an FRA. This FRA has been produced in accordance with paragraph 5.8.15 which lists the minimum requirements of the FRA.

2.1.2 NPS EN-3 (2011) covers 'significant onshore renewable energy infrastructure projects' and the latest version of NPS EN-3 (2023) specifically addresses solar PV generation. Paragraphs 3.10.75-3.10.79 of NPS EN-3 (2023) refer to the impact of drainage within solar developments.

2.2 National Planning Policy

2.2.1 The National Planning Policy Framework[8] and the accompanying Planning Practice Guidance[9] ('PPG') The NPPF and PPG aim to ensure that flood risk is taken into consideration at all stages of the planning process and advocates the use of a risk-based 'Sequential Test' to preferentially locate development in areas with a low risk of flooding. Where development is necessary in high risk areas, the NPPF aims to ensure that the development is safe without increasing flood risk through the application of the Exception Test.

2.2.2 The PPG defines the levels of flood risk within England as follows.

- Flood Zone 1 - Low Probability - Land having less than a 1 in 1,000 annual probability of river or sea flooding;
- Flood Zone 2 - Medium Probability - Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding;
- Flood Zone 3a - High Probability - Land having a 1 in 100 or greater annual probability of river flooding; or having a 1 in 200 or greater annual probability of sea flooding; and
- Flood Zone 3b - Functional Floodplain - Land where water has to flow or be stored in times of flood.

2.2.3 The PPG states that a site-specific FRA is required for all new development proposals located within Flood Zones 2 and 3, areas risk of flooding from sources other than river/tidal sources and for any proposal of 1 hectare (ha) or greater regardless of its flood zone classification. This is as stated in paragraph 5.8.13 of NPS EN-1. The flood zones as described above are

[8] Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 Accessed September 2023
[9]Available:https://www.gov.uk/guidance/flood-risk-and-coastal-change Accessed March 2023.

shown on the Environment Agency's (EA) Flood Map for Planning, available online.

2.2.4 Table 2 of the PPG classifies development types based on their vulnerability to flooding, ranging from 'Essential Infrastructure' that has to be operational in times of flood, through 'Highly Vulnerable' (e.g. emergency service stations), 'More Vulnerable' (e.g. residential dwellings and establishments), 'Less Vulnerable' (e.g. offices/retail), to 'Water Compatible' development (e.g. open space, docks, marinas, and wharves).

2.2.5 Based on Table 2 of the PPG, the Proposed Development is classified as Essential Infrastructure, defined as "essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood". Table 3 of the PPG indicates which vulnerability classes are acceptable in each of the Flood Zones, and when the Exception Test should be applied. This is reproduced as Table 1, below.

Table 1. Flood Risk Vulnerability and Flood Zone Capacity

FLOOD ZONE	ESSENTIAL INFRASTRUCTURE	HIGHLY VULNERABLE	MORE VULNERABLE	LESS VULNERABLE	WATER COMPATIBLE
1	✓	✓	✓	✓	✓
2	✓	Exception Test	✓	✓	✓
3a	Exception Test	×	Exception Test	✓	✓
3b	Exception Test	×	×	×	✓

2.2.6 This FRA has been produced in compliance with the NPPF and NPS EN-1 and confirms that the Sequential and Exception are passed.

2.3 Application of the Sequential and Exception Test

2.3.1 The Site is shown by the EA Flood Map for Planning[10] to extend across a number of Flood Zones (see Figure 1). The eastern and central areas of the Solar Array Area lie within Flood Zone 3, including the area adjacent to Hodge Dike.

2.3.2 The redline boundary of the Cable Route Corridor also extends through areas of Flood Zone 3 (see Figure 2). The final route of the cable within the redline boundary is, however, not confirmed at this stage.

2.3.3 The red line boundary of the access road 'corridor' is located within Flood Zone 1 (see Figure 3). The route of the road is also not confirmed at this stage.

2.3.4 Paragraph 5.8.15 of the Draft NPS EN-1 advises that the Secretary of State (SoS) should not grant consent for development "in flood risk areas (Flood Zone 2 in England…), accounting for all sources of flooding and the predicted

[10]Available: https://flood-map-for-planning.service.gov.uk/.

impacts of climate change unless they are satisfied that the sequential test requirements have been met" or "in Flood Zone 3… unless they are satisfied that the Sequential and Exception Test requirements have been met".

2.3.5 The Sequential Test, as set out in the PPG, aims to steer developments to areas with the lowest risk of flooding (i.e. Flood Zone 1), wherever possible. The Proposed Development will connect to the Bicker Fen National Grid substation, which is located within Flood Zone 3 (as shown on Figure 2). The Proposed Development and Cable Route Corridor could, therefore, not be wholly located within Flood Zone 3.

2.3.6 The area where the Solar Array Area will be located was selected as part of a three staged process undertaken by environmental and planning specialists to identify potential development sites within 10km of the Bicker Fen National Grid Substation which would be suitable for a solar development of 400-600 MW generation capacity (see Chapter 3 'Alternatives and Design Evolution').

2.3.7 Due to the size (i.e. 517 ha) of the Solar Array Area, it would not be feasible to locate all panels and infrastructure solely within areas of Flood Zone 1 and 2. A sequential approach has been applied to minimise the risk by directing the most vulnerable uses to areas of lowest flood risk. It is considered, therefore, that the Sequential Test has been passed.

2.3.8 The Exception Test, detailed in paragraph 164 of the NPPF and paragraph 5.8.10 of NPS EN-1, should be applied only after the Sequential Test has been applied and when More Vulnerable development and Essential Infrastructure cannot be located within Flood Zone 1 or 2, or a Highly Vulnerable development cannot be located within Flood Zone 1.

2.3.9 Paragraph 5.8.42 of NPS EN-1 states that in exceptional circumstances, the SoS may grant consent "where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, if they are satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure".

2.3.10 The majority of the western areas of the Solar Array Area will be situated within areas of Flood Zone 1 and Flood Zone 2, but the majority of the eastern areas are located within Flood Zone 3. Sections of the Cable Route Corridor will also cross areas of Flood Zone 3. The proposed access road crosses Flood Zone 1 only, with no sections within Flood Zone 3.

2.3.11 The Proposed Development is classified as Essential Infrastructure in Table 2 of the PPG. Table 1 (above) shows that Essential Infrastructure is appropriate within Flood Zone 3, with the completion of the Exception Test. The Exception Test must show that the sustainability benefits to the community outweigh the flood risk and that the development will be safe for its lifetime without increasing flood risk elsewhere.

2.3.12 It is considered that the nature of the Proposed Development, which will provide a source of renewable energy to the National Grid, and contribute to the meeting the UK's urgent need for new low-carbon electricity infrastructure as established in NPS EN-1, which would outweigh the flood risk. Further detail is provided in Chapter 3 ('Alternatives and Design Evolution').

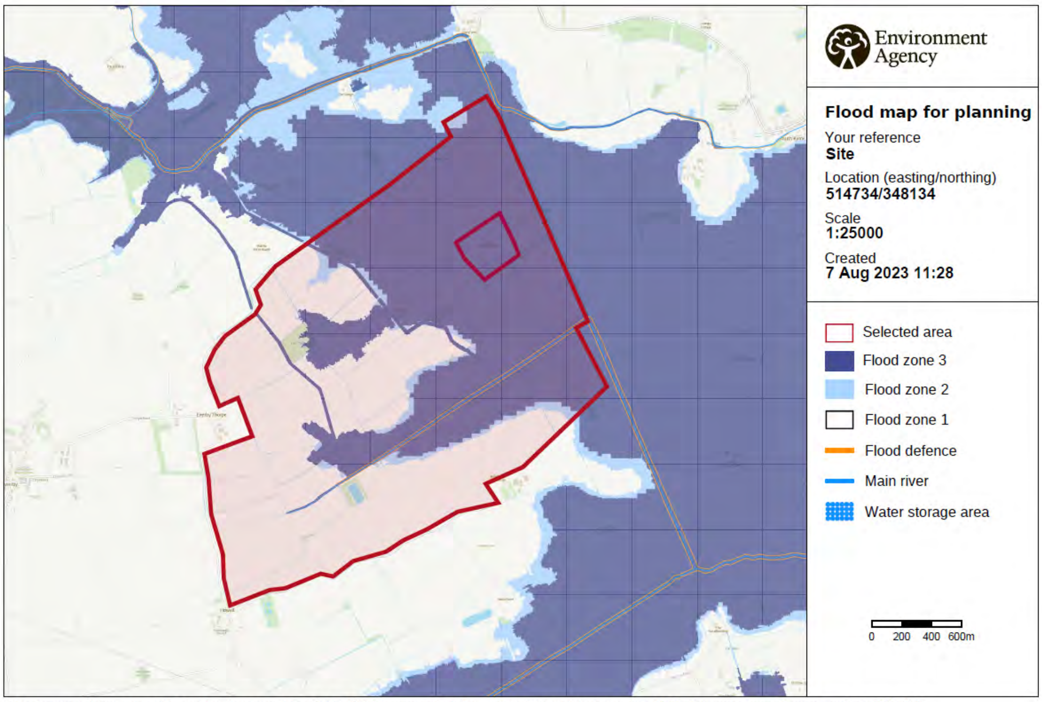


Figure 1. Environment Agency Flood Map for Planning (Solar Array Area)

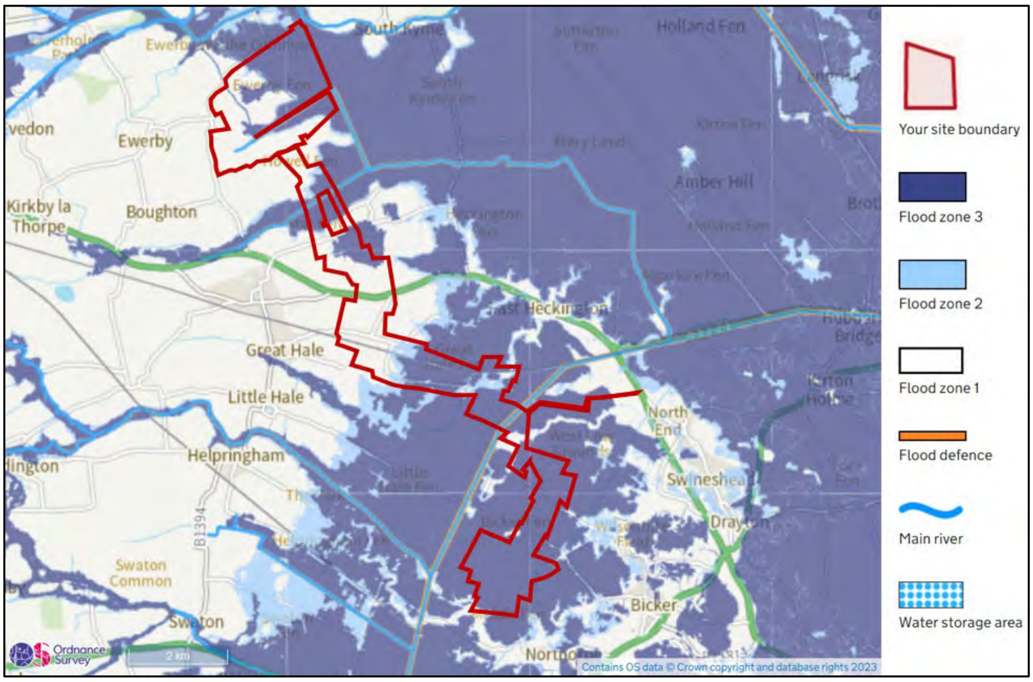


Figure 2. Flood Map for Planning (Solar Array Area and Cable Route Corridor)

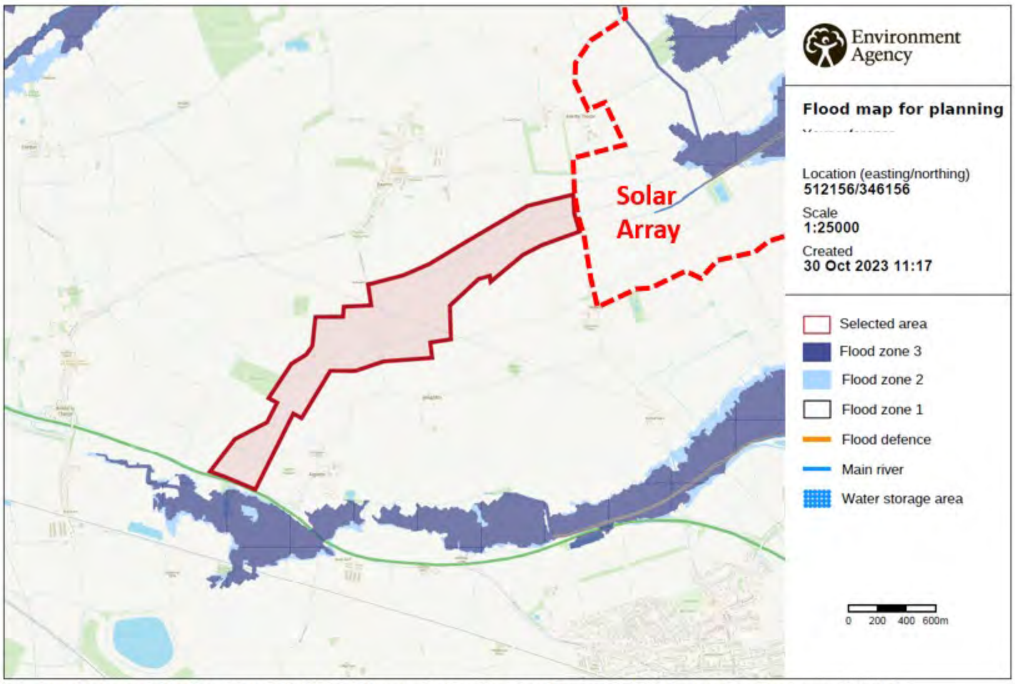


Figure 3. Flood Map for Planning (Access Road)

3. SITE SETTING

3.1 Site Description and Location

3.1.1 A summary of the Site and its characteristics is provided in Table 2, below.

Table 2. Site Location Summary

Site Name	Beacon Fen Energy Park
Site Address	Ewerby Thorpe, near Sleaford, Lincolnshire
Solar Array Area	Circa 517 ha (excluding cable route and access road)
National Grid Reference	TF 14921 48576
Existing Land Use	Agricultural
Proposed Land Use	Solar Farm
Local Planning Authorities	North Kesteven District Council

3.1.2 The Solar Array Area is to comprise of a solar array farm situated to the north of Heckington, between the small villages of Howell, Ewerby Thorpe and South Kyme as shown on Drawing No. ST19595-120 'Site Location with 5km Buffer', covering a total area of approximately 517 ha. The approximate National Grid Reference of the Solar Array Area is TF 14921 48576, and the nearest postcode is LN4 4AA. The proposed Cable Route Corridor will connect to the National Grid Bicker Fen Substation at Bicker Fen, close to the village of Bicker, approximately 9.5km to the south-east of the substation.

3.1.3 The Solar Array Area is irregular in shape and comprises agricultural land and areas of woodland. The redline boundary excludes a 10ha area of agricultural land around Gashes Barn Farm in the north-east. The Solar Array Area is surrounded by further agricultural land, with dwellings and farm buildings adjacent to the northern, southern and western boundaries.

3.1.4 Black Drove (named Howell Lane to the south of Ewerby Thorpe) extends along the western and northern boundaries of the Site before diverting southwards into the Site to the Gashes Barn farm. Howell Fen Drove extends along the majority of the southern boundary of the Site to join Howell Lane. No highways run adjacent to the eastern boundary.

3.1.5 The proposed Cable Route Corridor extends southwards from the Solar Array Area, through agricultural land, diverting around nearby settlements and dwellings. The redline boundary for the Cable Route Corridor is generally c. 1km wide and irregular in shape.

3.1.6 An access road will also be constructed as part of the proposed development. The road will extend from the western boundary of the Solar Array Area to Sleaford Road (A17), approximately 3km to the south-west of the site. The corridor of the access road is approximately 0.55km wide at its widest point. Following removal of the access road, the land will be restored to its condition pre-construction.

3.2 Existing Watercourses and Waterbodies

3.2.1 The locations of the existing watercourses in the vicinity of the Site are shown on Drawing No. ST19595-198, ST19595-199 and ST19595-200 Watercourse Network (Sheets 1 to 3).

Solar Array area

3.2.2 The Hodge Dike Main River flows north-eastwards through the southern half of the Solar Array Area, towards the eastern boundary. The Car Dyke ordinary watercourse (referred to as the Midfodder Dyke further upstream) forms the eastern Site boundary, flowing south-eastwards. The Hodge Dike joins Car Dyke at the eastern Site boundary.

3.2.3 Car Dyke joins Heckington Eau and is also a Main River, located approximately 1.4km to the south-east of the Site. Heckington Eau continues to flow generally south-eastwards to join the South Forty Foot Drain, approximately 7km to the south-east of the Site.

3.2.4 The River Slea (sometimes referred to as Kyme Eau), also a Main River, is located adjacent to the north-eastern corner of the Site, along the eastern boundary. This watercourse flows north-eastwards away from the Site.

3.2.5 The Solar Array Area is also crossed by a number of ordinary watercourses, with land drains present along almost all field boundaries. This is a typical characteristic of the area.

3.2.6 The ordinary watercourses are generally aligned north-eastwards flowing towards Car Dyke and south-eastwards flowing towards Hodge Dike. The most significant of these watercourses are the Catchwater Drain, which flows south-eastwards through the centre of Site to Hodge Dike, and the Twelve Drain, which flows north-eastwards in the northern corner of the Solar Array Area.

3.2.7 The Solar Array Area is located within the Black Sluice Internal Drainage Board (IDB) region.

Cable Route Corridor

3.2.8 The redline boundary for the Cable Route Corridor crosses the Heckington Eau and Old Sixteen Foot Drain, both of which are Main Rivers. A number of unnamed ordinary watercourses are also crossed. These generally form parts of wider land drainage networks which flow south-eastwards to the Old Sixteen Foot Drain.

3.2.9 The Cable Route Corridor is also located within the Black Sluice Internal Drainage Board (IDB) region.

Access Road

3.2.10 The proposed access road corridor crosses several unnamed ordinary watercourses. These are generally situated at field boundaries and aligned north-eastwards.

3.2.11 A short section at the southern end of the access road corridor adjacent to the A17 is located within the Black Sluice IDB region.

3.3 Existing Drainage

Solar Array Area

3.3.1 The Anglian Water CON29DW Drainage and Water Enquiry report (see Appendix 1) confirmed that there are no public sewers within the Solar Array Area. Owing to the rural, agricultural setting of the Site, it is assumed that there are no private sewer networks within the Solar Array Area.

3.3.2 As shown on Drawing No. ST19595-138 Existing Drainage and on plans within Appendix 2, fields within the Site area are underlain by land drains installed at regular spacing. Records show that these are typically 1m deep, 80mm in diameter and filled with porous material. The majority of drains discharge to the watercourses at field boundaries, but some records for some areas state that drains connect to water mains.

3.3.3 It is assumed that surface water runoff disperses naturally either via infiltration into the field drainage network or draining via overland flow following the Site topography.

Cable Route Corridor

3.3.4 It is also assumed that similar underground drainage will be present in some areas of agricultural land crossed by the Cable Route Corridor. The Cable Route Corridor will also pass beneath a number of roads and close to dwellings. Sewers or highway drainage may, therefore, be present in these areas.

Access Road

3.3.5 The route of the access road is also likely to cross agricultural land with field drainage networks discharging to ordinary watercourses. The route does not pass close to dwellings, and it is unlikely, therefore, that any public sewers will be present in the vicinity of the access road.

3.4 Ground Conditions

Solar Array Area

3.4.1 The online British Geological Survey (BGS) GeoIndex Onshore viewer indicates that the majority of the Site is underlain by mudstone of the Oxford Clay Formation. Land in the far east of the Site is underlain by mudstone and siltstone of the West Walton Formation. Both types of bedrock are classified as a ‘unproductive’ aquifers defined as ‘rock layers or drift deposits with a low permeability that have negligible significance for water supply or river base flow’.

3.4.2 The Site is wholly underlain by superficial deposits, with tidal flat clay and silt deposits in northern and eastern areas and mid-Pleistocene till deposits in southern and western areas. A narrow section of clay, silt and sand alluvium deposits is present in central areas of the Site, aligned along the route of the

Hodge Dike, with a narrow section of 'ice contact' sand and gravel deposits in the south-western corner of the Site.

3.4.3 The tidal deposits are classified as an unproductive aquifer. The alluvium, and sand and gravel deposits are classified as Secondary A aquifers (permeable layers capable of supporting water supplies at a local rather than strategic scale). The till deposits are classified as an undifferentiated Secondary aquifer (cases where it has not been possible to attribute either category A or B to a rock type… due to the variable characteristics of the rock type).

3.4.4 The Site area is not located with a groundwater Source Protection Zone (SPZ).

3.4.5 The Cranfield Soilscapes map records the soils at the Site as 'loamy and clayey soils of coastal flats with naturally high groundwater' within the eastern portion of the Site, 'slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' within the west and 'freely draining lime-rich loamy soils' central to the Site.

Cable Route Corridor

3.4.6 Approximately 2.5km of the Cable Route Corridor, located immediately to the south of the Site, extends through the West Walton Formation. The remainder of the route extends through the Oxford Clay formation.

3.4.7 The northern section of the Cable Route Corridor extends through superficial till deposits with smaller areas of sand and gravel deposits (Secondary B and undifferentiated Secondary aquifers). The southern section extends through clay and silt tidal flat deposits (unproductive aquifers).

3.4.8 The Cable Route Corridor does not cross through any groundwater SPZ.

3.4.9 The Soilscapes viewer shows that the initial 0.5km of the Cable Route Corridor in the north, crosses an area of loamy clayey coastal flats soil with high groundwater, adjacent to Heckington Eau. The next 4.5km of the route then crosses slowly permeable loamy clayey soils, with the remaining 4.5km of the route extending back into the area of coastal flats soil.

Access Road

3.4.10 The full access road corridor is underlain by the Oxford Clay Formation. Superficial deposits are present along the majority of the corridor, with northern sections underlain by superficial till deposits (Secondary Undifferentiated aquifer) and southern sections underlain by areas of sand and gravel deposits (Secondary B aquifer).

3.4.11 The Soilscapes viewer shows that the majority of the access road corridor crosses slowly permeable loamy and clayey soils. The southern extent of the route, adjacent to the A17 crosses freely draining loamy soils.

4. DEVELOPMENT PROPOSALS

4.1 Description of the Proposed Development

4.1.1 The Proposed Development would comprise of above ground solar PV and BESS infrastructure, connected by the Cable Route Corridor connecting to the existing Bicker Fen 400kV Substation situated to the west of the Village of Bicker. The Proposed Development includes the following key infrastructure:

- Solar PV modules;
- Inverters;
- Transformers;
- BESS;
- Substation
- Onsite cabling;
- Fencing; and
- Cable.

4.1.2 The PV arrays will be fixed panels mounted on metal frames (i.e. tables) up to 4.5m above ground level. These will be supported by galvanised steel piles driven approximately 2.5m into the ground. The supporting infrastructure consists of inverters, transformers and high-voltage switchgear and control equipment. The Proposed Development will also include an associated BESS in a large compound area close to the centre of the Site. Batteries will be placed within individual enclosures arranged regularly within a compound area with vehicular access available to each unit.

