

FLOOD RISK ASSESSMENT

PROPOSED RETENTION OF CARAVANS
BAR FARM
LITTLEWORTH DROVE
DEEPING ST. NICHOLAS
SPALDING
PE11 3BN



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INTRODUCTION

The Government has placed increasing priority on the need to take full account of the risks associated with flooding at all stages of the planning and development process. This seeks to reduce the future damage to property and the risk to life from incidents of flooding. Their expectations relating to flooding are contained in the National Planning Policy Framework March 2012, (NPPF), which identifies how the issue of flooding is dealt with in the drafting of planning policy and the consideration of planning applications by avoiding inappropriate development in areas at risk from flooding and to direct development away from areas at highest risk.

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change.

The Environment Agency's flood maps show areas that are at risk, from fluvial and tidal flooding. These maps show the limits of the flood plain of the area which could be affected by flood events, over topping or breaching of flood defences. They are based on the approximate extent of floods with a 1% annual probability of exceedance (1 in 100 year flood) for rivers and 0.5% annual probability of exceedance (1 in 200 years flood) for coastal areas under present expectations or the highest known flood. However they do not take into account of the presence of defences or the likelihood that flood return intervals will be reduced by climate change.

This Flood Risk Assessment has been prepared in support of the planning application and considers the risk of flooding from fluvial and tidal sources in accordance with National Planning Policy Framework (NPPF). It also considers the risks of localised flooding due to inadequate Foul and Surface Water Sewers, Failure of Reservoirs, Water Main pipe bursts, Sewer Blockages, Pump Failures or High Ground Water Table etc.

This document has been prepared solely as a flood risk assessment on behalf of the client, Mr. R. Turner.

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APPLICATION SITE

The site is located at Bar Farm, Littleworth Drove, Deeping St. Nicholas, Spalding, PE11 3BN, within the South Holland District Council's administrative area. **Plan 1**

The Site would be classed as Non Major Development applying the Town & Country Planning (Consultation) (England) Direction 2009 as the site is to be developed is less than one hectare.

The National Grid Reference is TF 22433 17764.

This flood risk assessment has been prepared for a planning application to extend the time period of the planning permission for a further five years for 45No caravans and a Portakabin type laundry and toilet facility for use of the migrant workers employed to meet the needs of the business, which provides agency drivers to the main logistics companies in Spalding, which was granted permission in 2009 for five years. **Plan 2**

The National Planning Policy Framework Technical Guidance (NPPF TG) defines three levels of flood risk depending upon the annual probability of fluvial flooding occurring.

- Zone 1 – Low Probability (<0.1%)
- Zone 2 – Medium Probability (0.1 – 1.0%)
- Zone 3 – High Probability (>1.0%)

The proposed development site is shown to be within Flood Zone 2 'Medium Probability' as detailed on the Environment Agency's Flood Zone Maps without defences, and as defined in Table 1 of NPPF TG.**Map1**

Table 1: Flood Zones Definition

Zone 2 - medium probability Definition This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year Appropriate uses Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed. Flood risk assessment requirements All development proposals in this zone should be accompanied by a flood risk assessment. Policy aims In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.

Applying the Flood Risk Vulnerability Classification in Table 2 of (NPPF TG), the proposed permanent caravan use for the site is classified as "Highly Vulnerable," Table 1 of NPPF TG states that such uses are permitted in Flood Zone 2 subject to the exception test.

Table 2: Flood Risk Vulnerability Classification

Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use¹. • Installations requiring hazardous substances consent². (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'essential infrastructure')³.
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From the topographic survey the road level on Littleworth Drove at the site entrance is at 2.67mODN with the site levels varying from 2.78mODN to 2.21mODN. The floor level of the caravans is 500mm above the natural ground level at a minimum level of 2.80mODN. **(Plan 3)**

The proposed development site is shown to be within an area of Low Risk as detailed on the Environment Agency's Risk of Flooding from Rivers & Sea Maps.**Map2**

DRAINAGE AUTHORITIES

Environment Agency

The Environment Agency is responsible for reducing the risk of flooding from designated main rivers and from the sea.

The following potential sources of flooding affecting the development site have been identified as:

- From the River Welland
- Welland & Deepings Internal Drainage Board system

The Flood Zone Maps identify river catchments over 3 sq. km. These maps are a theoretical estimate of areas that could be inundated should no defence exist. In practice current standards of protection would result in flood envelopes substantially less than shown by these maps. The maps make no allowance for local, site specific features.

The flood zone maps show that the site of the proposed development is considered at risk from flooding. These maps indicate that the area would be flooded without flood defences, which are in place, (with an annual probability of more than 0.5% i.e. return frequency of less than 1 in 200 years for tidal flooding or more than 1.33% return frequency of less than 1 in 100 years for fluvial flooding). **(Map 1)**

RIVER WELLAND

The Left bank of the River Welland is formed by an earth bank which is provided with a soak dyke on the landward toe. The right bank to the river is at a slightly lower level and of less proportions and this forms the embankment to the Cowbit Washlands which allows water to overtop to control the levels in the river from overtopping the left bank

which consequently controls the river levels downstream during a high flow event. Further upstream there is a similar controlling flood storage washlands at Crowland. The standard of protection provided by these defences is for the 1 in 100 year flood event.