4.1.3 The compound will also include a substation area containing a control building, office space and welfare facilities. The Cable Route Corridor will extend south-eastwards from this substation.

4.1.4 The Site will be accessed via existing access tracks off Black Drove and Howell Fen Drove and the proposed access road from the A17, located to the south-west.

4.1.5 An indicative layout of the proposed Solar Array Area is shown on Drawing No. LCA-2023-01-C-Beacon Fen 'Preliminary Cable Route Corridor Option'.

5. BASELINE FLOOD RISK ASSESSMENT

5.1 Flood Risk to the Development

5.1.1 The main sources of flooding identified within the NPPF are rivers, tidal waters and the sea, surface water, groundwater, sewers and drains, and artificial sources (e.g. canals and reservoirs). The presence of a potential flooding source does not necessarily translate into a high risk of flooding. Table 3, below, summarises the potential flood sources and the related flood risk posed to the Site.

Table 3. Sources of Flood Risk

FLOOD SOURCE	AREA	PRESENCE AT THE SITE	POTENTIAL RISK AT THE SITE	DESCRIPTION
Rivers (fluvial) flooding	Solar Array Area	Y	Very Low to High	Western areas of the Solar Array Area are within Flood Zone 1. Eastern areas within Flood Zone 2 and 3.
	Cable Route Corridor	Y	Low	If cable is installed underground. Fluvial flood risk can be managed during excavation of the trench.
	Access Road Corridor	Y	Low	Route crosses Flood Zone 1
Tidal	Solar Array Area	N	N/A	No tidally-influenced watercourses in the vicinity of the Site.
	Cable Route Corridor	N	N/A	No tidally-influenced watercourses along the route.
	Access Road Corridor	N	N/A	No tidally-influenced watercourses along the route.
Groundwater	Solar Array Area	Y	Medium	Areas of the Site potentially vulnerable to groundwater flooding.

	Cable Route Corridor	Y	Low	Sections of route also vulnerable to flooding. Flood risk can be managed during excavation of trench.
	Access Road Corridor	Y	Low	Areas of the route potentially vulnerable to flooding. Impact on access road will be minimal
Surface Water (Pluvial) Flooding	Solar Array Area	Y	Very Low to High	Risk Very Low or Low for majority of site and Medium to High risk adjacent to Hodge Dike.
	Cable Route Corridor	Y	Very Low	Crosses overland flow routes. Flooding can be managed during excavation of the trench.
	Access Road Corridor	Y	Low	Majority of the route at Very Low risk. Areas of Medium/High risk at southern end of route.
Sewer	Solar Array Area	N	N/A	No sewers within Site area.
	Cable Route Corridor	Y	Very Low	If cable will be below ground, all sewer routes will be identified before trenches excavated.
	Access Road Corridor	Y	Very Low	Access track extends to highways where sewers may be present
Artificial	Solar Array Area	Y	Very Low	Eastern and northern areas at risk of reservoir flooding only when flooding from rivers is also occurring. This scenario is considered unlikely. Majority of Site at no risk.
	Cable Route Corridor	Y	Very Low	Areas at risk of flooding from reservoirs at all times. This can be managed during excavation of the trench.
	Access Road Corridor	Y	Very Low	Small area at southern end of route at risk of reservoir flooding

5.2 Historical Flooding Incidents

5.2.1 Historical flood mapping in the 2009 North Kesteven Strategic Flood Risk Assessment (SFRA) does not show any flooding incidents in the vicinity of the Solar Array Area, the closest area shown to be affected being land to the west of Sleaford in 1977. The Cable Route Corridor and route of the access road also do not extend through any areas affected by historical flooding incidents.

5.2.2 The Lincolnshire Preliminary Flood Risk Assessment (PFRA) does not refer to any historical flooding incidents in the vicinity of the Solar Array Area, Cable Route Corridor or the access road.

5.2.3 The LCC database (Section 19 Flood Investigations) shows that there are no ongoing or completed investigations within the Solar Array Area, Cable Route Corridor or the access road, with the closest ongoing or completed investigation being within the Village of South Kyme completed in 2019, located approximately 2.1km to the north-east of the Site. It was concluded that the incident was the result of rainfall entering the foul public sewer causing surcharging and flooding.

5.2.4 The EA state in their correspondence that they have no record of any historical flood events within the Solar Array Area (see Appendix 3).

5.3 Fluvial Flooding

Solar Array Area

5.3.1 The EA Flood Map for Planning (see Figure 1) shows that western areas of the Site are located in fluvial Flood Zone 1, with an annual probability of flooding of less than 1 in 1,000 years (<0.1%). Eastern areas of the Site are located within Flood Zone 3 with an annual probability of flooding of greater than 1 in 100 years (>1%).

5.3.2 Sections of Hodge Dike, Car Dyke (downstream of the confluence with Hodge Dike) and the River Slea are protected by flood defences. These comprise earth embankments along the length of the watercourses. EA data shows that the defences along Hodge Dike provide protection up to the 75 year return period and the defences along the Car Dyke provide protection up to the 200 year return period. Data shows the Car Dyke defences are in a Fair condition, with the condition of the Hodge Dike defences not given.

5.3.3 The EA provided Product 4 modelled flood level data for the Solar Array Area, taken from the 2009 Lower Witham model for the River Slea/Kyme Eau and the 2016 South Forty Foot model for Hodge Dike, Car Dyke and Heckington Eau. The location of the modelled node points is shown on Figure 4, with the results for the most relevant nodes, summarised in Table 4. The full dataset is included in Appendix 2.

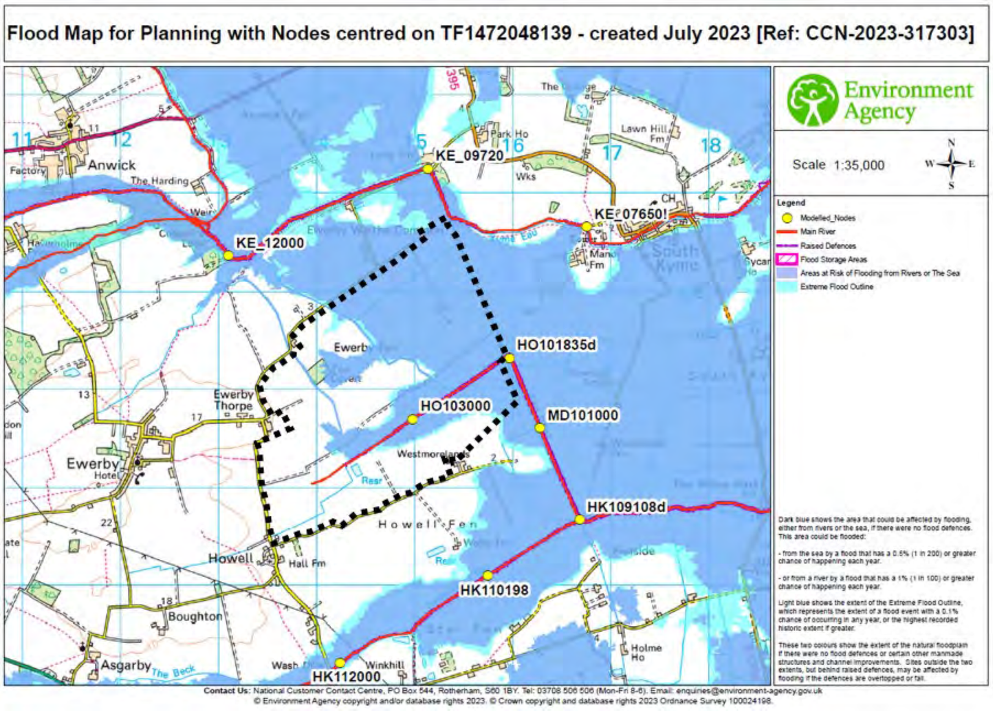


Figure 4. Environment Agency Flood Model Nodes

Table 4. Environment Agency Modelled Flood Levels

NODE	RETURN PERIOD				
	1 IN 10	1 IN 100	1 IN 100 (+20% CC)	1 IN 1000	1 IN 1000 (+20% CC)
Lower Witham Model (River Slea) – mAOD					
KE_07650	3.90	3.94	3.95	3.98	4.07
KE_09720	*3.96*	*4.01*	*4.01*	*4.07*	*4.23*
KE_12000	4.01	4.05	4.06	4.13	4.34
South Forty Foot (Heckington Eau, Hodge Dike, Car Dyke) – mAOD					
HO103000	*2.63*	*2.80*	*2.85*	*3.00*	*3.09*
HO101835d	2.63	2.80	2.85	3.00	3.09
MD101000	2.63	2.80	2.85	3.00	3.09
HK110198	2.64	2.80	2.85	3.02	3.12
HK109108d	2.63	2.80	2.85	3.00	3.09
Italics show modelled node used for calculating flood depths					

5.3.4 The modelled flood levels from both models have been transposed across the LIDAR topographical data to estimate the depth of flooding at fifteen points within the Site (see Drawing No. ST19595-139, ST19595-140, ST19595-141 and ST19595-142).

5.3.5 As shown on Drawing ST19595-139 Lower Witham Flood Depth Mapping 100+20% Climate Change Allowance, a flood level of 4.01m AOD within the Kyme Eau would result in a depth of flooding of 2.70m at point 15 close to the north-eastern boundary of the Site. Areas in the south and west of the Site would generally be unaffected.

5.3.6 In the 1 in 1,000 year event (shown on Drawing ST19595-140 Lower Witham Flood Depth Mapping 1 in 1000 Storm Event) a flood level of 4.23m AOD would result in a depth of flooding of 2.76m at point 5. Areas in the south and west of the site would continue to (generally) be unaffected.

5.3.7 As shown in Drawing ST19595-141 South Forty Foot Flood Depth Mapping 100+20% Climate Change Allowance, a modelled flood level of 2.85m AOD within the Hodge Dike in the 1 in 100 +20% return period would result in a depth of flooding of over 1.52m at point 5 east of the Site. The extent of flooding is less than that for the Lower Witham model with no flooding in the majority of areas to the west of Catchwater drain and south of Hodge Dike.

5.3.8 For the 1 in 1,000 year return period (shown on ST19595-142- South Forty Foot Flood Depth Mapping 1 in 1,000 Year Storm Event), the depth of flooding would be 1.67m at point 5, with areas to the west of Catchwater drain and south of Hodge Dike unaffected.

5.3.9 It should be noted that both models provided by the EA provide data for the defended scenario only, as opposed to the undefended or defence-breach scenario. The defended scenario represents the baseline scenario, accounting for the presence of existing flood defences, thereby considering the protection offered by existing defences.

5.3.10 Furthermore, the modelled flood levels represent ‘in-channel’ levels and not water levels across the floodplain. The ‘in-channel’ levels are an output of the hydraulic model, which is built on the assumption that water can rise up within the confines of the flood defences. The modelled flood levels could, therefore, be higher than the realistic level across the adjacent ground. Extrapolating the modelled in-channel flood levels across the adjacent ground to determine flood depth (as above), therefore, has limitations in accuracy. The EA data does not provide information on the crest height of the raised flood defences.

5.3.11 Photographs of the Hodge Dike, Car Dyke and Midfodder Dyke, taken from the Ewerby Pumping Station (close to Node HO101835d on Figure 34), are included as Figures 45, 56 and 67, below. These show that fields to the north and south of Hodge Dike are situated several metres below raised embankments adjacent to the watercourse. There are also raised embankments along Car Dyke and the upstream Midfodder Dyke. If there is no pathway for water to flow around these embankments, water levels within the channels could rise above the level of the adjacent ground without flooding the Site.

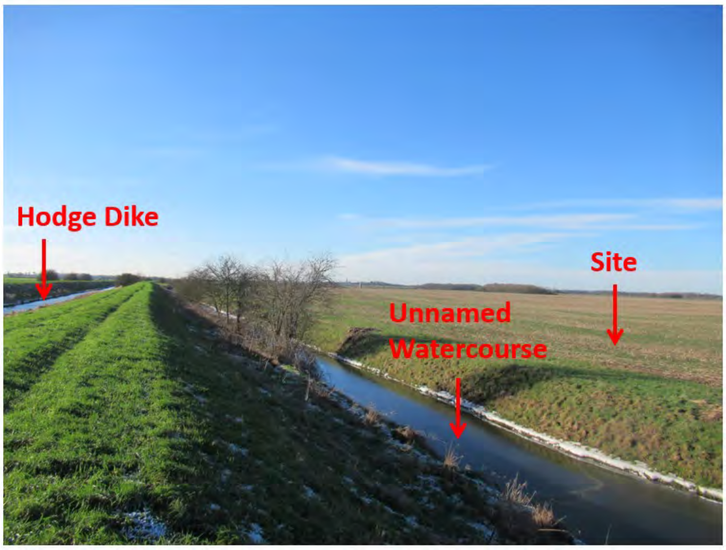


Figure 5. Hodge Dike and Car Dyke (looking south-west from Ewerby Pumping Station)

Figure 6. Hodge Dike and Unnamed Watercourse (looking west)

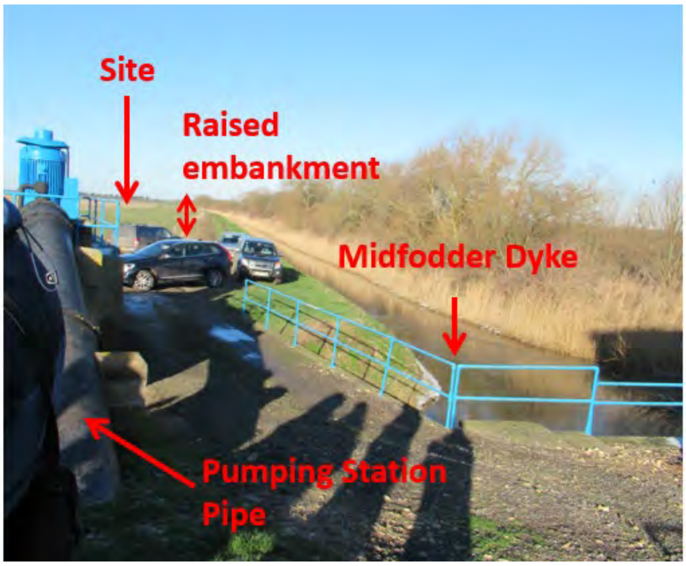


Figure 7. Midfodder Dyke (looking north from Ewerby Pumping Station)

5.3.12 It is also assumed that the Lower Witham model does not include Hodge Dike and Car Dyke, and that the South Forty Foot model does not include the River Slea and Kyme Eau.

5.3.13 To more accurately confirm the fluvial flood risk at the Site, it is proposed to undertake fluvial flood modelling. This will combine both models and include a 2D model to assess flood depths across the floodplain. The results of this modelling will feed into the FRA for the ES.

5.3.14 Based on the information presently available, it is considered that risk of fluvial flooding to the Site is LOW within the south and western areas of the site and HIGH within the northern and eastern areas.

Cable Route Corridor

5.3.15 The northern and southern sections of the Cable Route Corridor will cross through areas of Flood Zone 3. Central sections will cross areas of Flood Zone 1. To prevent fluvial flooding impacting on the Cable Route Corridor, measures could be taken during the installation works to minimise this risk. For example, excavation works could be halted in areas of high risk when the potential for fluvial flooding is highest. This could include prolonged periods of wet weather, when intense rainfall is forecast, or flood warnings.

5.3.16 The risk of fluvial flooding to the Cable Route Corridor is, therefore, considered to be LOW.

Access Road

5.3.17 The access road corridor crosses areas of Flood Zone 1, with the closest area of Flood Zone 3 situated to the south of the A14, approximately 30m from the access road. The A14 is, however, elevated above the area of Flood Zone 3 and it is considered that there would be no pathway for fluvial flooding to affect the proposed access road.

5.3.18 Ordinary watercourses at field boundaries are assumed to provide land drainage with small catchment areas to each. The risk of fluvial flooding is, therefore, considered to be LOW.

5.4 Surface Water Flooding (Pluvial Flooding)

5.4.1 Surface water flooding often occurs during intense rainfall when water is unable to infiltrate into the ground or enter drainage systems and runs quickly overland resulting in local flooding. The EA classifies the risk of surface water flooding as:

- Very Low - an annual probability of less than 1 in 1,000 years (<0.1%);
- Low - an annual probability of between 1 in 1,000 and 1 in 100 years (0.1% - 1.0%);
- Medium - an annual probability of between 1 in 100 and 1 in 30 years (1.0% - 3.3%); and
- High - an annual probability of greater than 1 in 30 years (>3.3%).

Solar Array Area

5.4.2 The EA Surface Water Flooding Extents map (see Figure 8) shows that the majority of the Site is at a Very Low risk of surface water flooding. There are areas of Low risk in the north-east of the Site and adjacent to the route of Hodge Dike.

5.4.3 There are areas of Medium to High risk in the south-west of the Site at the upstream extent of Hodge Dike. It is assumed that this is potentially where overland flows are obstructed by a raised embankment or bund adjacent to an unnamed watercourse in this location. Other areas with an increased risk of surface water flooding are generally consistent with the alignment of watercourse corridors within the Site.

5.4.4 The northern extents of the Cable Route Corridor also extends through small areas of Medium and High risk, in the vicinity of Heckington Eau and the Village of Great Hale. The southern section of the Cable Route Corridor generally cross through areas at a Very Low risk of surface water flooding.

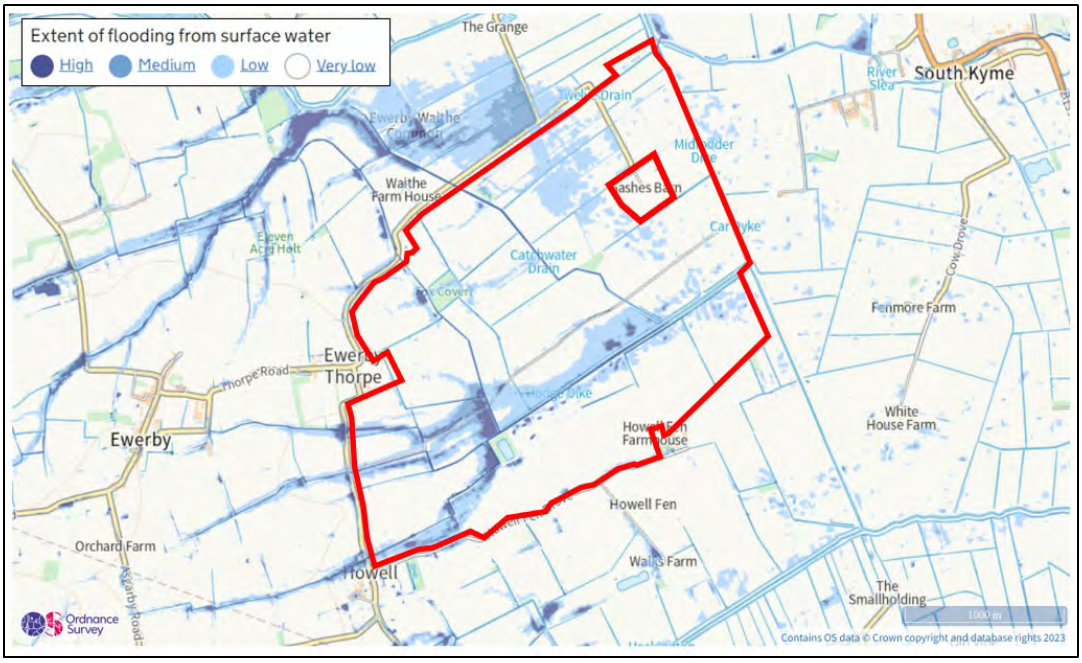


Figure 8. Environment Agency Surface Water Flooding Extents (Solar Array Site).

5.4.5 The EA surface water velocity mapping provides an indication of potential overland flow pathways. The mapping for the 1 in 1,000 year storm event (i.e. the extent of areas at a Low risk of flooding) is shown in Figure 89, below. Detailed mapping at a smaller scale is included in Appendix 4.

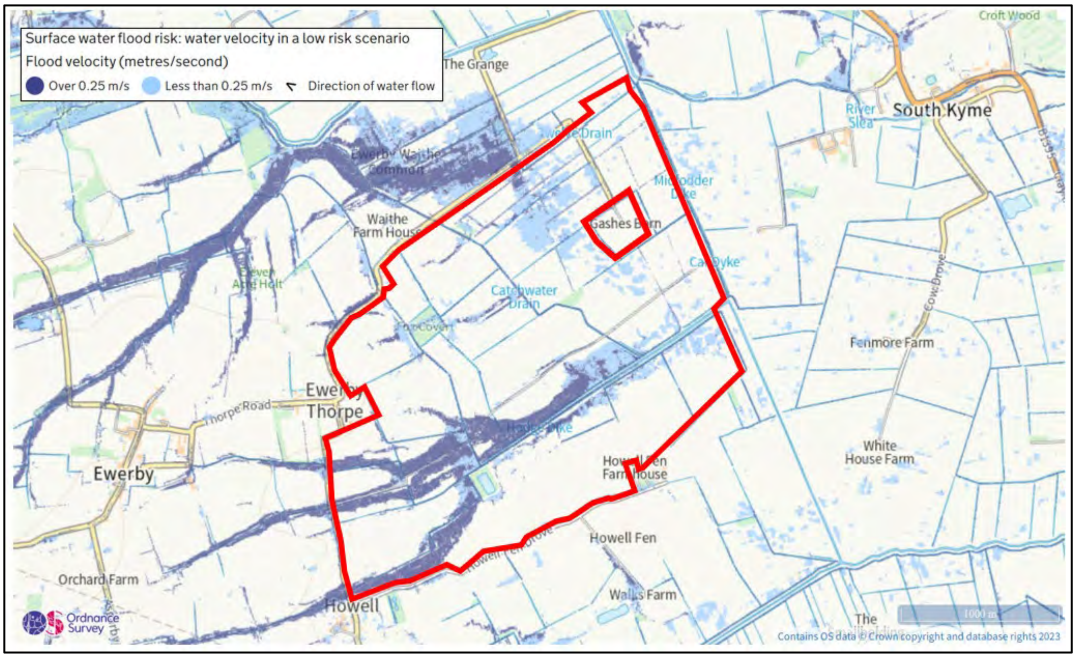


Figure 9. Environment Agency Velocity Mapping Locations (Solar Array Site)

5.4.6 As shown on Figure 9, three overland flow pathways extend eastwards into the Site to converge at the upstream extent of Hodge Dike. The combined flows would then continue north-eastwards along the route of the Hodge Dike. The velocity of the flows and the width of the pathway generally reduce as the flows progress north-eastwards across the Site.

5.4.7 A second overland flow pathway follows the route of the River Slea and Catchwater Drain to the north-west of the Site. This route runs adjacent to the northern boundary of the Site and ends in the field adjacent to the junction between Ferry Lane and Black Drove. The overland flow route then extends across Black Drove and the northern Site boundary, terminating within the Site.

5.4.8 EA flood depth mapping (see Figure 10) shows that the depth of surface water flooding would generally be less than 300mm even in the extreme 1 in 1,000 year storm event. Depths increase to between 300mm and 900mm in areas adjacent to Hodge Dike and the junction between Black Drove and Ferry Drain beyond the northern Site boundary.

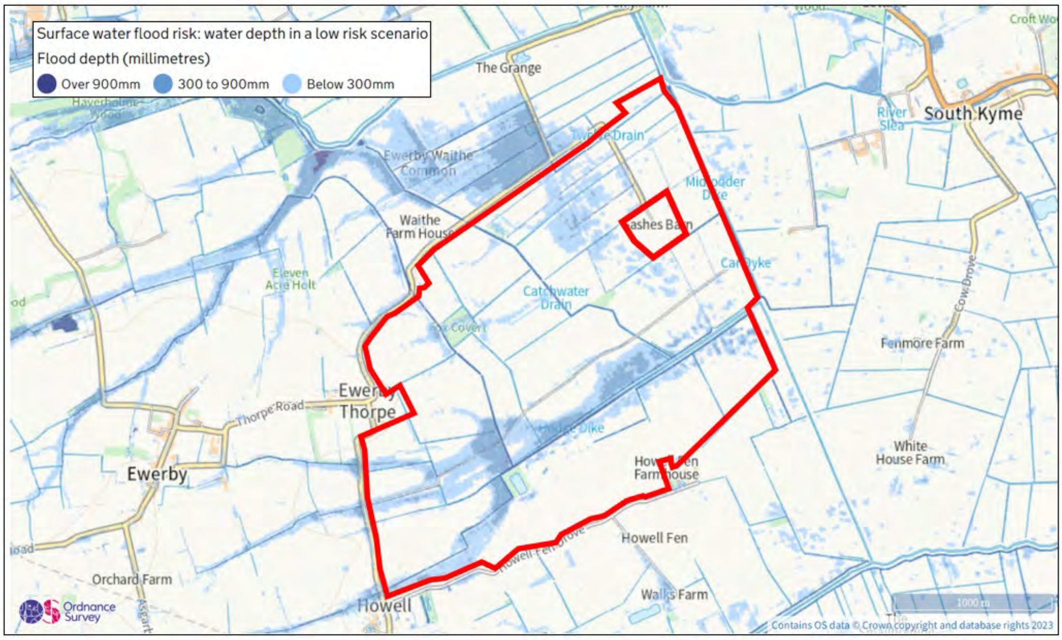


Figure 10. Environment Agency Surface Water Flood Depths (Solar Array Site)

5.4.9 Based on the available information, it is considered that the risk of surface water flooding is VERY LOW to LOW for the majority of Site, with small areas at a MEDIUM to HIGH risk adjacent to Hodge Dike.

Cable Route Corridor

5.4.10 Northern and central sections of the Cable Route Corridor will also cross overland flow routes in the vicinity of Heckington Eau and to the east of the Village of Great Hale as shown on Figures 11 and 12.

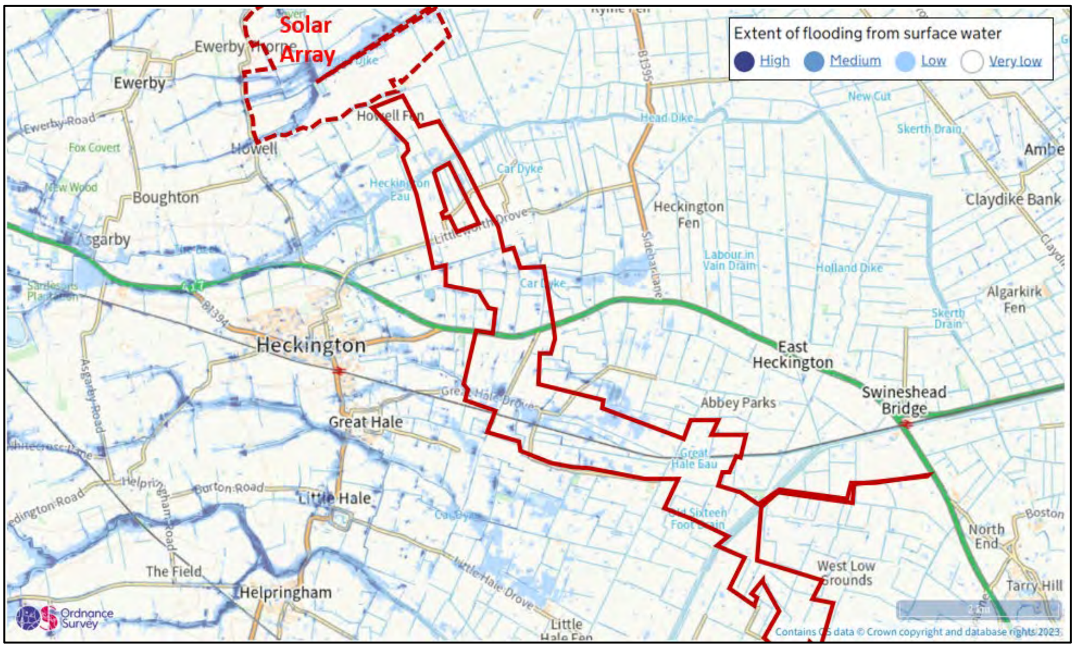


Figure 11. Environment Agency Surface Water Flood Depths (Northern Cable Route)

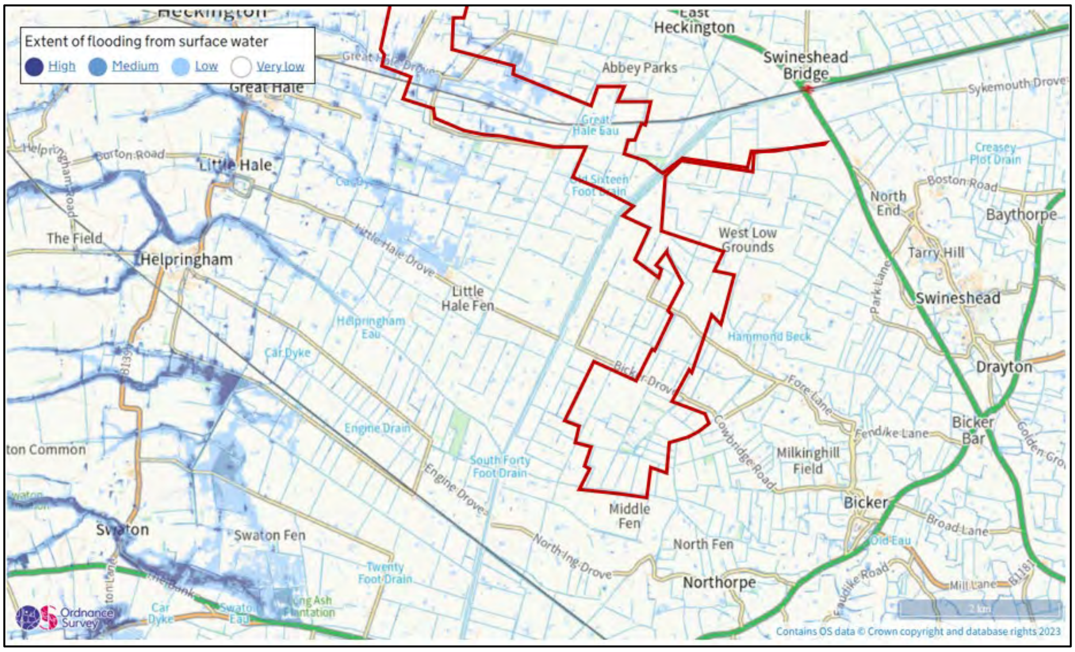


Figure 12. Environment Agency Surface Water Flood Depths (Southern Cable Route)

5.4.11 These pathways are also aligned generally south-eastwards. There are minimal overland flow pathways in the vicinity of southern sections of the Cable Route Corridor. With suitable protection around the cable trenches to prevent any ingress of surface water runoff during storm events, the risk of flooding impacting the underground cable will be minimal. It is considered, therefore, that the risk of flooding is VERY LOW.

Access Road

5.4.12 The majority of the access road corridor extends through areas of land at a Very Low risk of surface water flooding as shown on Figure 13. The southern section adjacent to the A14 is located within an area of Medium to High risk. This forms part of an overland flow pathway flowing eastwards towards Heckington Eau.

5.4.13 A narrow section of land in the northern section of the corridor is at a Low to Medium risk of flooding. This forms part of a series of overland flow routes which converge within the solar array site upstream of Hodge Dike.

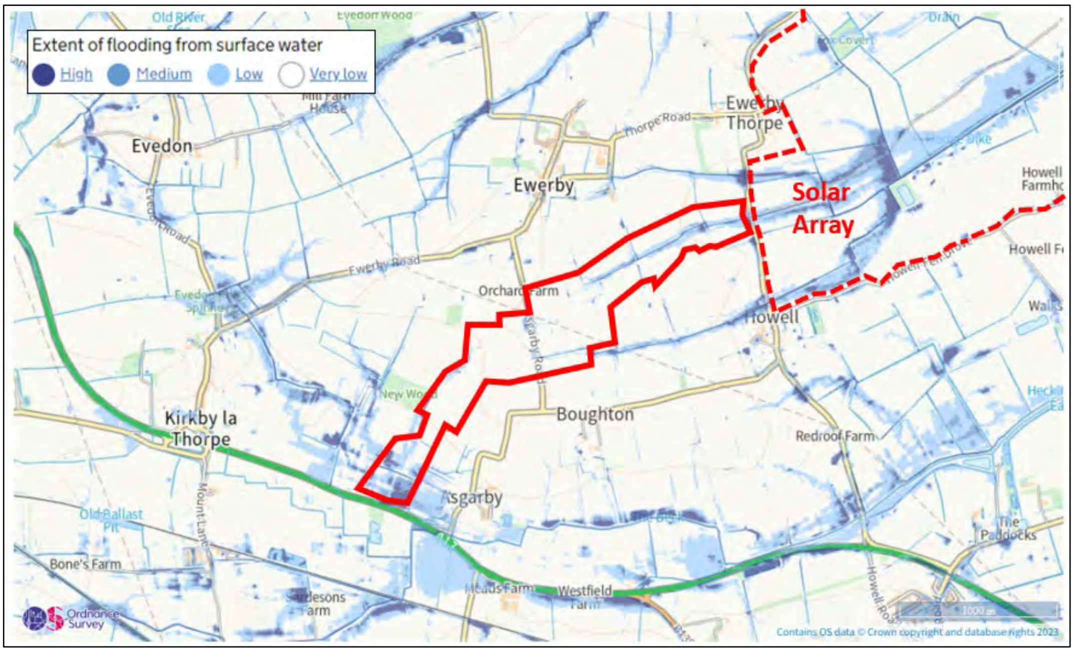


Figure13. Environment Agency Surface Water Flooding Extents (Access Road).

5.4.14 Based on the available information it is considered that the risk of surface water flooding to the proposed access track is LOW.

5.5 Groundwater Flooding

5.5.1 Groundwater flooding can occur when prolonged rainfall causes the groundwater table to rise above ground level. Groundwater flooding can occur at the same time as flooding from other sources, such as overland flow. The LCC PFRA states that the Sleaford and Bourne areas are susceptible to flood risk due to high groundwater levels in the underlying aquifer. The Susceptibility to Groundwater Flooding mapping within the PFRA divides the region into 1km grid squares and assigns a percentage based on the proportion of that area in which hydrogeological conditions are such that groundwater flooding could occur and does not refer to the risk of flooding.

Solar Array Area

5.5.2 Mapping shows that south-western areas of the Solar Array Area have a greater than 75% 'susceptibility'. The susceptibility decreases with distance from Sleaford and north-eastern areas of the Site have a less than 25% susceptibility.

5.5.3 This corresponds with BGS mapping, which shows that south-western areas are underlain by bedrock and superficial deposits classified as Secondary aquifers, and north-eastern areas are underlain by unproductive bedrock and superficial deposits. Cranfield 'Soilscapes' Viewer states that the loamy and clayey soils in the east of the Site have naturally high groundwater.

5.5.4 As there will be minimal development below ground level, it is unlikely that groundwater would be encountered except during pile installation. Based on the available information it is considered that the risk of groundwater flooding to the Solar Array Area is MEDIUM.

Cable Route Corridor

5.5.5 The northern sections of the Cable Route Corridor will be situated within land with a susceptibility of over 75%. Central and southern sections will have a minimal susceptibility. The cable trenches will generally be approximately 1.5m deep and it is possible that they will intersect the groundwater table. Where any groundwater ingress is encountered within cable trenches, this can be dispersed by pumping to adjacent ground before the cable is laid and there would be minimal impact on the proposed Cable Route Corridor.

5.5.6 It is considered that the risk of flooding from groundwater is LOW.

Access Road

5.5.7 The northern section of the access road crosses areas with a susceptibility of over 75%. The susceptibility decreases with distance from the solar array site, with southern sections having a 25% - 50% susceptibility. Based on the available information it is considered that the risk of groundwater flooding to the access road corridor is MEDIUM. As there will be no below-ground construction, the impact of any groundwater flooding will be minimal.

5.6 Sewer Flooding

Solar Array Area

5.6.1 The Anglian Water CON29DW Drainage and Water Enquiry report (see Appendix 1) confirmed that there are no public sewers within the Solar Array Area. It is also assumed that there are no private sewers in the vicinity of the Site and this potential source of flooding is, therefore, discounted.

Cable Route Corridor

5.6.2 The cable will be below ground and not affected by sewer flooding. Where the Cable Route Corridor crosses highways or runs close to built-up areas, sewers will be identified along with other services prior to excavation to ensure no damage is caused during the works. The risk of sewer flooding will, therefore, be VERY LOW.

Access Road

5.6.3 The route extends between Heckington Road and Asgarby Road; and Asgarby Road and the A14. There may be sewers or highway drains present within these carriageways. It is assumed that the access road will not cross any public or private sewers within areas of agricultural land and the overall risk of flooding will, therefore, be VERY LOW.

5.7 Artificial Sources

Solar Array Area

5.7.1 Artificial sources of flooding include reservoirs, canals and any other impounded water body that is elevated above the level of the Site. Flooding can occur when the impounding structures (such as dams and embankments) fail, when culverts become blocked or during extreme rainfall events when the waterbodies overflow. The EA Maximum Extent of Flooding from Reservoirs map (see Figure 1014) shows that the northern and eastern areas of the Site are at risk of flooding from reservoirs when there is also flooding from rivers. The extent of the area of risk generally follows the outline of Flood Zone 3 on the Flood Map for Planning (see Figure 1).

5.7.2 Based on mapping, the risk of flooding relates to an unnamed impounded reservoir located approximately 4.5km to the south-west of the Site. Any flooding would affect large areas in the vicinity of the Site, and it is assumed, therefore, that raised embankments surrounding the reservoir would be well-maintained. As a breach of the reservoir would also need to coincide with a fluvial flooding event in order to impact the majority of Site, it is considered that the likelihood of both occurring at once is likely to be relatively minimal.

5.7.3 There is a small, impounded waterbody in the south of the Site, adjacent to Hodge Dike. It is considered that any flooding from this waterbody would continue north-eastwards along the route of Hodge Dike without risk to the wider Site.

5.7.4 There are no other potential sources of artificial sources within the vicinity of the Site and, based on the available information, it is considered that the risk of flooding from this source is VERY LOW.

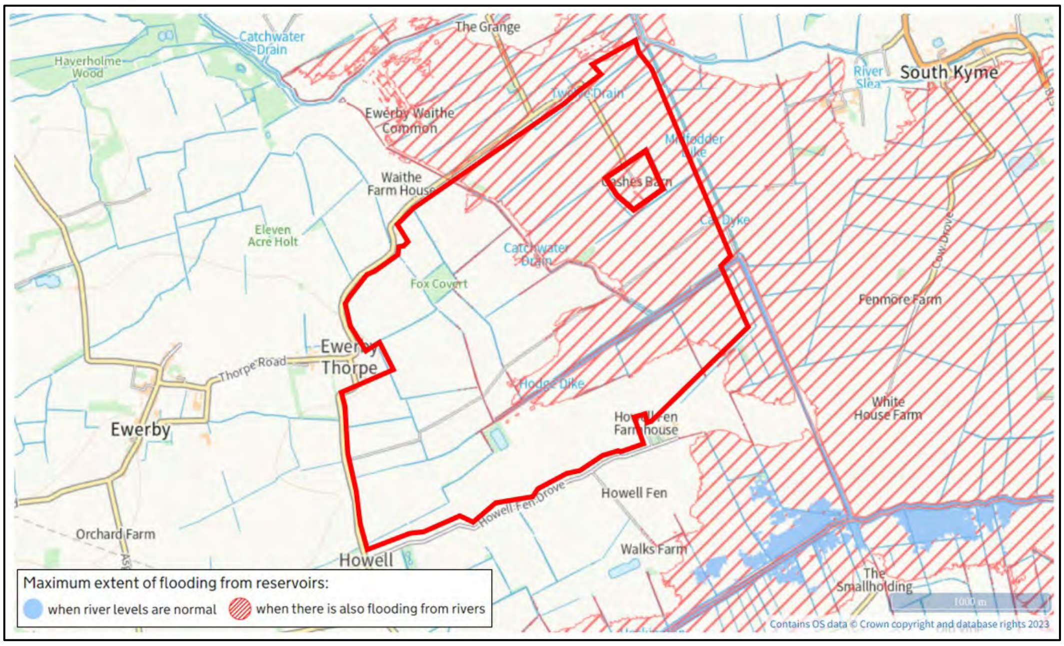


Figure 14. Environment Agency Reservoir Flooding Extents (Solar Array Area

Cable Route Corridor

5.7.5 Sections of the Cable Route Corridor would also be at risk when there is fluvial flooding, with land adjacent to Heckington Eau at risk at all times. As with the management of fluvial flooding, excavation works could be suspended during periods of heavy rainfall or when there are flood warnings are in place. The risk of flooding would, therefore, be VERY LOW.

Access Road

5.7.6 A small area in the southern section of the access road, adjacent to the A14, is at risk of reservoir flooding at all times as shown on Figure 15. The source of flooding is the unnamed reservoir, located approximately 1km to the south-west.

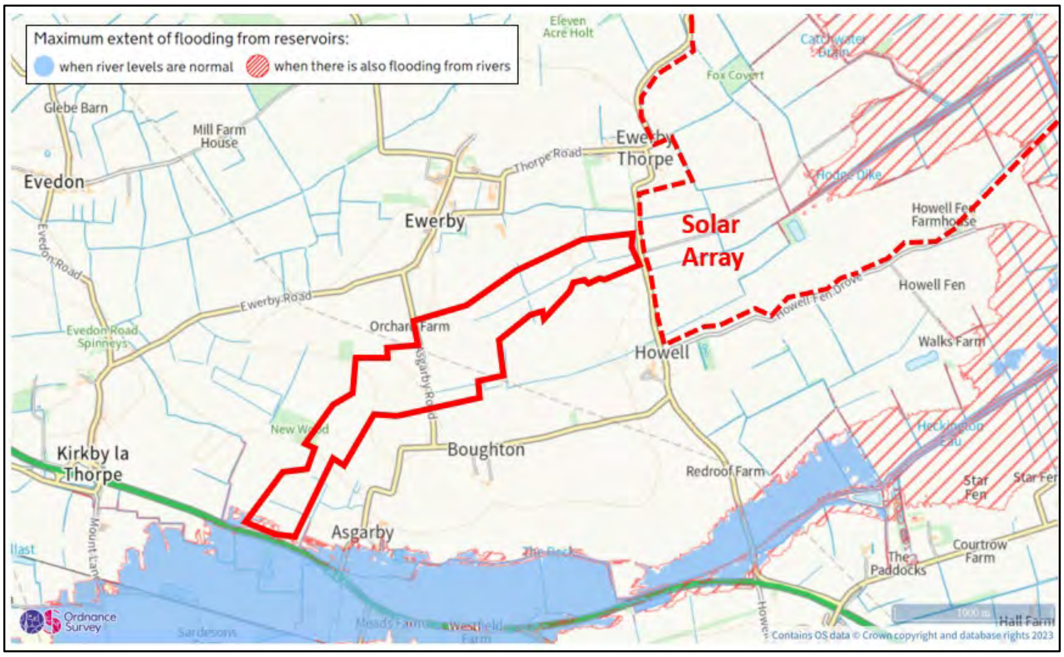


Figure 18. Environment Agency Reservoir Flooding Extents (Access Road)

5.7.7 The remainder of the route is not at risk of flooding from reservoirs and there are no canals or impounded water bodies in the vicinity. The risk of flooding from artificial sources is, therefore, considered to be VERY LOW.

6. POST DEVELOPMENT FLOOD RISK ASSESSMENT

6.1 Flood Risk from the Proposed Development

6.1.1 New development can pose a risk of flooding to neighbouring properties and areas downstream of a site, often as a result of an increase in impermeable area which has the effect of increasing the rate and volume of surface water runoff. In addition, climate change can be expected to cause an increase in rainfall intensity and surface water runoff over the lifetime of a development. Flood risk can also be increased as a result of new development if the development reduces the floodplain storage area or alters flood flow paths, ultimately displacing flood water and resulting in an increased risk to the surrounding area.

6.2 Fluvial Flooding

6.2.1 As shown in the EA Flood Map for Planning (see Figure 1), the northern and eastern areas of the Solar Array Area are situated within Flood Zone 3. Areas in the south and west of the Solar Array Area are located within Flood Zone 1.

6.2.2 The Proposed Development within areas of Flood Zone 3 will primarily comprise solar panels secured on metal piles. Where ground levels are not modified, any loss of floodplain storage from these piles will be minimal and any fluvial flood flows would be able to pass beneath the panels unimpeded with no diversion.

6.2.3 The majority of structures will be located within the substation area, which will be situated within Flood Zone 1. In order for the site to remain operational, it may be necessary to situate transformers located in Flood Zone 3 on raised ground to elevate these above the 1 in 100 year (+ climate change) flood level. Any loss of floodplain storage would, however, be minimal when compared to the large area of the Site and floodplain extent. Any impact on fluvial flooding as the result of the Proposed Development within the Solar Array Area will, therefore, be negligible.

6.2.4 These assumptions are based on the Environment Agency flood modelling data which is considered presently to be the best available data. Detailed, site specific fluvial flood level modelling will be undertaken as part of future works to confirm the extent of the Flood Zones and estimate depths of flooding within the site area.

6.2.5 The Cable Route Corridor will cross areas of Flood Zone 3 (see Figure 2). It is intended that the Cable Route Corridor will be situated below ground, within a trench. The trench will be reinstated with arisings to the existing ground level and there will be no areas of raised ground that may result in a loss of floodplain storage or diversion of flood flow routes. Where the Cable Route Corridor crosses larger watercourses, this will be done using Horizontal Directional Drilling (HDD) and there will be no impact on flows within the watercourses.

6.2.6 The route of the proposed access road will cross Flood Zone 1 (see Figure 3) and there will, therefore, be no impact on the risk of fluvial flooding as a result of the proposed development.

6.3 Surface Water (Pluvial) Flood Risk

6.3.1 The EA surface water velocity mapping (see Figures 8 and 9 and Appendices 4 to 16) shows that the south-eastern part of the Solar Array Area is located within an overland flow route, which extends eastwards towards Hodge Dike and will pass through areas of solar panels. The substation area will not be located within potential overland flow routes.

6.3.2 As all solar panels will be situated above ground level on piles, it is considered that they would not cause any diversion of existing overland flow routes and there would be no increased risk to areas previously unaffected by surface water flooding.

6.3.3 When the cable is being installed within trenches, excavated material will be stored such that flood flow routes are not impeded (i.e. gaps will be left between short lengths of stockpiled material).

6.3.4 The proposed access road will be constructed at the existing ground level and will, therefore, not obstruct or divert any existing overland flow routes.

6.4 Surface Water Runoff

6.4.1 The solar panels will be supported on piles driven into the ground without any form of concrete base. This would occupy minimal ground surface area and their presence would not affect the present character of the ground. Rain falling on the panels will run off onto the ground and disperse naturally, mimicking the existing greenfield characteristics.

6.4.2 There is limited empirical evidence of the effect of solar development on surface water runoff. The research paper 'Hydrologic Response of Solar Farms' , however, found that, with well-maintained grass underneath the panels, the solar panels themselves did not have a significant impact on the runoff volumes and peak runoff rates. There will, therefore, be a negligible increase in runoff reaching the Site boundary as a result of the solar panels.

6.4.3 In addition to the solar panels, there will also be a number of structures associated with the substation and transformers located across the Site that will act as impermeable surfaces. Access tracks will also be constructed within the Site that will act as a semi-permeable surface. As a result of the increased impermeable area, the rate and volume of surface water runoff may increase as a result of the Proposed Development. Mitigation measures will, therefore, be required.

6.4.4 As it is intended that the proposed cabling is be installed underground and infilled with arisings, there will be no increase in impermeable area along sections of the Cable Route Corridor.

6.4.5 The proposed access track will be constructed from crushed aggregate which will generally act as a semi-permeable surface, retaining some surface water during a storm event. There may, therefore, be a small increase in surface water runoff as a result of the proposed access track and mitigation measures will be required.

6.5 Climate Change

6.5.1 Climate change can be expected to cause an increase in rainfall intensity during the lifetime of the Proposed Development (which comprises a temporary structure with a modelled operational lifespan of up to 40 years, being the expected operational life of the solar PV modules) and surface water runoff rates and volumes may increase. Mitigation measures will, therefore, be required.

6.5.2 In assessing the potential flood risk at the Site over the lifetime of the Proposed Development, climate change must be considered. Climate change allowances have been based on the guidance set out in the NPPF Technical Guidance.

6.5.3 The Proposed Development would have a lifespan of approximately 40 years and, based upon the PPG guidance for Essential Infrastructure located in Flood Zone 3 within the Witham Management Catchment, the Upper End allowance of 35% for the 1 in 30 year and 40% for the 1 in 100 year storm events is considered to be appropriate. It is considered, therefore, that the risk of surface water flooding could increase as a result of climate change and that mitigation measures are required.

7. FLOOD RISK MITIGATION MEASURES

7.1.1 The assessment has indicated that mitigation measures will be required for the:

- The anticipated increase in surface water runoff due to increased impermeable area; and,
- The anticipated increase in surface water runoff due to the predicted increase in rainfall intensity due to climate change.

7.1.2 When available, the updated fluvial flood modelling may also indicate that the Site is at risk of fluvial flooding in the defended scenario. Should this be the case, appropriate mitigation measures will be required. This will be determined when the model results are available.

7.2 Surface Water Management

7.2.1 The risk of flooding to areas downstream of the Site may increase as a result of the Proposed Development due to an increase in impermeable area and an increase in rainfall intensity (i.e. climate change) resulting in increased rates and volumes of surface water runoff. To mitigate this increased risk, it is proposed that surface water runoff from the Proposed Development is managed in a sustainable manner and in accordance with EA and Local Lead Flood Authority (LLFA) guidelines.

7.2.2 These guidelines advise the inclusion of Sustainable drainage Systems (SuDS) within new developments, such as swales, permeable paving and attenuation ponds in order to appropriately control and store additional surface water runoff generated by the development onsite, preventing an increase in flood risk elsewhere.

7.2.3 A Surface Water Management Plan for the Site is proposed. This aims to mimic the existing greenfield characteristics of the Site, with surface water discharges restricted to Greenfield rates for all storm events up to and including the 1 in 100 year event, including an allowance for climate change.

7.3 Residual Risk

7.3.1 Areas of the Site are shown to be at risk of flooding from fluvial, surface water and artificial sources. Similarly, climate change and increases in impermeable area are likely to result in increased surface water runoff rates and volumes.

7.3.2 Whilst there is always a possibility that the design standards of any proposed flood risk management measures will be exceeded by an extreme storm event, any mitigation will be designed in accordance with the EA guidelines and it is, therefore, considered that the residual risk will be minimal.

7.3.3 It is not presently proposed to modify ground levels within the Site and so the existing topography will be retained. If the capacity of any proposed drainage features is exceeded during an extreme storm event exceeding the design return period, it is considered that exceedance flows would follow the existing topography with no risk to areas previously unaffected by surface water flooding. Where these routes extend beyond the Site boundary, this would only impact agricultural land with no risk to dwellings or developed areas.

7.3.4 The Solar Array Area benefits from fluvial flood defences along Hodge Dike and Car Dyke. The condition of the earth embankments is generally shown to be Fair in the EA data. There is a risk, however, that these will be breached or overtopped resulting in flooding. The embankments should, therefore, be regularly inspected during the operational period and any necessary repairs made to minimise the risk of a breach.

8. DRAINAGE STRATEGY

8.1 Surface Water Drainage Strategy

8.1.1 Surface water runoff from the Proposed Development will be controlled on the Site to ensure that there is no increase in risk of flooding to areas downstream of the Site and the Proposed Development itself.

8.1.2 The PPG stipulates a hierarchy for the disposal of surface water that will be followed as part of any surface water drainage design. This hierarchy is as follows:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain or another drainage system;
- to a combined sewer.

8.1.3 In accordance with the hierarchy, it is proposed that surface water runoff will be discharged by infiltration, where feasible to do so. The infiltration rate of the soils and subsoils within the Site area will be confirmed with percolation testing undertaken in accordance with Building Research Establishment (BRE) Digest 365 guidelines. Testing will record the time taken for a known volume of water to infiltrate into the surrounding ground and convert this into an infiltration rate.

8.1.4 Soilscapes mapping shows soils are freely draining in central areas of the Solar Array Area, meaning infiltration drainage may be feasible in this location. Eastern and western areas are underlain by more clayey soils and the infiltration rates in these areas of the Site will be lower. The aquifer in the eastern areas of the Site is also classified as unproductive.

8.1.5 Where it is not feasible to discharge via infiltration alone, surface water runoff will be discharged at a restricted rate to the local watercourses. Any discharge offsite will be restricted to greenfield runoff rates.

8.1.6 Surface water runoff from the access road will be managed in accordance with the drainage hierarchy, with drainage via infiltration used preferentially.

8.2 Sustainable Drainage Systems

8.2.1 Sustainable Drainage Systems (SuDS) will be utilised across the Site, if required, to convey and/or store surface water runoff from the Proposed Development before it is discharged either via infiltration or offsite to local watercourses. The drainage system will be designed to ensure that runoff from the 1 in 100 year plus climate change storm event can be dispersed or stored safely onsite. SuDS features can also provide water quality treatment and additional biodiversity benefits. A range of potential SuDS techniques are available and are summarised in Table 5, below.

Table 5. Sustainable Drainage Systems (Suds) Options and Suitability

TYPE	DEVICE	DESCRIPTION	SUITABILITY
Source Controls	Green roof	Green roofs are systems that cover a building's roof with vegetation. They are constructed over a drainage layer, with other layers providing protection, waterproofing and insulation.	Solar farm developments would typically not have structures suitable for green roof systems
	Infiltration devices	Infiltration devices temporarily store runoff from a development and allow it to percolate into the ground.	Infiltration drainage may be suitable in areas of the Proposed Development underlain by soils and bedrock with a higher permeability. The feasibility of infiltration is subject to confirmation.
	Pervious surfaces	Pervious surfaces allow rainwater to infiltrate through the surface into an underlying storage layer, where water is stored before infiltration to the ground, reuse, or release to surface water or sewers.	Pervious surfaces may be suitable for access tracks, and hardstanding adjacent to structures, in areas of the Site underlain by soils and bedrock with a higher permeability. This would allow surface water to be filtered through the pervious layers before dispersing via infiltration.
Permeable Conveyance	Filter strips	These are wide, gently sloping areas of grass or other dense vegetation that treat runoff from adjacent impermeable areas.	Filter strips may potentially be suitable adjacent to access tracks and hardstanding within the Proposed Development.
	Swales	Swales are broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey and/or store runoff and can infiltrate the water into the ground (if ground conditions allow).	Swales are suitable for use on the Site as conveyance and for the dispersal of runoff. The feasibility of infiltration is subject to confirmation.
Passive treatment/ end of pipe treatment	Infiltration basins	Infiltration basins are depressions in the surface that are designed to store runoff and infiltrate the water to the	The underlying geology in areas of the Site may be suitable for infiltration drainage. The feasibility of infiltration is subject to confirmation.

TYPE	DEVICE	DESCRIPTION	SUITABILITY
		ground. They may also be landscaped to provide aesthetic and amenity value.	
	Detention basins	Detention basins are depressions which are designed to store runoff prior to discharge to a watercourse or sewer. They may also be landscaped to provide aesthetic and amenity value.	Detention basins are considered to be suitable within areas of open space and green infrastructure at the Site.
	Wet ponds	Wet ponds are basins that have a permanent pool of water for water quality treatment. They provide temporary storage for additional storm runoff above the permanent water level. Wet ponds may provide amenity and wildlife benefits.	Wet ponds may be suitable for use within areas of open space and green infrastructure at the Site.
	Constructed wetlands	Constructed wetlands are ponds with shallow areas and wetland vegetation to improve pollutant removal and enhance wildlife habitat.	Constructed wetlands may be suitable for use on the Site.
	Underground attenuation	Underground attenuation can be used where other forms of SuDS are not appropriate for the site. Underground attenuation stores water for volumes above the allowable discharge rate and releases the water at the restricted discharge rate.	Underground attenuation would be suitable for use on the Site.

8.2.2 The drainage strategy will be confirmed as part of the FRA accompanying the ES. This will confirm the impermeable area within the Proposed Development, the existing and post-development runoff rates and estimate the required attenuation for storm events up to and including the 1 in 100 year (plus climate change) storm event. A Surface Water Management Plan will be produced, incorporating SuDS features where feasible.

9. CONCLUSIONS

9.1.1 This FRA has been carried out in accordance with the NPPF, PPG, NPS EN-1 and updated NPS EN-3.

9.1.2 The proposed Solar Array Area, Cable Route Corridor and access road will be located within Flood Zones 1, 2 and 3. The vulnerability class of the Proposed Development is Essential Infrastructure. Table 3 of the PPG indicates that such developments are suitable for sites within Flood Zone 3a if confirmed, with the Exception Test, that benefits to the community to outweigh the risk of flooding, and that the development and surrounding area will be safe from flooding. As the Proposed Development will provide a source of renewable energy to the National Grid, this will provide significant benefit to the UK, and it is considered that this benefit outweighs the flood risk.

9.1.3 The risk of flooding to the Proposed Development from fluvial, surface water, groundwater and artificial sources varies across the Site. Eastern areas of the Site and southern portions of the Cable Route Corridor are located within Flood Zone 3 (i.e. High risk). These areas are also at risk of reservoir flooding. Areas of the development are also at high risk of surface water flooding with overland flow pathways extending through central areas of the Solar Array Area and sections of the access road and Cable Route Corridor. Western areas of the Site may also be susceptible to groundwater flooding.

9.1.4 With the exception of the solar panels, the majority of structures within the Solar Array Area will be outside of Flood Zone 3. The impact solar panels have on floodplain storage is minimal and it is considered that the Proposed Development will not increase the risk of fluvial flooding to areas downstream of the Site. This will be confirmed with detailed fluvial flood level modelling as part of future works.

9.1.5 It is not currently proposed to modify existing ground levels and therefore, there will be minimal impact on existing overland flow pathways. The cable route and proposed access road will not impede fluvial and surface water flood pathways. If any increased risk is later identified, appropriate mitigation measures will be put in place (e.g. floodplain compensation).

9.1.6 There will be a negligible increase in impermeable ground at the Site as a result of the Proposed Development. The management of surface water runoff will ensure that flood risk from the Site is not increased as a result of the Proposed Development. Any offsite discharges of surface water will be restricted to Greenfield runoff rates for all storm events up to an including the 1 in 100 year plus climate change return period. SuDS will be utilised within the site to provide conveyance and storage for surface water runoff, as well as water quality treatment and enhancing biodiversity. The findings of this assessment, which has been based on the data available at the PEIR stage, confirm that from a flood risk perspective, the Site is likely to be suitable for the Proposed Development subject to appropriate mitigation measures. Full confirmation of the level of flood risk will be provided within the Environmental Statement following further assessment and modelling. Appropriate mitigation measures will then be determined.

Appendices

Appendix 1. Anglian Water CON29DW Drainage and Water Enquiry report

Version 1.0 September 2021

Order Reference:G2716261-1
Produced on:03 February 2022

CON29DW Commercial Plus Drainage and Water Enquiry

The information in this document refers to:

Land at
Howell
Sleaford
NG34 9PT

This document was ordered by:

InfoTrack Limited
Orion Gate
1st Floor Guildford Road
Woking
GU22 7NJ

Customer reference: 21746868

This document was produced by: Geodesys, Osprey House, 1 Percy Road, Huntingdon, Cambs, PE29 6SZ. For any queries relating to this report please contact our customer services team on 0800 085 8050, quoting order reference: G2716261-1.

Interpretation of Drainage and Water Search

Appendix 1 of this report contains definitions of terms and expressions.

Enquiries and Responses

The records were searched by Jay Cooney (Anglian Water Services Limited trading as Geodesys) who has no, nor is likely to have, any personal or business relationship with any person involved in the sale of the property.

The report was completed by Jay Cooney (Anglian Water Services Limited trading as Geodesys) who has no, nor is likely to have, any personal or business relationship with any person involved in the sale of the property.

This was requested on 26 January 2022 and completed on 03 February 2022

Geodesys, has a robust and uniformly efficient complaints process. Formal complaints and queries can be made, by telephone on 0800 085 8050, in writing to Geodesys, Osprey House, 1 Percy Road, Huntingdon, Cambs, PE29 6SZ or by e-mail to customer.services@geodesys.com

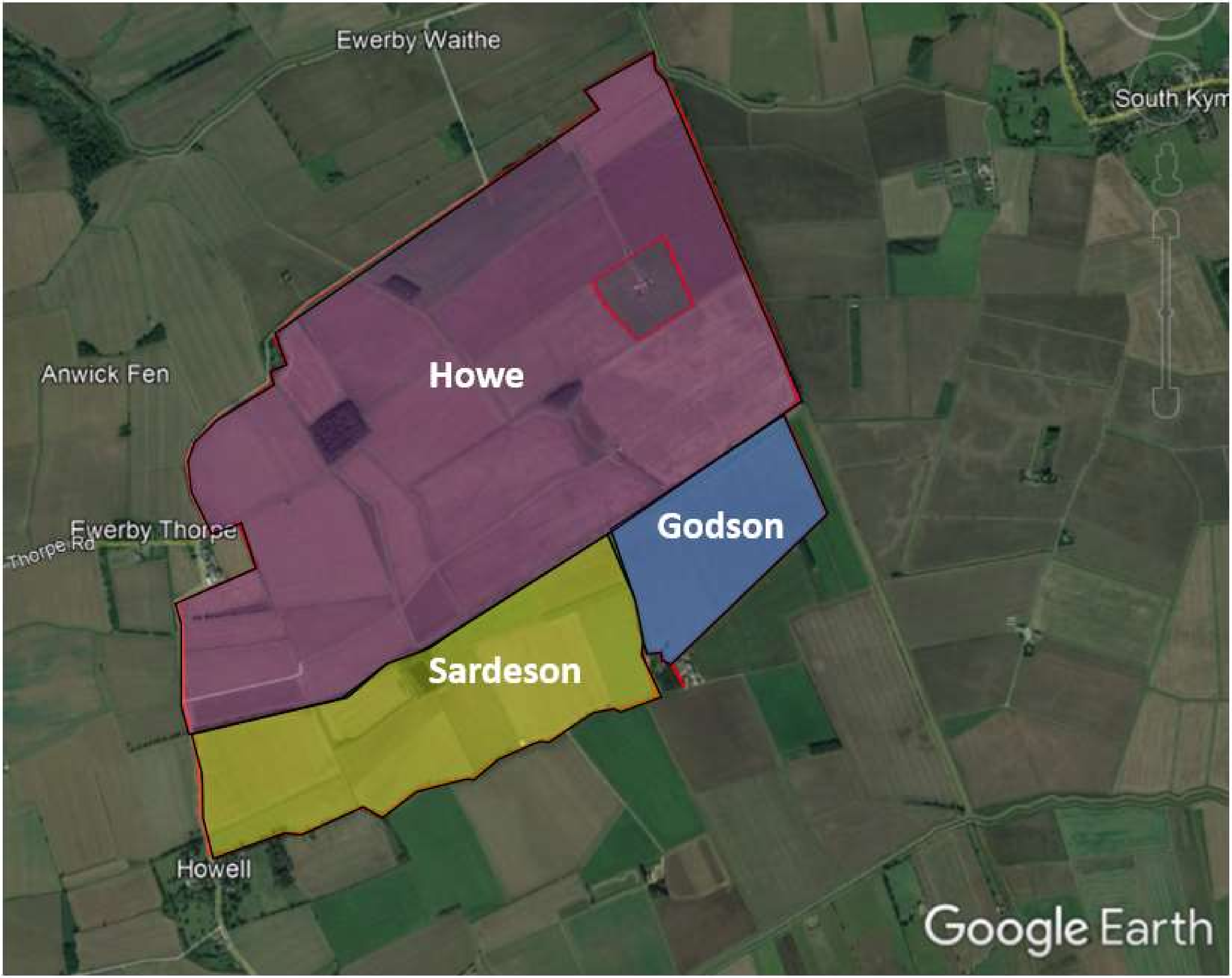
Our standard terms and conditions for Commercial Drainage and Water Enquiries apply to this report. They are included in this search and are available on our website.

On 1 October 2011 ownership of private sewers and lateral drains changed in accordance with The WaterIndustry (schemes for Adoption of Private Sewers) Regulations 2011. The contents of this search may not reflect these changes. Please visit www.anglianwater.co.uk/sewerswitchover for more details.

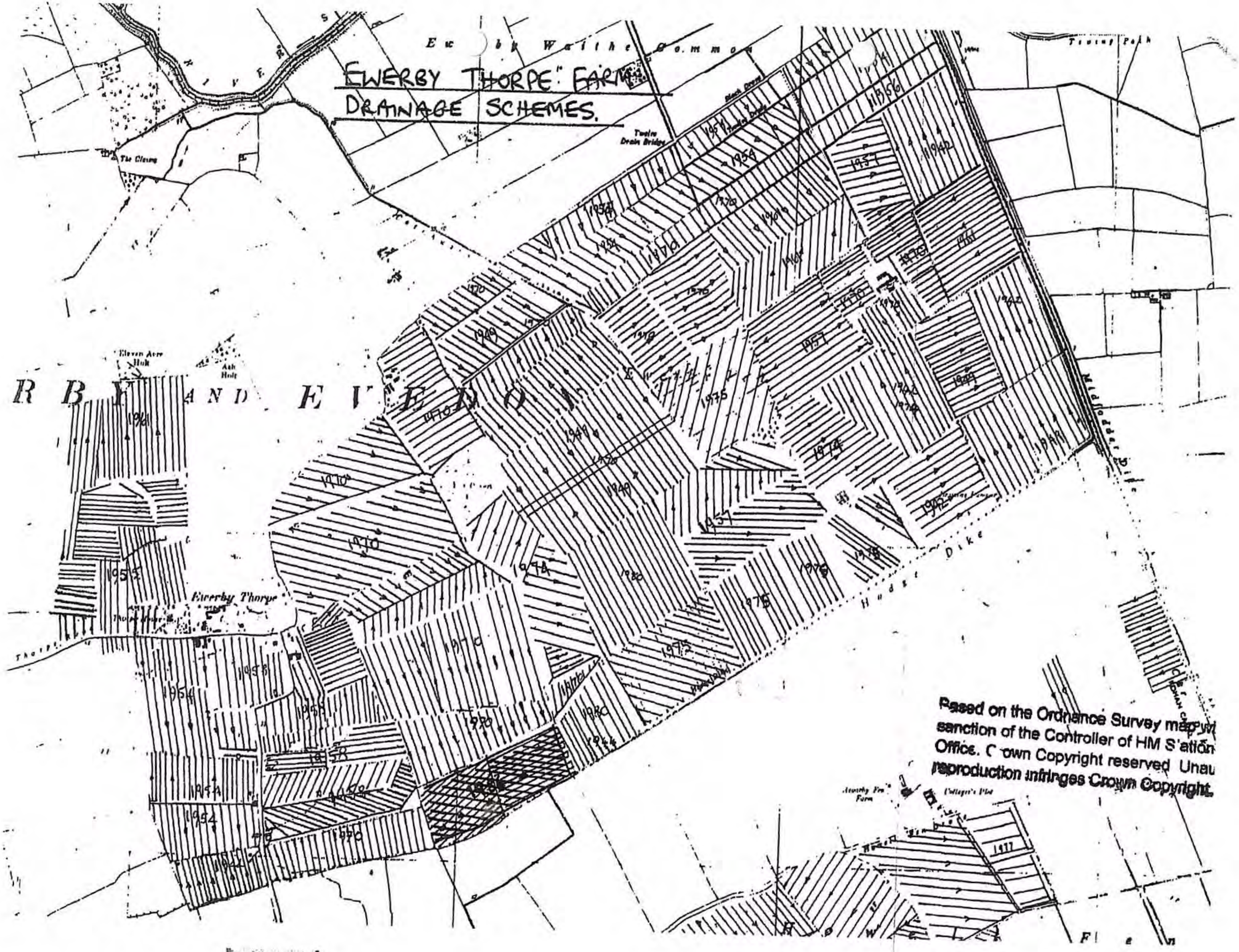
Summary of Responses

Question		Answer
1.1	Where relevant, please include a copy of an extract from the public sewer map	**Not Included**
1.2	Where relevant, please include a copy of an extract from the map of waterworks	**Map Included**
2.1	Does foul water from the property drain to a public sewer?	**Land/Plot**
2.2	Does surface water from the property drain to a public sewer?	**Land/Plot**
2.3	Is a surface water drainage charge payable?	**See Details**
2.4	Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundaries of the property?	**No**
2.4.1	Does the public sewer map indicate any public pumping station or any other ancillary apparatus within the boundaries of the property?	**No**
2.5	Does the public sewer map indicate any public sewer within 30.48 metres (100 feet) of any buildings within the property?	**No**
2.5.1	Does the public sewer map indicate any pumping station or any other ancillary apparatus within 50 metres of any buildings within the property?	**No**
2.6	Are any sewers or lateral drains serving or which are proposed to serve the property the subject of an existing adoption agreement or an application for such an agreement?	**Land/Plot**
2.7	Has a Sewerage Undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?	**Not Applicable**
2.8	Is any building which is or forms part of the property, at risk of internal flooding due to overloaded public sewers?	**No**
2.9	Please state the distance from the property to the nearest boundary of the nearest sewage treatment works	**See Details**
3.1	Is the property connected to mains water supply?	**Land/Plot**
3.2	Are there any water mains, resource mains or discharge pipes within the boundaries of the property?	**Yes**
3.3	Is any water main or service pipe serving, or which is proposed to serve the property, the subject of an existing adoption agreement or an application for such an agreement?	**No**
3.4	Is this property at risk of receiving low water pressure or flow?	**No**
3.5	What is the classification of the water supply for the property?	**See Details**
3.6	Is there a meter installed at the property?	**Land/Plot**
3.7	Please include details of the location of any water meter serving the property	**See Details**
4.1.1	Who is responsible for providing the sewerage services for the property?	**Anglian Water Services Limited**
4.1.2	Who is responsible for providing the water services for the property?	**Anglian Water Services Limited**
4.2	Who bills the property for sewerage services?	**See Details**
4.3	Who bills the property for water services?	**See Details**
5.1	Is there Consent, on this property, to discharge Trade Effluent under S118 of the Water Industry Act (1991) into the public sewerage system?	**No**
6.1	Is there a wayleave/easement agreement giving the Water and/or Sewerage Undertaker the right to lay or maintain assets or right of access to pass through private land in order to reach the Company's assets?	**No**
6.2	On the copy extract from the public sewer map please show manhole cover, depth, and invert levels where the information is available.	**See attached where applicable**

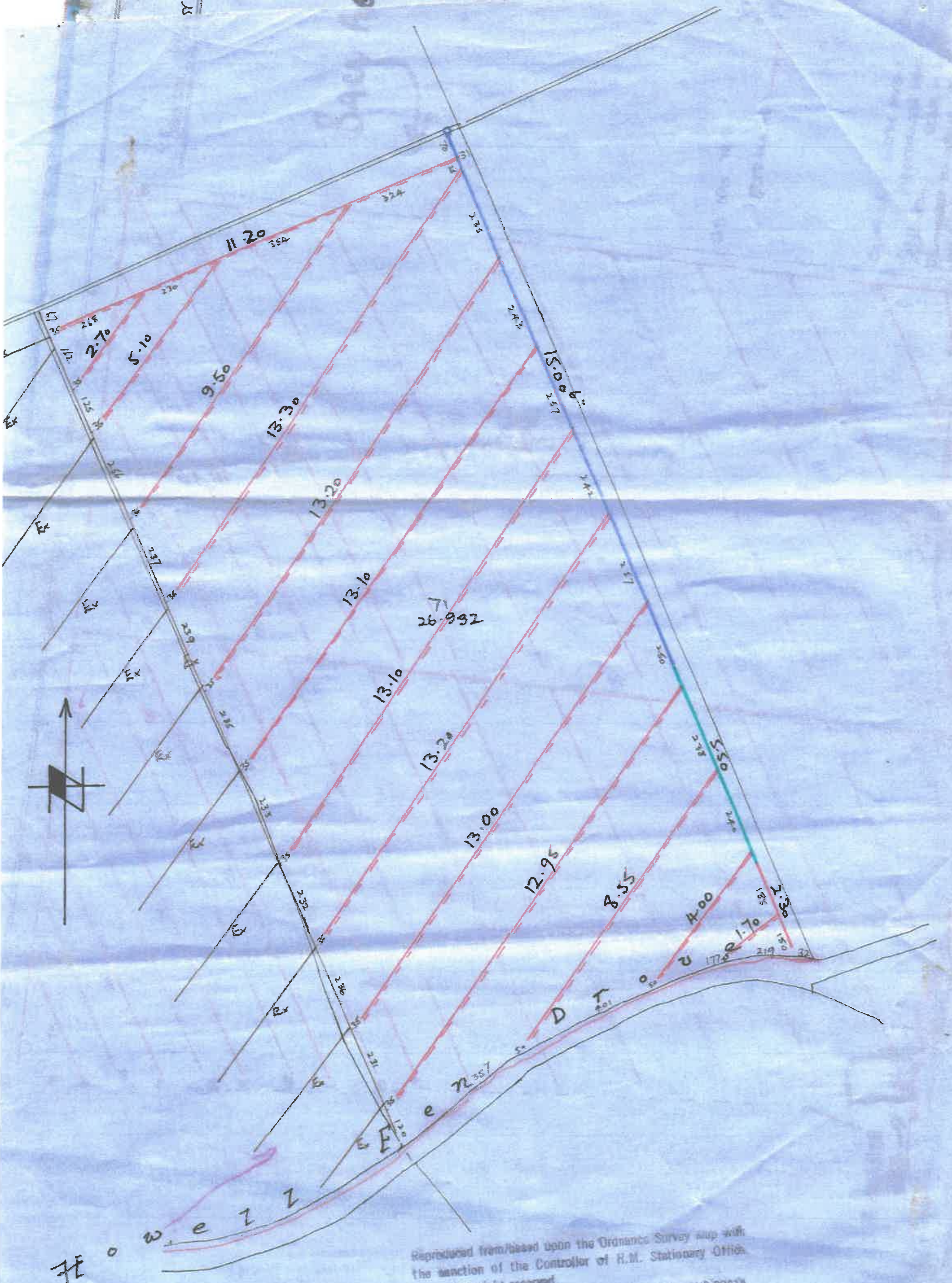
Appendix 2. Existing Drainage Plan



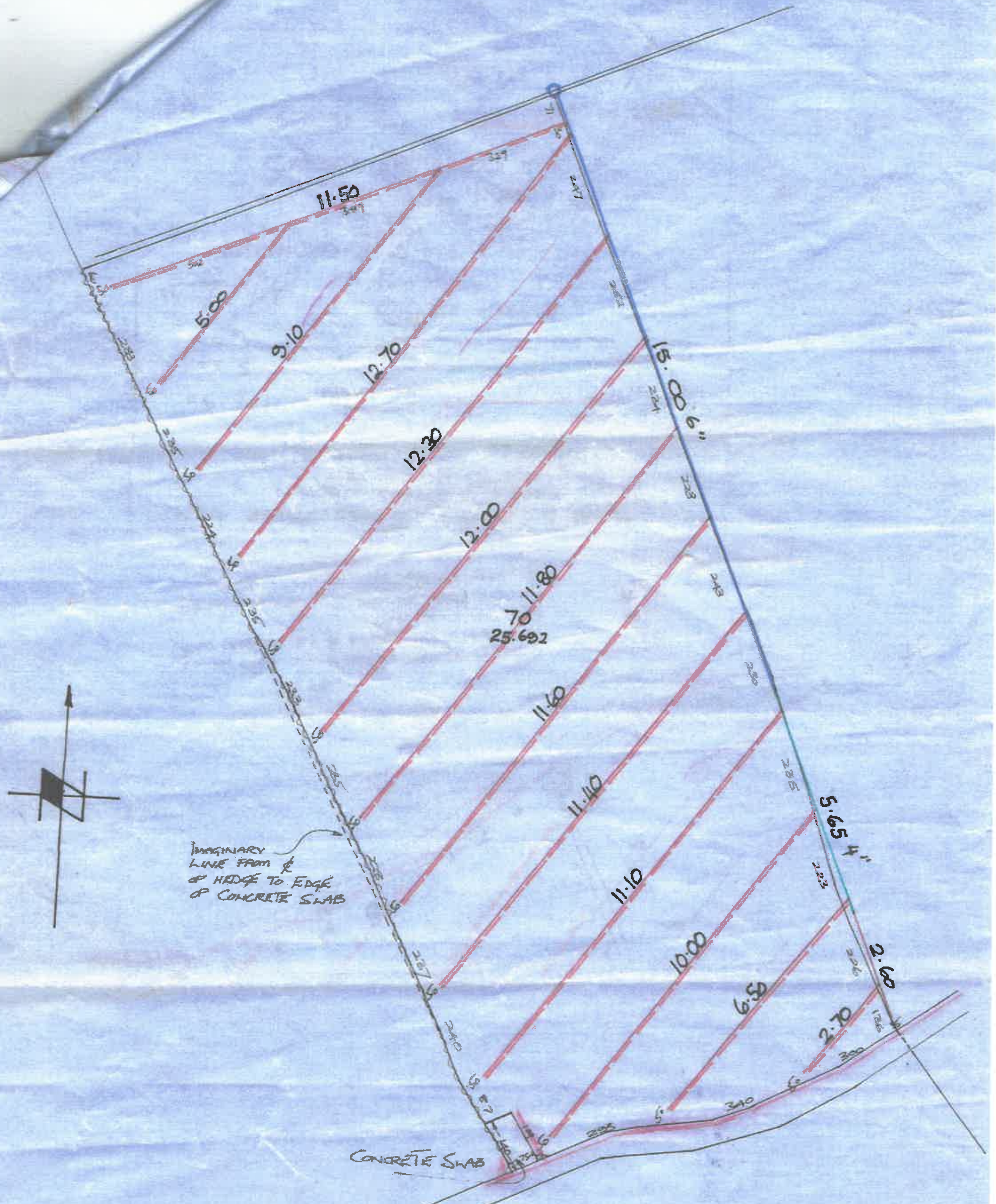
Ewerby Waithe
South Kym
Anwick Fen
Howe
Ewerby Thorpe
Thorpe Rd
Godson
Sardeson
Howell
Google Earth


EWERBY THORPE" FARM
DRAINAGE SCHEMES.
Ewerby Waithe Common
Twelve Drain Bridge
Ewerby Thorpe
Eleven Acre Holt
Ash Holt
Hodge Dike
Howell Fen


Godson Land drainage
Clay tiles installed in 1950's or 60's
Runs to nothern drain
At 2 chain intervals
Precise locations not known but potential indicative layout shown
Legend
Hodge Dike
Car Dyke
Car Dyke
Fen Farm
Google Earth
N
500 m



MESSRS C. SANDERSON & SONS. MANOR FARM.


11.50
5.00
9.10
12.70
12.30
12.00
11.80
70
25.692
11.60
11.40
11.10
10.00
6.50
2.70
15.00 6"
5.65 4"
2.60
IMAGINARY LINE FROM ℄ OF HEDGE TO EDGE OF CONCRETE SLAB
CONCRETE SLAB

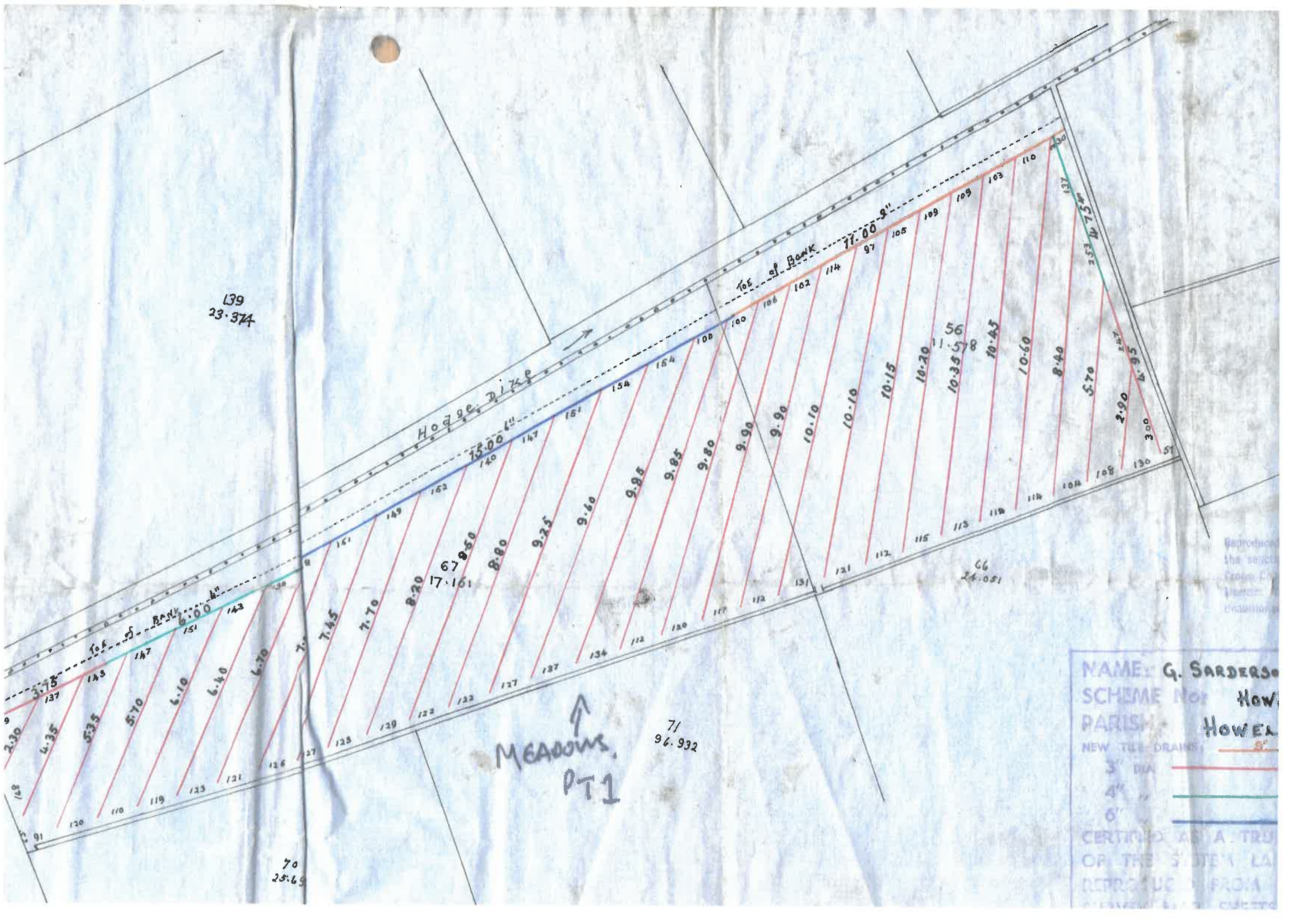
J. Sardeson, Manor Farm, Howell, Sleaford.

BARN FIELD.

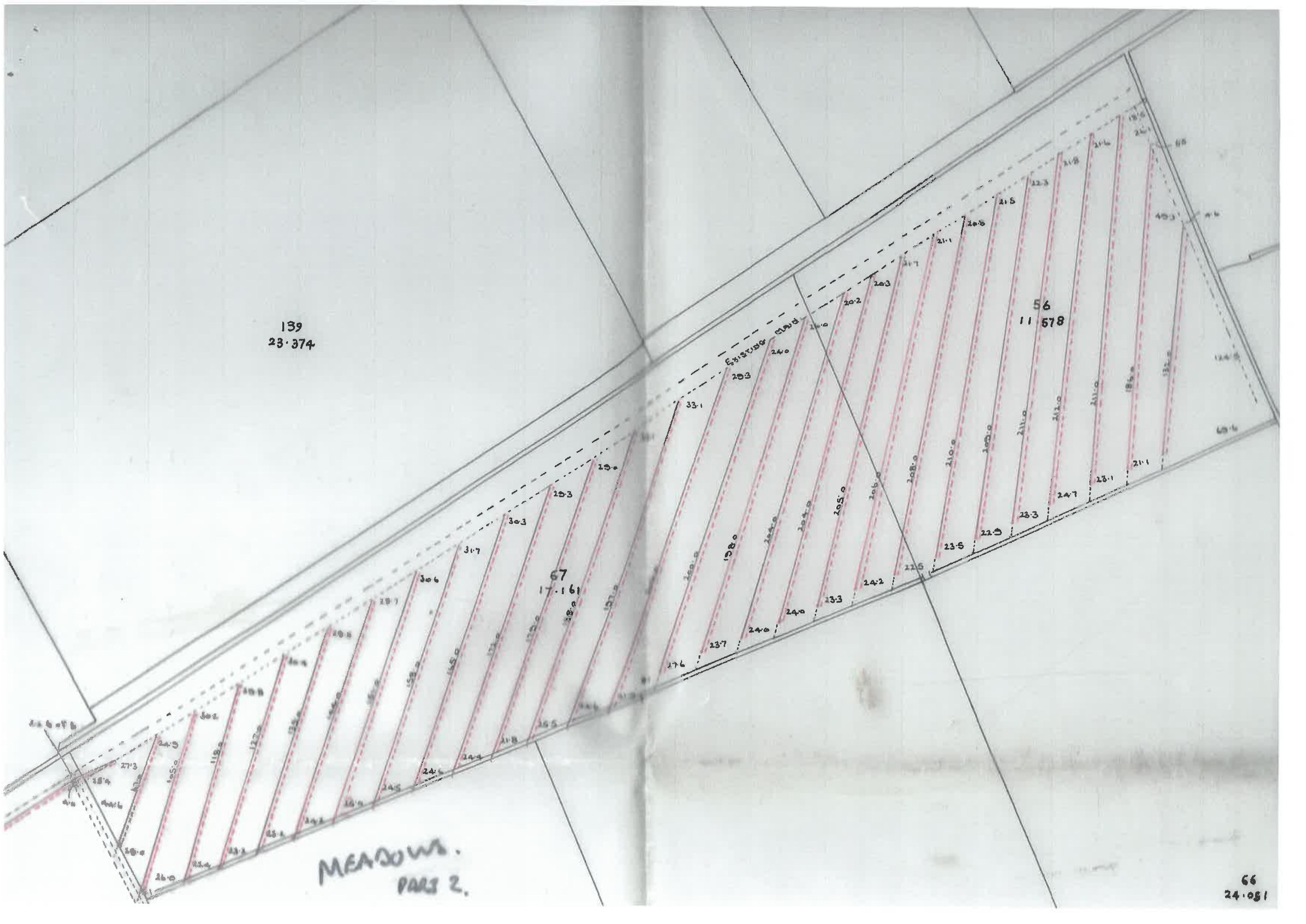
O.S. Nos. 70, 71. Parish Howell

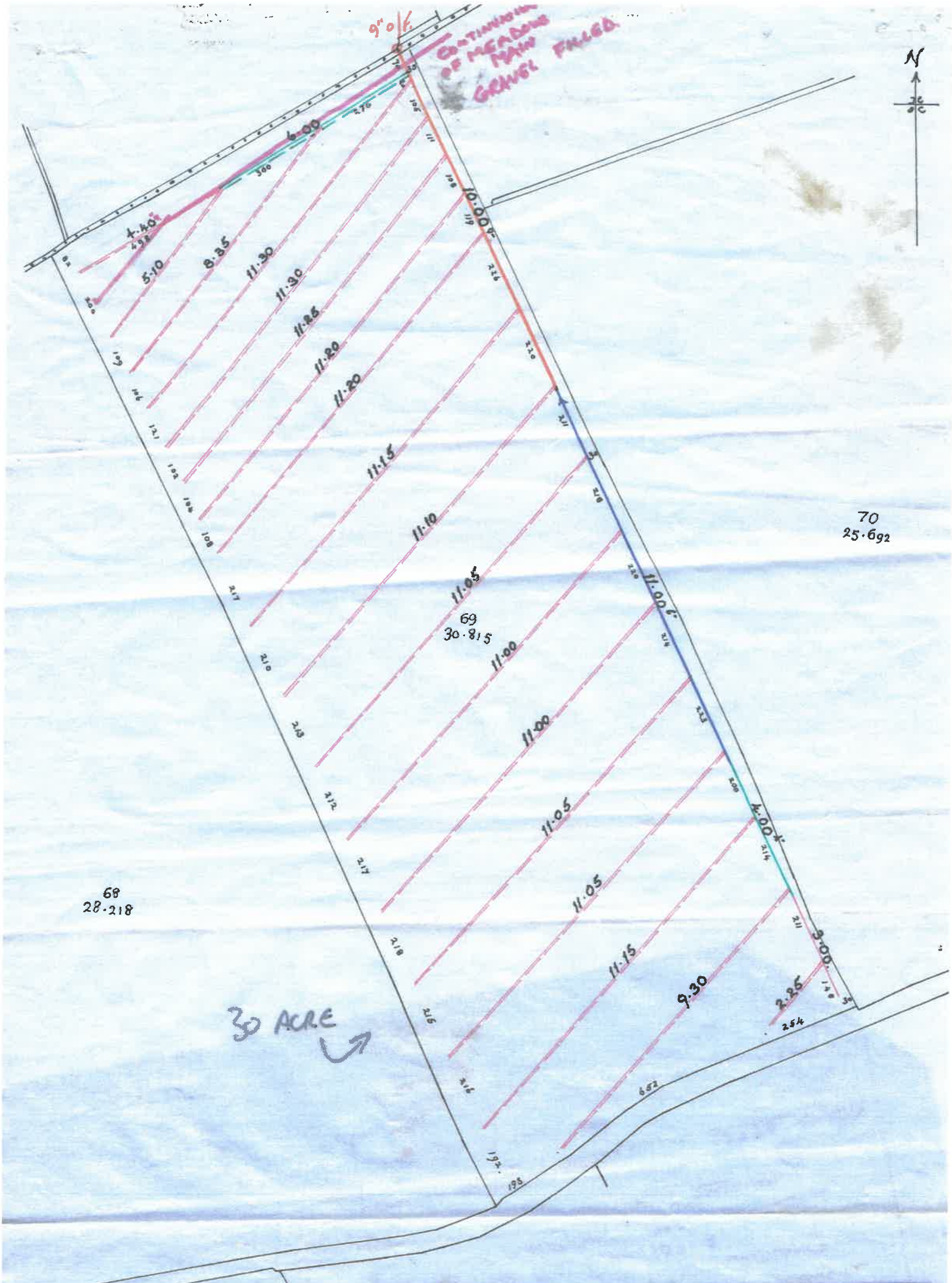
1559 metres — 3" clay Pipes

Certified as a true record of the system laid down
Reproduced from O.S. Sheets 107.2.
Scale – 1:2500
[signature]
Permeable to within 15" from surface 1559 metres.
Measured in metres Crown Copyright Reserved.

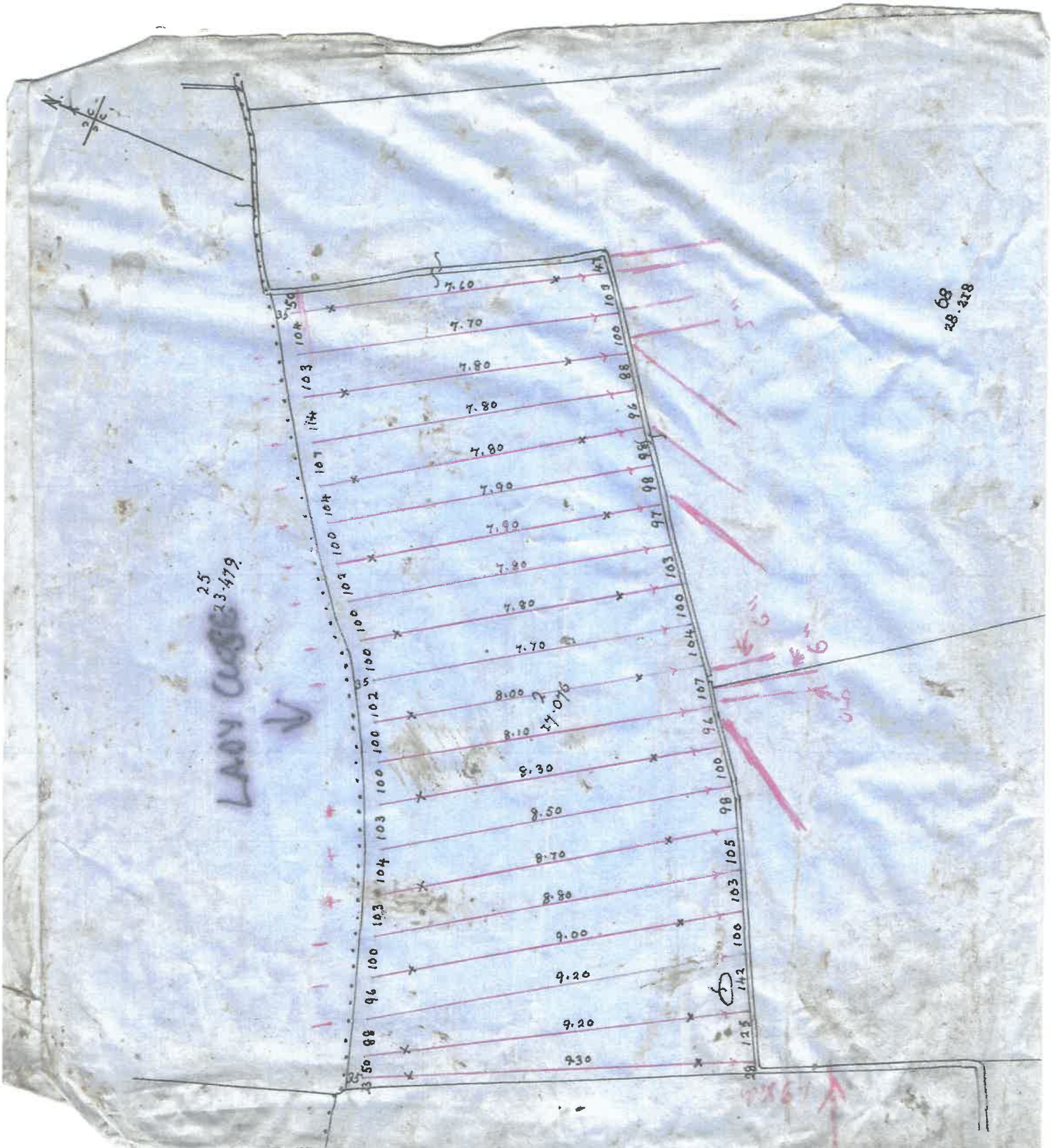


Hodge Dike
Top of Bank
11.00 9"
15.00 6"
6.00 4"
4.75 4"
56
11.578
67
17.161
66
24.051
139
23.374
71
96.932
70
25.69
MEADOWS. PT 1
NAME: G. SARDERSO
SCHEME No: HOW
PARISH: HOWEL
NEW TILE DRAINS
3" DIA
4" "
6" "
CERTIFIED AS A TRU
OF THE SYSTEM LA
REPRODUCED FROM

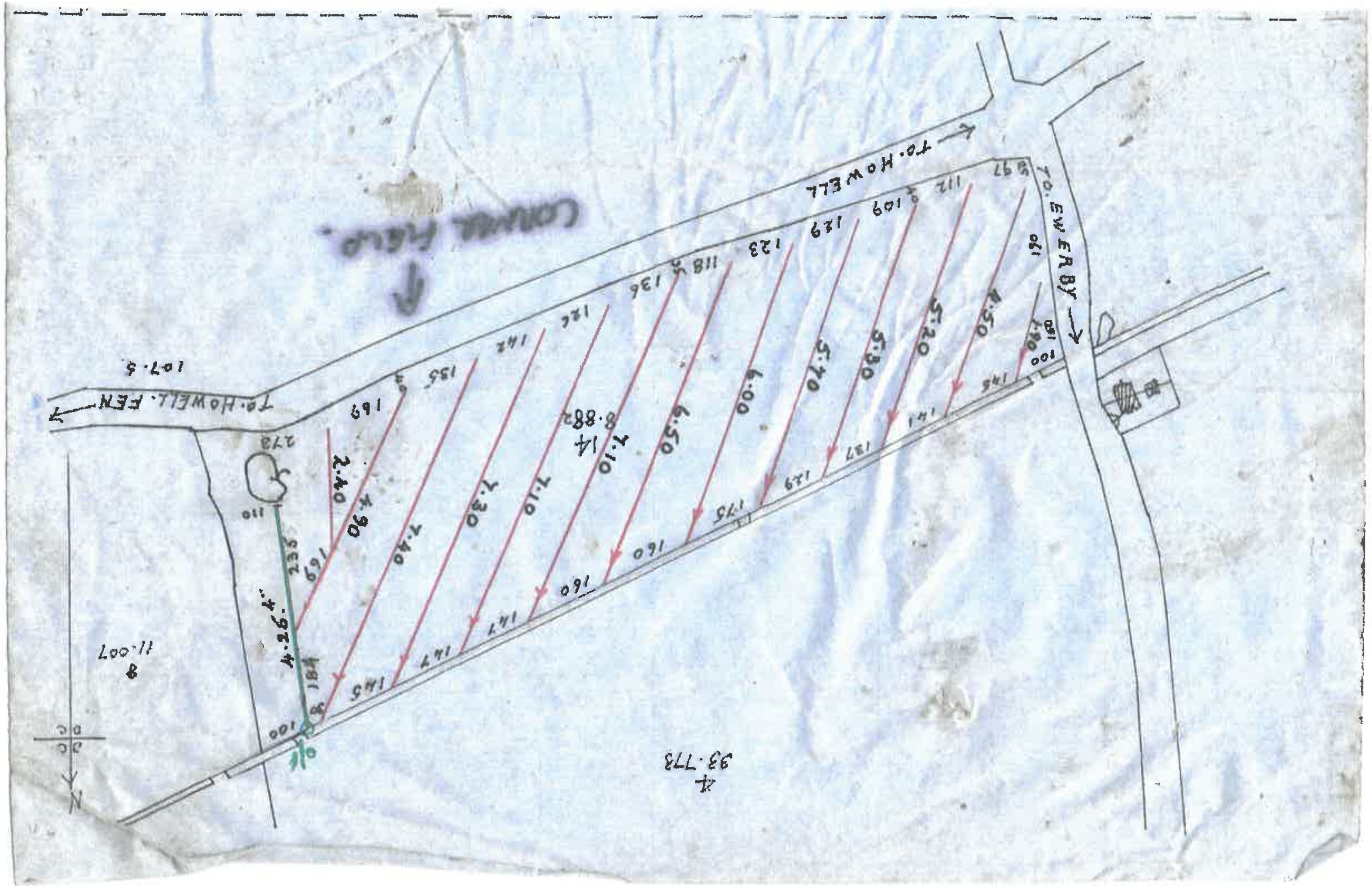

139
23·374
56
11·578
67
17·161
66
24·051
EXISTING MAIN
MEADOWS.
PART 2.



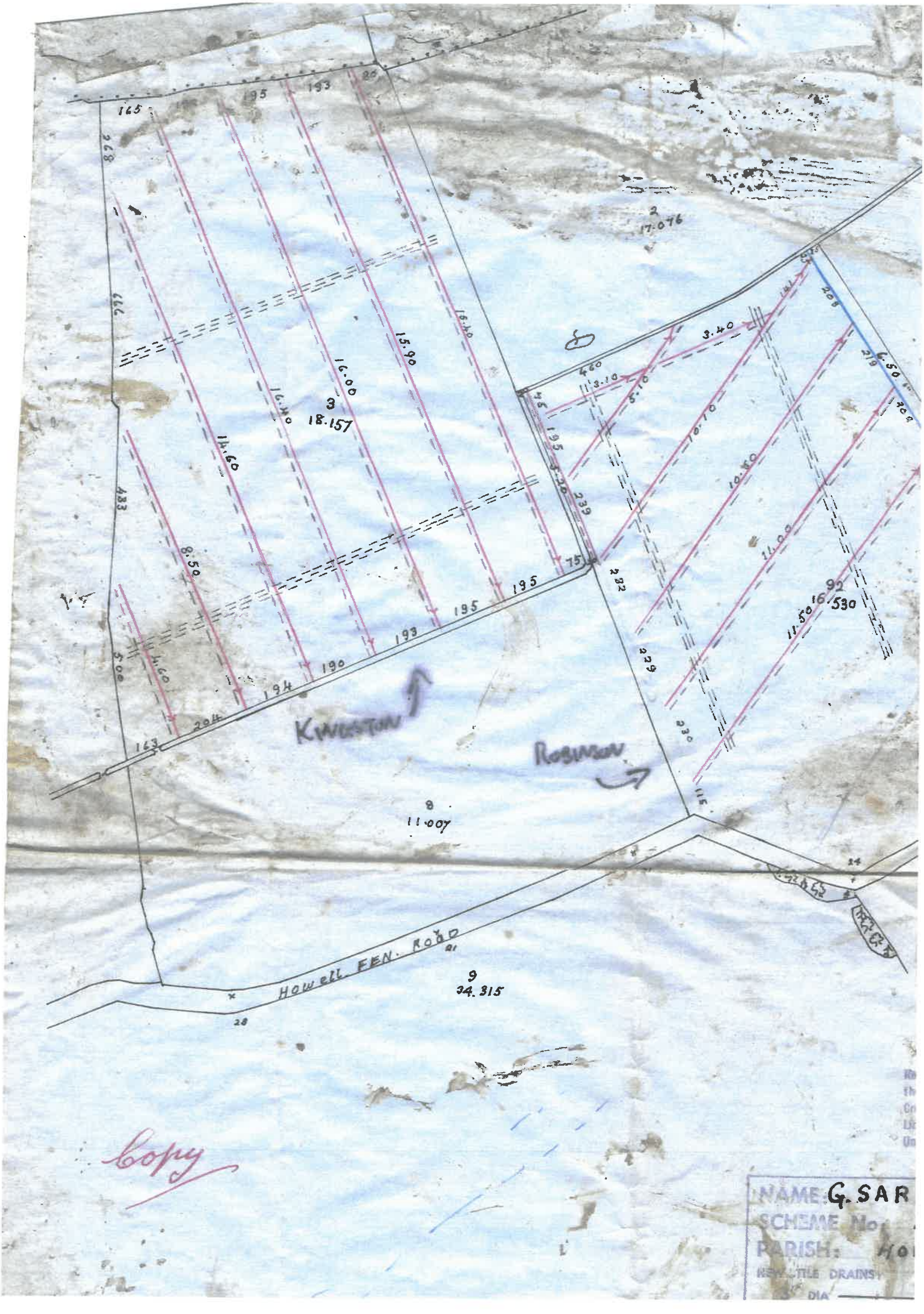
NAME: G. Sardeson & Son. – Manor Farm.
SCHEME No: Howell Sleaford.



LADY CLOSE
25
23.479
68
28.218
17.076
7.60
7.70
7.80
7.80
7.80
7.90
7.90
7.80
7.80
7.70
8.00
8.10
8.30
8.50
8.70
8.80
9.00
9.20
9.20
9.30



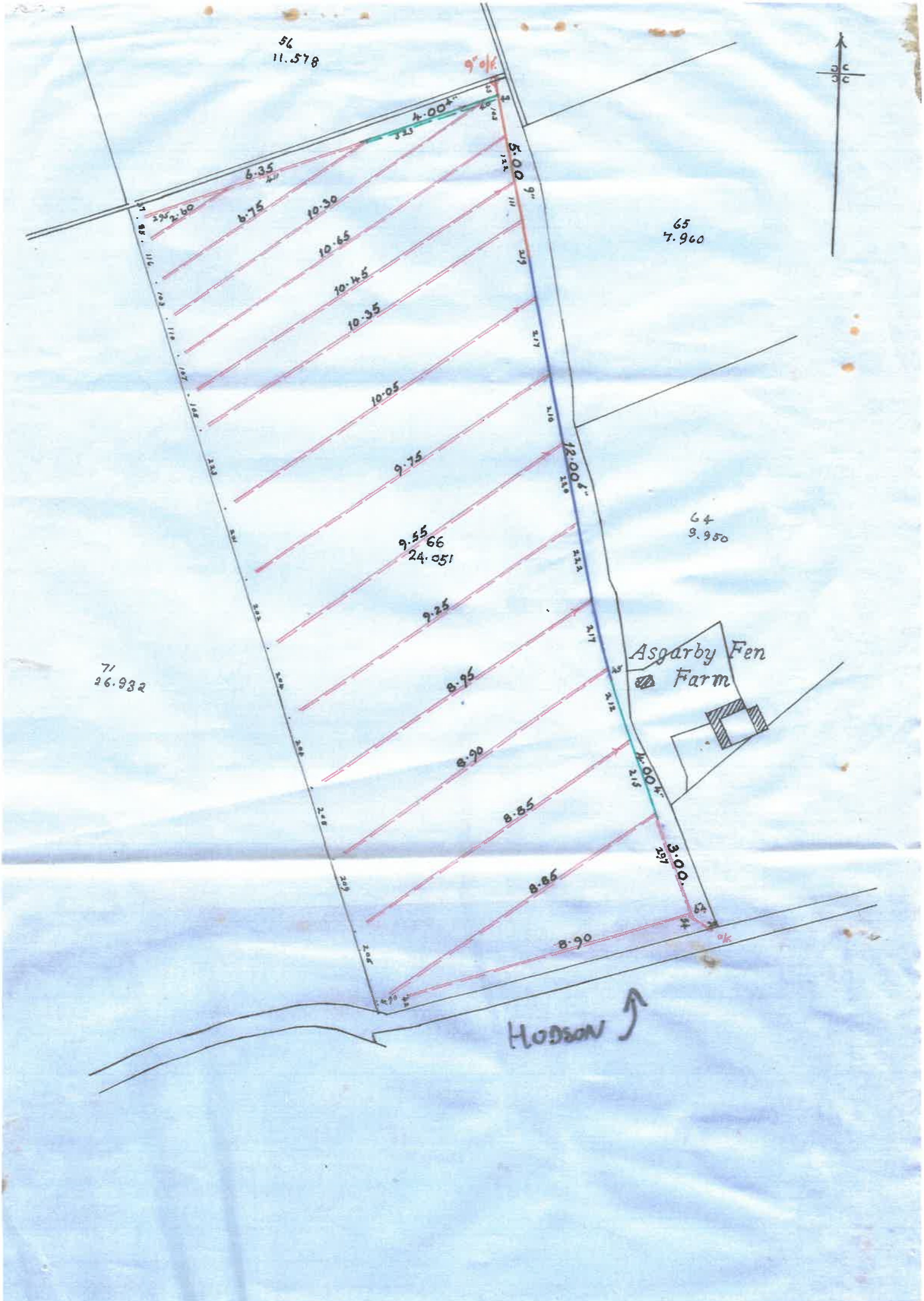
TO. HOWELL. FEN
TO. HOWELL
TO. EWERBY
CORNER FIELD.
14
8.882
4
33.773
8
11.007
107.5
4.26.4"
7.40
7.30
7.10
7.10
6.50
6.00
5.70
5.30
5.20
4.50
4.90
2.40



Howell Fen. Road
9
34.315
8
11.007
3
18.157
2
17.076
92
16.530
Kingston
Robinson
Copy
NAME: G. SAR
SCHEME No.
PARISH: Ho
NEW TILE DRAINS
DIA

TITLE J. SARDESON RSA.
O.S. Nos. 68. 92.
Plastic Drains
52mm. chains
— 60 " 225·5 "
70 " "
80 " "
100 " "
110 " "
Certified as a true record of
Reproduced from O.
Scale – 1:25
Permeable to within 15" fro
P.F. 6" over pipe 1.3 ch
Measured in feet Crow


NAME: G. SARDESON. & SON. MANOR. FARM.
PINFOLD
24
15·071
4
33·773
14
8·382
3
18·157
6
23·536
17
·767
19
·153
B.M. 248
B.M. 29 0
G.P.



56
11.578
9" o/k.
4.00 6"
6.35
2.60
6.75
10.30
10.65
10.45
10.35
10.05
9.75
9.55
66
24.051
9.25
8.95
8.90
8.85
8.65
8.90
5.00 9"
12.00 6"
4.00 6"
3.00
o/k
65
7.960
64
9.950
71
26.932
Asgarby Fen
Farm
HODSON

Appendix 3. Environment Agency Modelled Flood Levels

Environment Agency

Holly McIntosh
hmcintosh@wardell-armstrong.com

Our ref: CCN-2023-317303

Date: 17/07/2023

Dear Holly

Provision of Flood Risk Information for Bicker Fen, Lincolnshire

Thank you for your request for our flood risk information for the above site. The information is set out below and attached. It is important you read any contextual notes on the maps provided.

If you are preparing a Flood Risk Assessment (FRA) for this site, please note this information may not be sufficient by itself to produce an adequate FRA to demonstrate the development is safe over its lifetime. Additional information may be required to carry out an appropriate assessment of all risk, such as consequence of a breach in defences.

We aim to review our information on a regular basis, so if you are using this data more than twelve months from the date of this letter, please contact us again to check it is still valid.

Please read the letter in full as the information covered has been updated in **June 2023.**

1. Flood Map for Planning

The attached map includes the current Flood Map for Planning for your area. The map indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

In some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defences, water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow depths and could leave pockets of locally slightly higher land as isolated dry islands. It is important to understand the actual risk of the flooding to these dry islands, particularly in the event of defence failure.

The Flood Map for Planning also shows the location of formal raised flood defences and flood storage reservoirs. It represents areas at risk of flooding for present day only and does not take account of climate change.

The Flood Map for Planning only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered flooding may occur from other sources such as surface water sewers, road drainage, etc.

The Flood Map has been supplied at a 1:10,000 scale and also at a 1:35,000 scale in order to show the main river channel and node points.

2. Recorded Flood Outlines

With regards to the history of flooding I can advise we do not have any records of flooding in this area. It is possible recent flooding may have occurred which we are currently investigating, therefore this information may be subject to change. It is possible other flooding may have occurred which other risk management authorities, such as the Lead Local Flood Authority (ie top tier council) or Internal Drainage Board (where they exist) have responsibility.

3. Schemes in the area

There are no ongoing capital projects to reduce or sustain the current flood risk to this site.

4. Fluvial Flood Risk Information

This site is considered to be at risk of flooding from main rivers.

The site may also be at risk from local ordinary watercourses for which other risk management authorities, such as the Lead Local Flood Authority (ie top tier council) or Internal Drainage Board (where they exist) have responsibility.

4.1 Fluvial Defence Information

The existing fluvial defences reducing the risk of flooding from Kyme Eau to this site consist of earth embankments. They are in fair condition and reduce the risk of flooding (at the defence) to a 1% (1 in 100) chance of occurring in any year. We inspect these defences routinely to ensure potential defects are identified.

The existing fluvial defences reducing the risk of flooding from Midfodder Dyke to this site consist of earth embankments and concrete floodwalls. They are in fair condition and reduce the risk of flooding (at the defence) to a 2% (1 in 50) chance of occurring in any year. We inspect these defences routinely to ensure potential defects are identified.

The existing fluvial defences reducing the risk of flooding from Heckington Edu to this site consist of earth embankments. They are in fair condition and reduce the risk of flooding (at the defence) to a 1% (1 in 100) chance of occurring in any year. We inspect these defences routinely to ensure potential defects are identified.

There are no formal flood defences reducing the risk of flooding to this site from Hodge Dyke.

Refer to paragraph 3 for details of any ongoing capital projects to reduce the flood risk to this site.

4.2 Fluvial Modelled Levels and Flows

Available modelled fluvial flood levels and flows for the model nodes shown on the attached map are set out in the data table attached. This data is taken from the model named on the data table, which is the most up-to-date model currently available.

Please note these levels are "in-channel" levels and therefore may not represent the flood level on the floodplain, particularly where the channel is embanked or has raised defences.

Our models may not have the most up to date climate change allowances. In time we will update our models for the latest allowances. You should refer to 'Flood risk assessments: climate change allowances' to check if the allowances modelled are appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

4.3 Fluvial Modelled Flood Extents

Please find attached a map showing available modelled flood extents, taking into account flood defences, for your area. This data is taken from the model named on the map, which is the most up-to-date model currently available.

In some cases the flood extents shown may not be from main river, but may be from other sources such as IDB lowland drainage networks.

4.4 Fluvial Hazard Mapping

For certain locations we have carried out modelling to map the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from overtopping and / or breaching of defences at specific locations for a number of scenarios.

At present this information is available for fluvial flood risk in Northampton, Lincoln, Wainfleet and some isolated rural locations.

The number of locations we have this information for is expected to increase in time.

At present this site is not covered by any fluvial hazard mapping.

5. Tidal Flood Risk Information

Whilst the site is within a tidal flood zone, ie assuming no tidal defences exist, it is not at risk of tidal flooding in either a overtopping or breaching of defences scenario, today or with an allowance for climate change.

6. Development Planning

If you would like local guidance on preparing a flood risk assessment for a planning application, please contact our Sustainable Places team at LNplanning@environment-agency.gov.uk. It will help if you mention this data request and attach your site location plan.

We provide free preliminary advice; additional/detailed advice, review of draft FRAs and meetings are chargeable at a rate set to cover our costs, currently £100 (plus VAT) per hour of staff time. Further details are available on our website at https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals.

General advice on flood risk assessment for planning applications can be found on GOV.UK at https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

Climate change will increase flood risk due to overtopping of defences. Please note, unless specified otherwise, the climate change data included has an allowance for 20% increase in flow. Updated guidance on how climate change could affect flood risk to new development - ‘Flood risk assessments: climate change allowances’ was published on GOV.UK in **July 2021**. The appropriate updated climate change allowance should be applied in a Flood Risk Assessment.

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

7. Data Licence and Other Supporting Information

We respond to requests for recorded information we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

This information is provided in accordance with the Open Government Licence which can be found here: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Further information on flood risk can be found on the GOV.UK website at: https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

8. Other Flood Risk Management Authorities

The information provided with this letter relates to flood risk from main river or the sea. The Flood Map for Surface Water can be viewed at https://www.gov.uk/check-long-term-flood-risk

Additional information may be available from other risk management authorities, such as the Lead Local Flood Authority (ie top tier council) or Internal Drainage Board (where they exist).

I hope we have correctly interpreted your request. If you have any queries or would like to discuss the content of this letter further please contact Jacob Lowe using the email address below and quoting our CCN reference number above.

Yours sincerely,

Jacob Lowe
Tel: 07788 596786

for Ian Cappitt
Witham Partnerships and Strategic Overview Team Leader
e-mail PSOLINCS@environment-agency.gov.uk

Enc.
Flood Map for Planning
Modelled Node Points Map
Modelled Fluvial Levels and Flows Data Sheet
Modelled Flood Extent Maps

Flood Map for Planning centred on TF1472048139 - created July 2023 [Ref: CCN-2023-317303]

Environment Agency

Scale 1:10,000

N
W E
S

Legend

- Main River
- Raised Defences
- Flood Storage Areas
- Areas at Risk of Flooding from Rivers or The Sea
- Extreme Flood Outline

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.

- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Flood Map for Planning with Nodes centred on TF1472048139 - created July 2023 [Ref: CCN-2023-317303]

Environment Agency

Scale 1:35,000

N W E S

Legend

- Modelled_Nodes
- Main River
- Raised Defences
- Flood Storage Areas
- Areas at Risk of Flooding from Rivers or The Sea
- Extreme Flood Outline

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.

- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

			Annual Exceedance Probability - Maximum Water Levels (mODN)											
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	4% (1 in 25)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
KE_07650!	516752	349656	3.72	3.88	3.90	3.93	3.93	3.94	3.94	3.94	3.95	3.95	3.98	4.07
KE_09720	515133	350248	3.77	3.93	3.96	3.99	4.00	4.00	4.00	4.01	4.01	4.01	4.07	4.23
KE_12000	513100	349360	3.81	3.96	4.01	4.04	4.04	4.05	4.05	4.05	4.06	4.06	4.13	4.34

Fluvial Flood Flows (m^3/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m^3/s).

			Annual Exceedance Probability - Maximum Flows (m^3/s)											
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	4% (1 in 25)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
KE_07650!	516752	349656	5.97	7.96	8.82	8.84	8.86	9.05	9.11	9.14	9.30	9.22	9.98	11.79
KE_09720	515133	350248	5.73	7.96	8.70	8.75	8.77	8.96	9.03	9.06	9.18	9.13	9.95	12.33
KE_12000	513100	349360	5.74	7.94	8.60	8.67	8.69	8.89	8.98	9.25	9.50	9.42	10.17	12.31

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

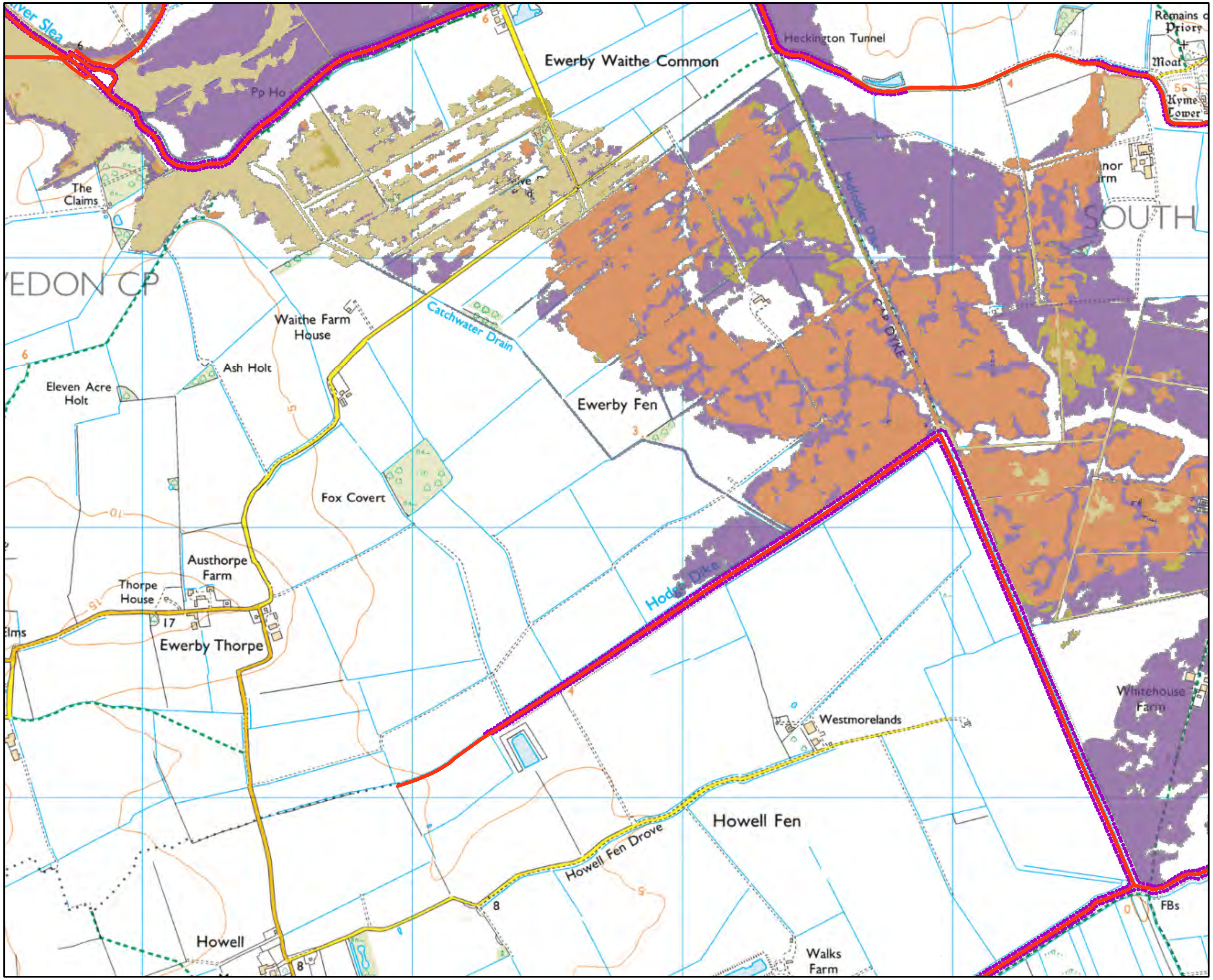
			Annual Exceedance Probability - Maximum Water Levels (mODN)										
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
HK109108d	516683	346670	2.18	2.54	2.63	2.64	2.73	2.78	2.80	2.85	2.85	3.00	3.09
HO101835d	515967	348320	2.19	2.55	2.63	2.64	2.73	2.78	2.80	2.85	2.85	3.00	3.09
HO103000	514981	347695	2.19	2.55	2.63	2.64	2.74	2.78	2.80	2.85	2.85	3.00	3.09
MD101000	516277	347602	2.18	2.54	2.63	2.64	2.73	2.78	2.80	2.85	2.85	3.00	3.09
HK110198	515744	346102	2.19	2.54	2.64	2.65	2.74	2.78	2.80	2.85	2.85	3.02	3.12
HK112000	514238	345212	2.19	2.55	2.65	2.67	2.80	2.86	2.89	2.99	2.99	3.34	3.54

Fluvial Flood Flows (m^3/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m^3/s).

			Annual Exceedance Probability - Maximum Flows (m^3/s)									
Node Label	**Easting**	**Northing**	**50% (1 in 2)**	**20% (1 in 5)**	**10% (1 in 10)**	**5% (1 in 20)**	**2% (1 in 50)**	**1.33% (1 in 75)**	**1% (1 in 100)**	**1% (1 in 100) inc 20% Climate Change**	**0.5% (1 in 200)**	**0.1% (1 in 1000)**	**0.1% (1 in 1000) inc 20% Climate Change**
HK109108d	516683	346670	2.78	4.16	4.83	5.17	6.29	7.21	7.60	9.02	8.97	13.78	16.75
HO101835d	515967	348320	1.47	2.63	3.19	3.24	3.30	2.71	2.65	3.06	3.06	4.35	5.08
HO103000	514981	347695	0.89	1.19	1.56	1.98	2.47	2.81	2.91	3.42	3.42	4.82	5.60
MD101000	516277	347602	1.78	2.51	3.54	3.55	3.62	2.69	2.58	3.01	2.97	3.94	4.67
HK110198	515744	346102	1.29	2.39	3.23	3.85	4.89	5.59	5.95	7.07	7.01	10.64	12.67
HK112000	514238	345212	1.43	2.58	3.40	4.01	5.08	5.81	6.19	7.35	7.30	10.93	12.95

Modelled Flood Extents (with defences) Model: Lower Witham 2009 [CCN-2023-317303]



Environment Agency

Scale 1:20,000

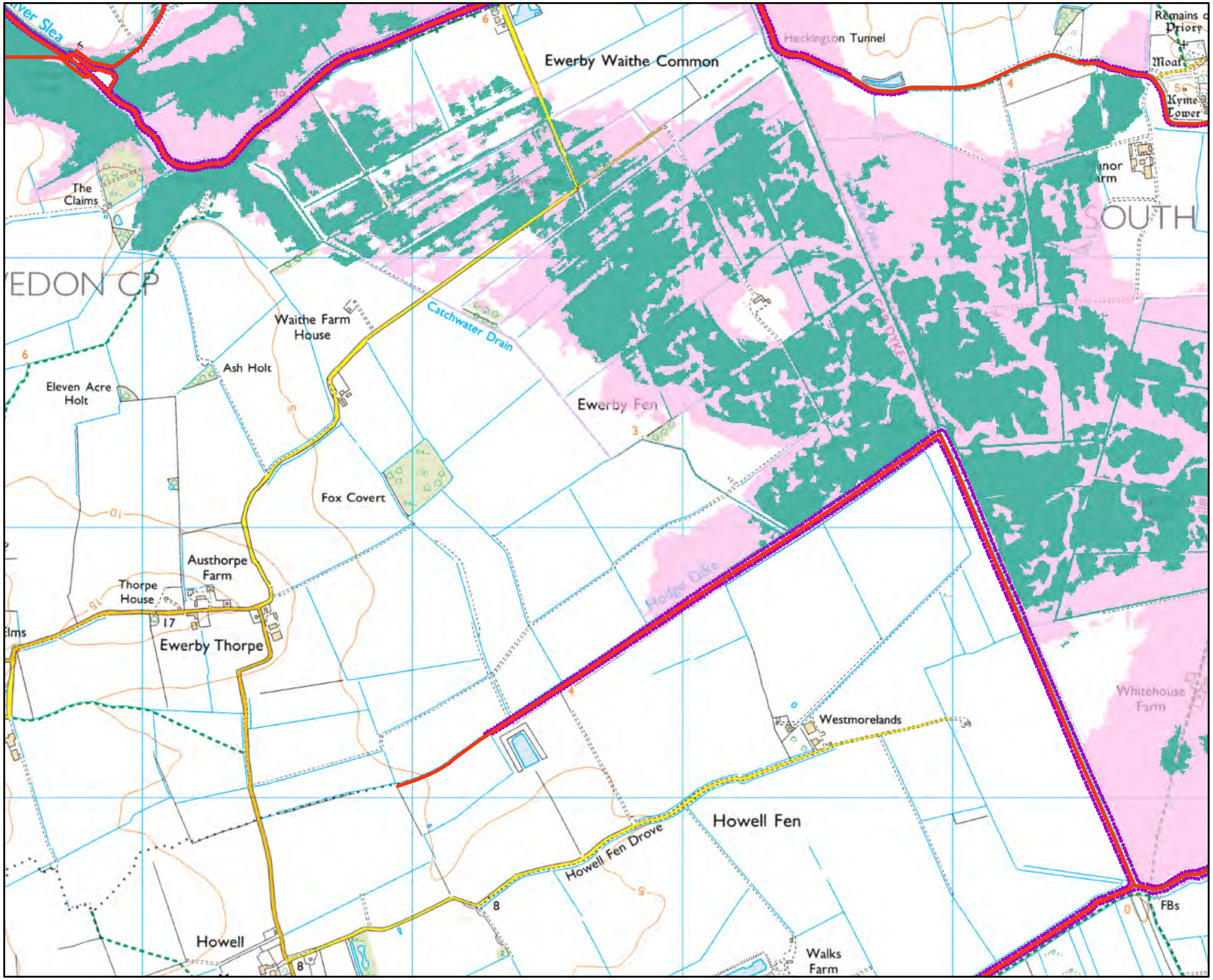
N
W E
S

Legend

- Main River
- Raised Defences
- Flood Storage Areas
- 2009_LW_Defended_Baseline_1in25
- 2009_LW_Defended_Baseline_1in50
- 2009_LW_Defended_Baseline_1in100
- 2009_LW_Defended_Baseline_1in1000

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Modelled Flood Extents Climate Change (with defences) Model: Lower Witham 2009 [CCN-2023-317303]



Environment Agency

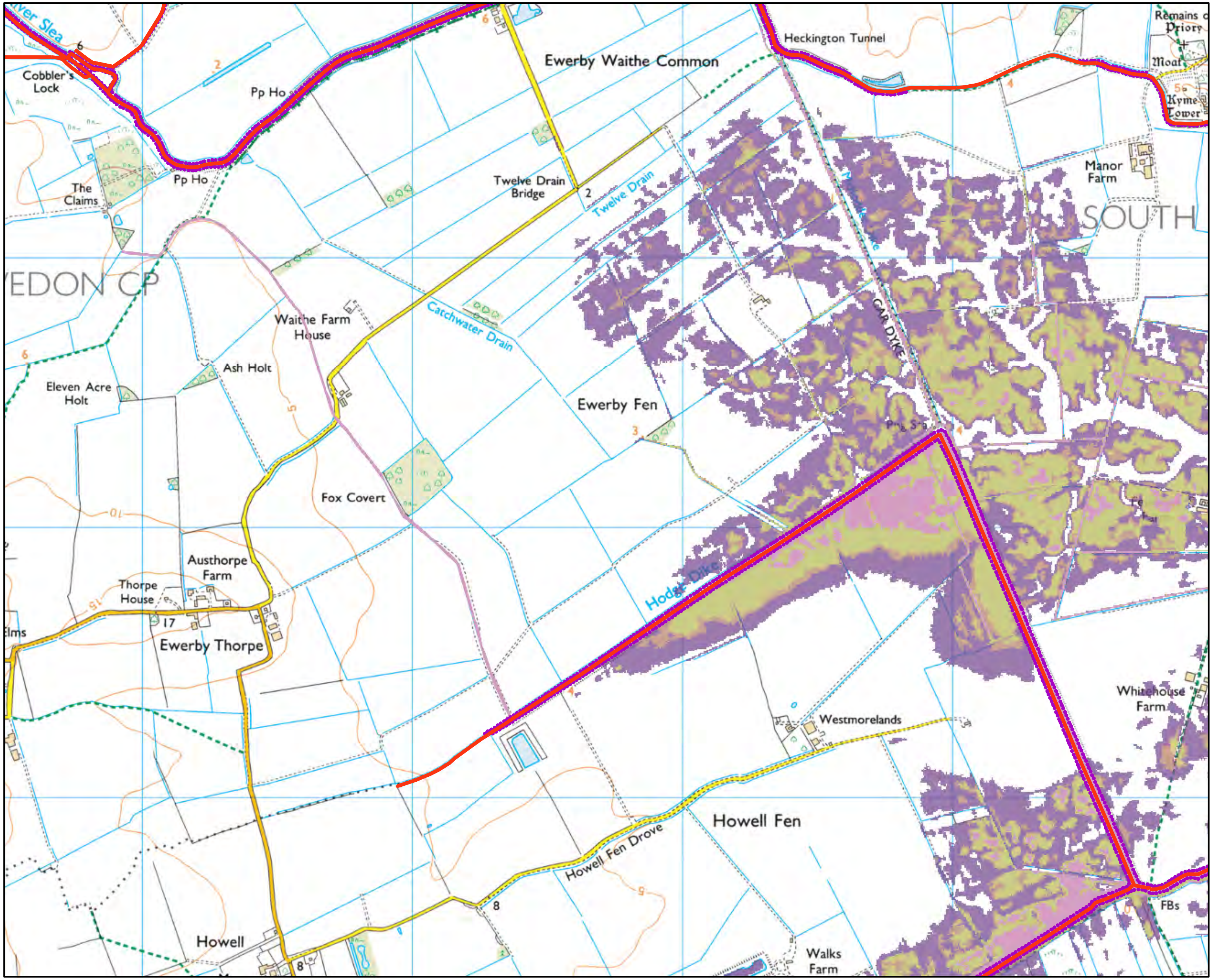
Scale 1:20,000

N W E S

Legend

- Main River
- Raised Defences
- Flood Storage Areas
- 2009_LW_Defended_Baseline_1in100_CC20pc
- 2009_LW_Defended_Baseline_1in1000_CC20pc

Modelled Flood Extents (with defences) Model: South Forty Foot 2016 [CCN-2023-317303]



Environment Agency

Scale 1:20,000

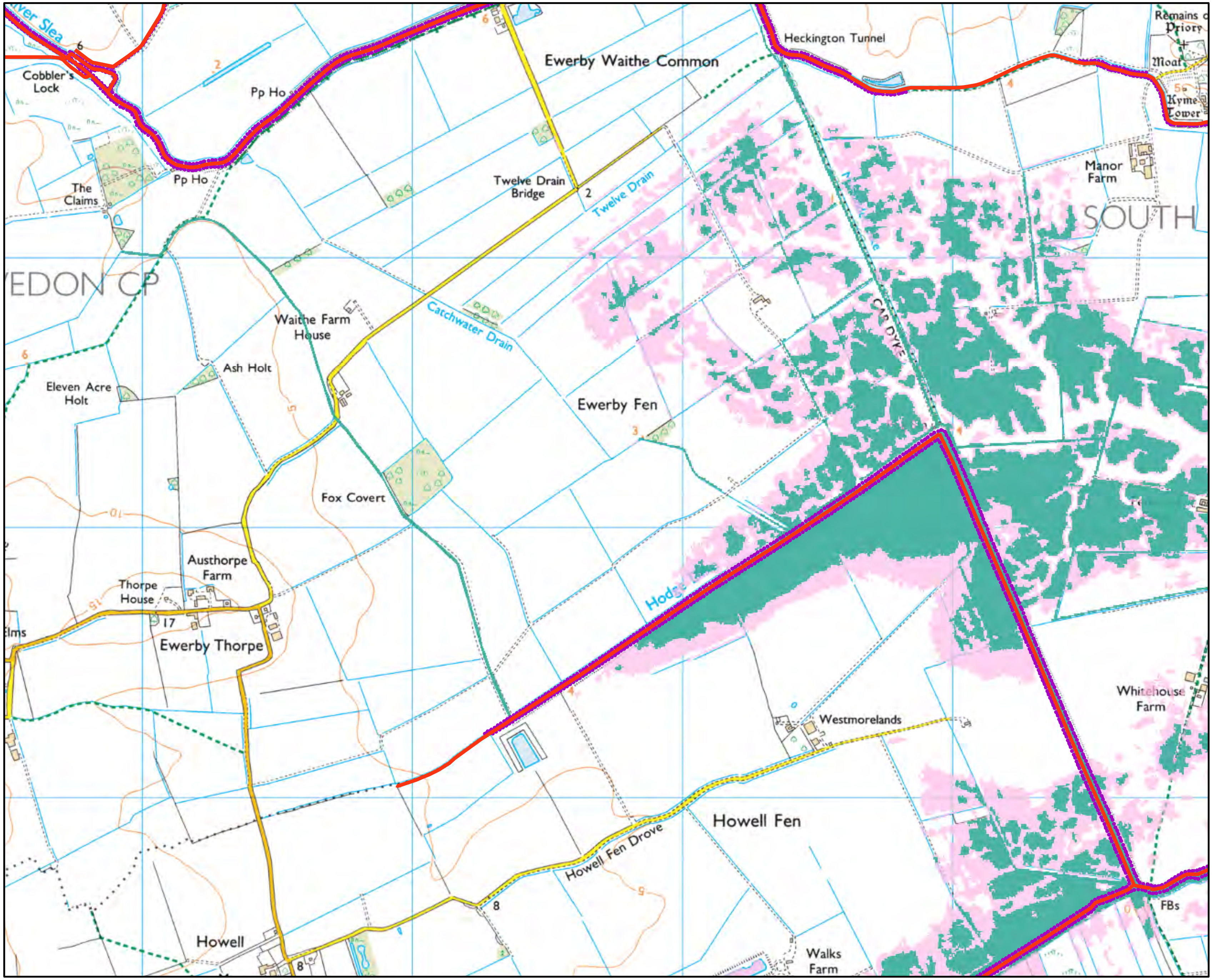
N W E S

Legend

Main River
Raised Defences
Flood Storage Areas
2016_SFFC_Defended_Baseline_1in10
2016_SFFC_Defended_Baseline_1in50
2016_SFFC_Defended_Baseline_1in100
2016_SFFC_Defended_Baseline_1in1000

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Modelled Flood Extents Climate Change (with defences) Model: South Forty Foot 2016 [CCN-2023-317303]



Environment Agency

Scale 1:20,000

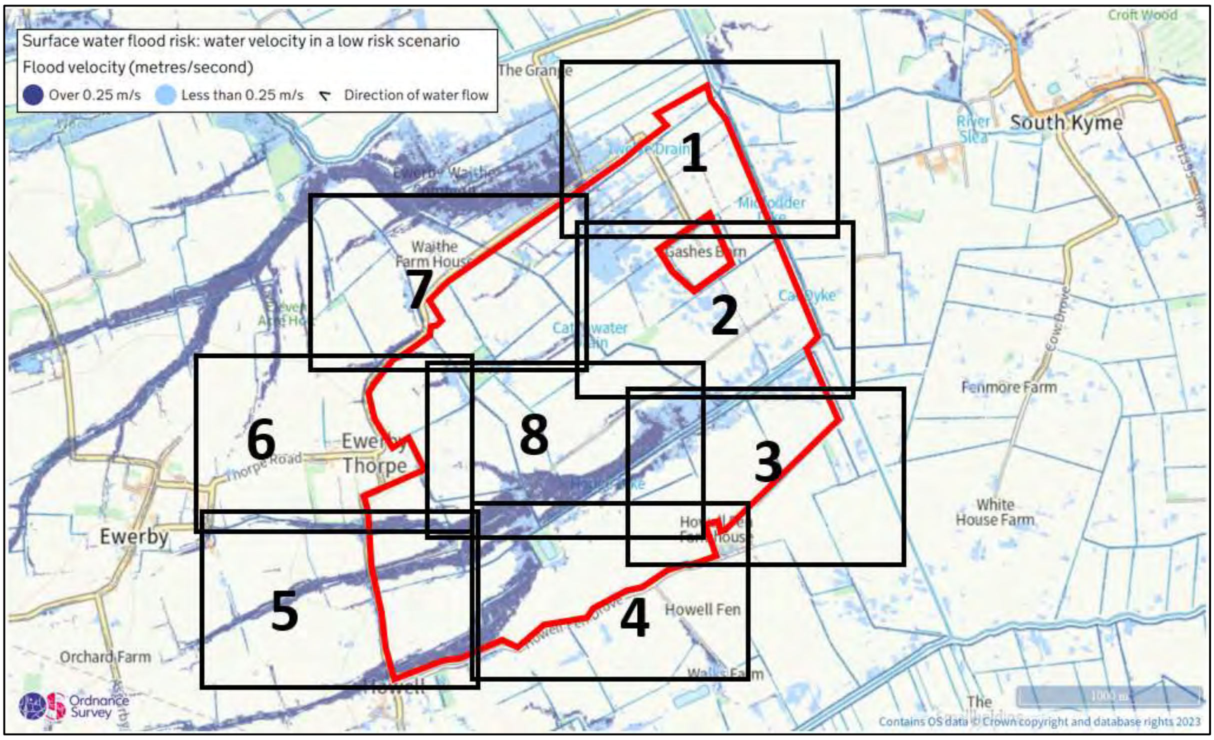
N W E S

Legend

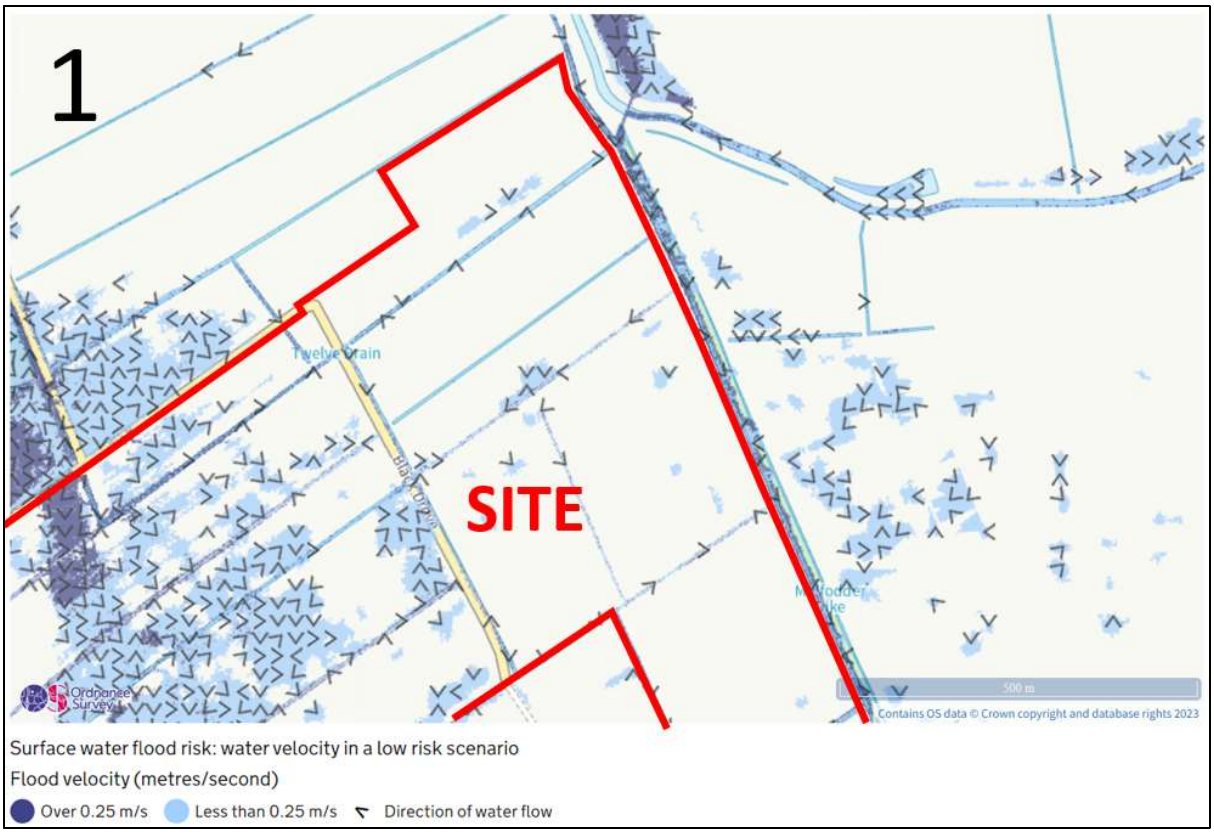
- Main River
- Raised Defences
- Flood Storage Areas
- 2016_SFFC_Defended_Baseline_1in100_CC20pc
- 2016_SFFC_Defended_Baseline_1in1000_CC20pc

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

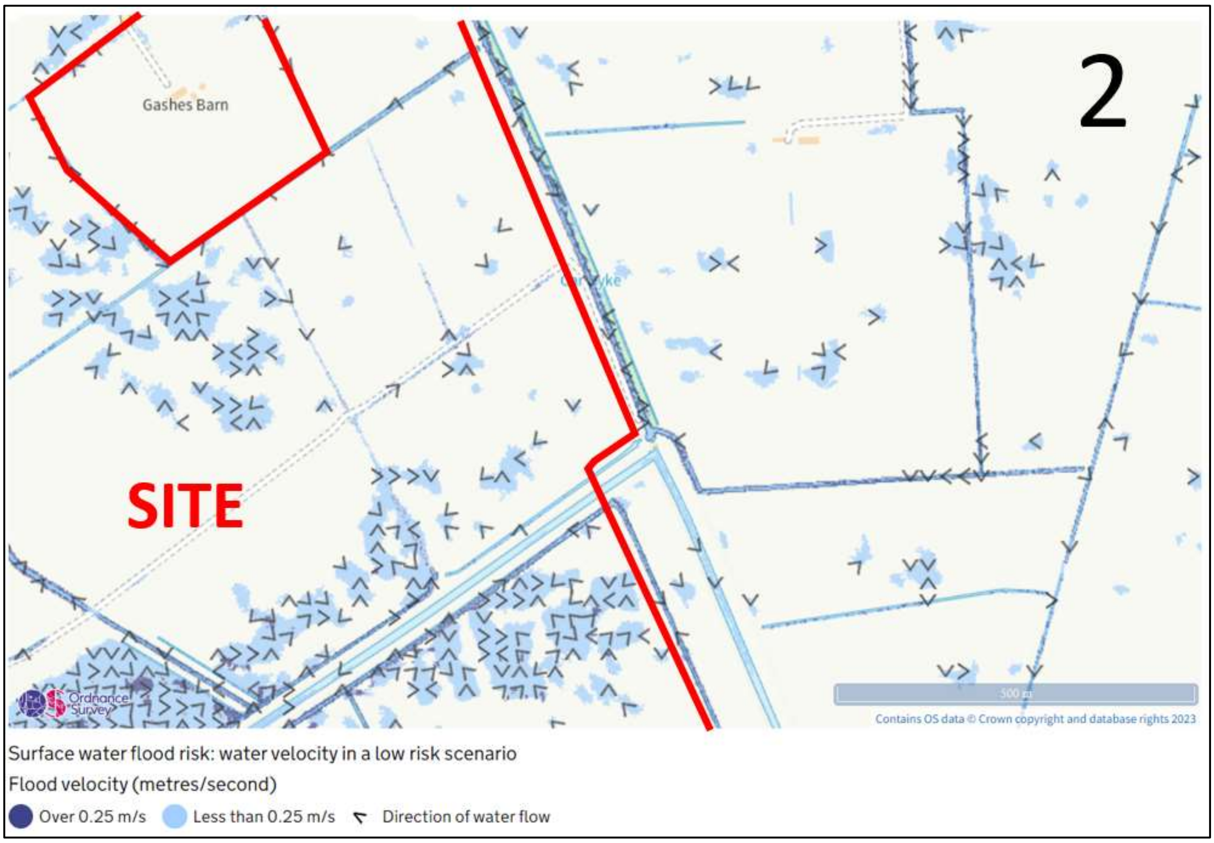
Appendix 4. Environment Agency Surface Water Flow Direction Mapping



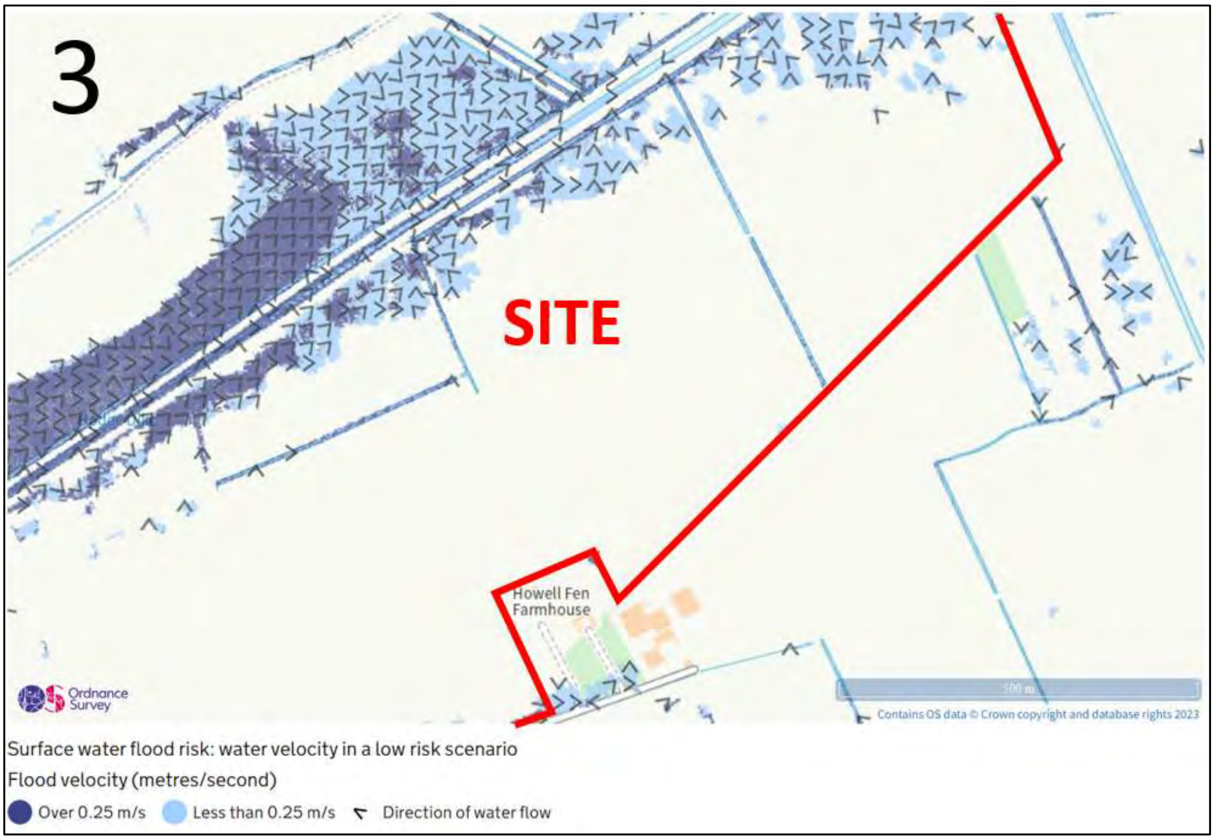
Environment Agency Velocity Mapping Locations



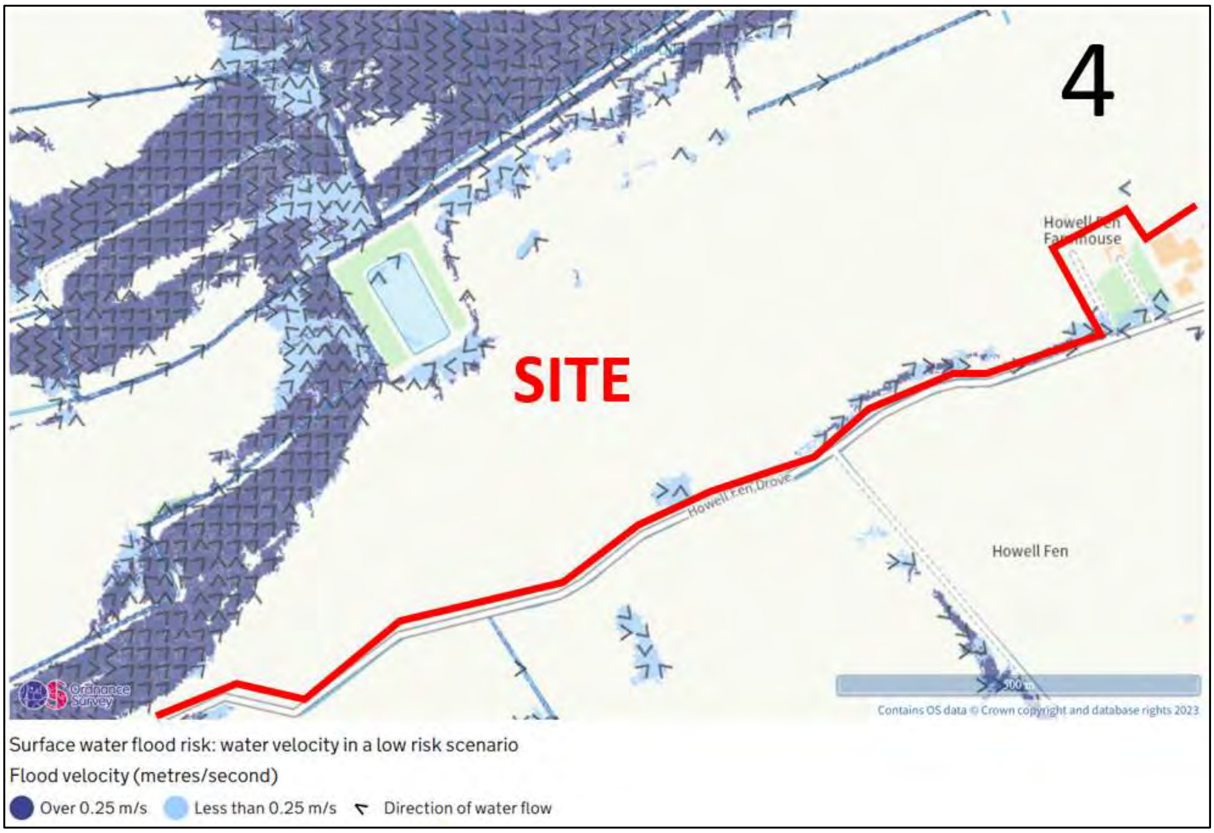
Environment Agency Velocity Map 1



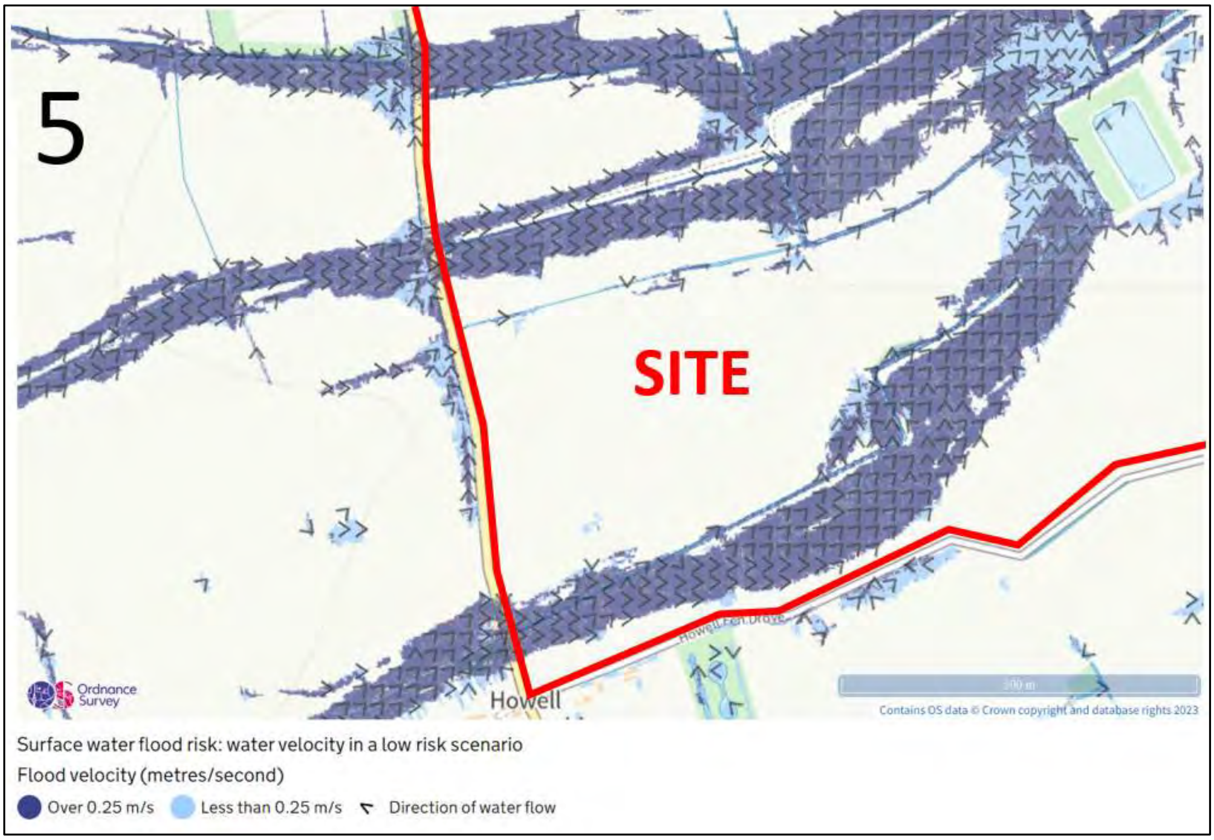
Environment Agency Velocity Map 2



Environment Agency Velocity Map 3

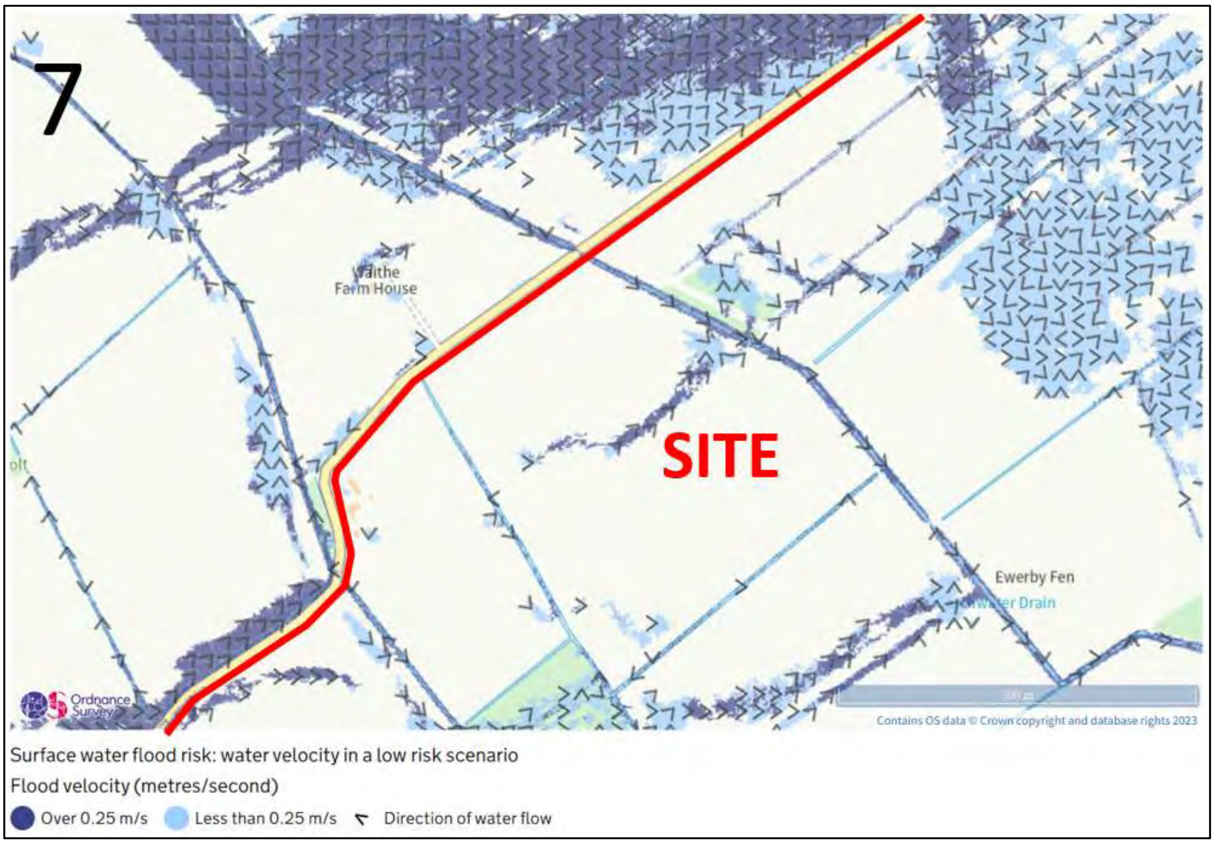


Environment Agency Velocity Map 4

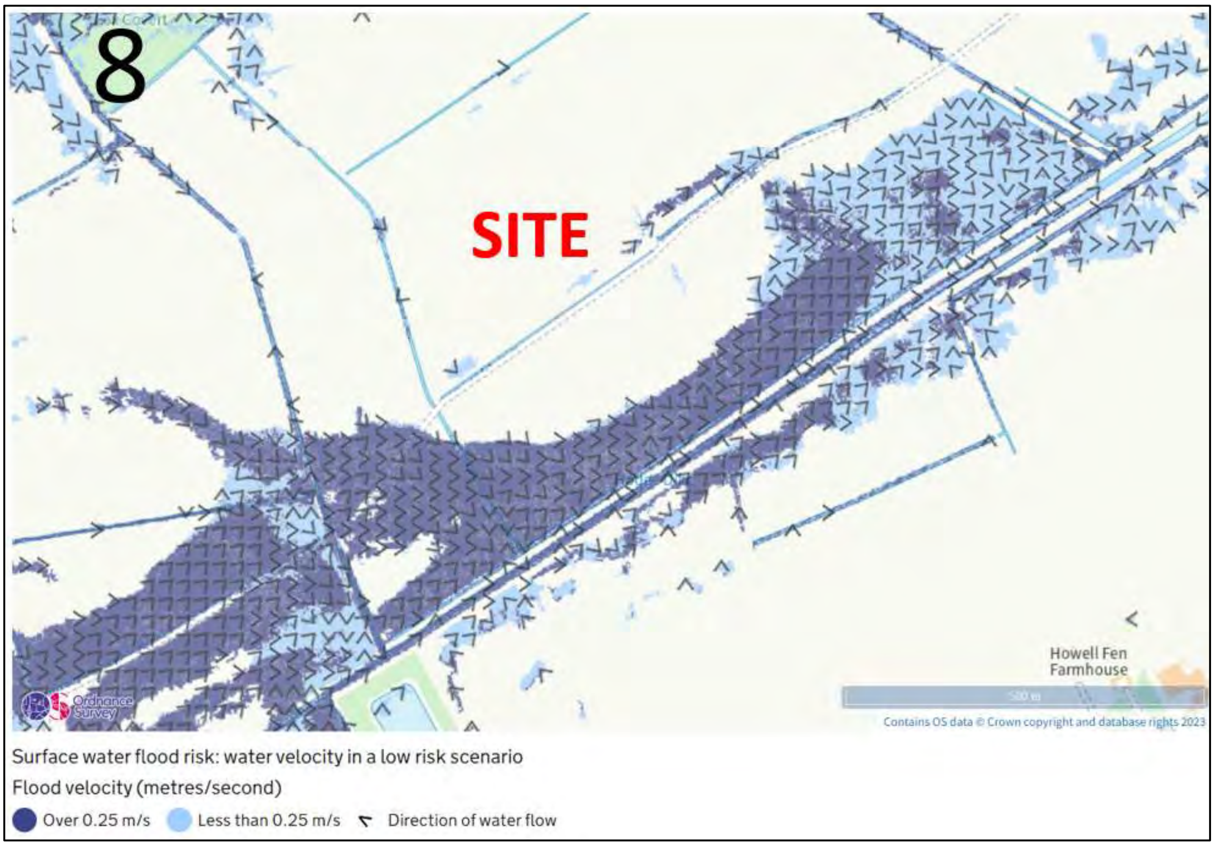


Environment Agency Velocity Map 5

Environment Agency Velocity Map 6



Environment Agency Velocity Map 7



Environment Agency Velocity Map 8