The following is an abstract from Table 6R & 7R SHSFRA

Location	Chainage (km)	Peak 1 in 100 year fluvial Flood level (mODN)		Peak 1 in 1000year fluvial Flood Level (mODN)		Left Bank Defence Crest Level (mODN)
		2007	2115	2007	2115	
Little London Bridge	0.0	4.42	4.67	4.43	4.68	5.22
A16 Road Bridge	2.4	4.50	4.67	4.51	4.67	5.98
Welland Farm	5.0	4.57	4.69	4.59	4.69	6.08

Taking the precautionary approach the Hazard Rating following a breach which in Flood Risk Assessment (FD 2320) Guidance for New Development Phase 2 R& D Technical Report these are classified as low <0.75, moderate 0.75 - 1.25, significant 1.25 - 2.50 and extreme >2.50 based upon an empirical measure of velocity and depth.

Flood Hazard value	Degree of flood hazard	Description	Indicative depth range
< 0.75	Low	Caution 'Flood zone with shallow flowing water or deep standing water'	Up to 0.25 m
0.75 – 1.25	Moderate	Danger for some (i.e. children) 'Danger: flood zone with deep or fast flowing water'	Up to 0.5 m
1.25 – 2.0	Severe	Danger for most 'Danger: flood zone with deep fast flowing water'	0.5 m to 3 m
> 2.0	Extreme	Danger for all 'Extreme danger: flood zone with deep fast flowing water'	0.5 m to over 3 m

$$HR = d \times (v + 0.5) + DF$$

Where V = Flood flow velocity (m/sec)

D = Flood depth (m)

DF = A debris factor included to represent the greater damage, or risk of injury to people, that can occur if debris is swept along with the water. = 0.5 for depths <0.25 or 1.0 for depths

Flood depth (m)	All areas (rural and urban)
≤ 0.25	0.5
> 0.25	1

For the degree of Flood Hazard to be classified as low HR has to be <0.75

The updated South Holland SFRA carried out Mapping following a breach to the flood defences. With climate change up to year 2115 the maps show that the site is not within a Hazard Rating area, therefore the site is subject to flooding following a breach to the flood defences. **Map 2 and Map 3**

Welland & Deepings Internal Drainage Board

The proposed development site is located within Catchment area of Welland & Deepings Internal Drainage Board.

The Board is responsible to operate and maintain the arterial fluvial system. **Map 4**

The Boards Drain which serves the site is:-

South Drove Drain

This watercourse is one of the Boards main drains which flows north-westwards to Pode Hole pumping station which discharges into Vernatts Drain which flows by gravity to Surfleet Seas End where it discharges through pointing doors into the tidal River Welland. The design flood level in South Drove Drain at Pode Hole pumping Station is 1.20mODN.

South Holland District Council

In order to inform the process of risk assessment and site selection the District Council commissioned Haskoning UK Ltd Consultants to prepare a Strategic Flood Risk Assessment in December 2002. They have carried out an update of this report and this report was published in January 2010

This Flood Risk Assessment has taken the results of the updated South Holland Strategic Flood Risk Assessment (SHSFRA) into account in its findings.

It was found that the actual risk from primary sources of flooding (taken as being rivers and the sea) was assessed as being the product of:

- Medium probability (assigned because the standards of the primary defences are variable) and
- Low consequence (assigned because of the District's generally rural nature and because any urban flooding is likely to be shallow with minimal impact).

The findings reflect the considerable protection afforded to the area by coastal and tidal & fluvial flood defences and by the extensive well organised system of lowland IDB fluvial drainage.

The computer modelling used in the SFRA to produce the Hazard, depth and velocity maps simulated the spread of flood waters over the land and allowed for the presence of locally raised features such as road embankments etc. The maps produced by the Environment Agency took a more precautionary approach.

The potential flooding consequences shown on this map relate to flooding from the sea, main rivers and Internal Drainage Board systems taking into account the presence of current flood risk management measures such as flood defences.

The consequences designated as being an Actual Risk arise from direct overtopping of defences, where this would occur, together with assumed breach failure of some defences. Breach failure has been assumed to occur in places where the freeboard between peak sea or river water level and the defence crest level is less than the minimum desirable for structural security of the defence.

From the Actual Peak Depth Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event Probability and Actual Flood Hazard Spalding - Year 2115 1% Fluvial / 0.5% Tidal Event Probability maps from the update of strategic flood risk assessment for South Holland District Council the site is not affected from any breach to the flood defences. **Map 2 & Map 3**

SEQUENTIAL APPROACH

When considering the sequential approach for flood risk from fluvial flooding in accordance with NPPF the site would fall into Zone 3a (High Probability) as defined in Table 1: Flood Zones, and illustrated on the Environment Agency's Flood Maps, if defences were not present.

The flood zones as detailed on the flood map show the area of land which theoretically would be inundated by floodwater during a flooding event from either tidal or fluvial sources without flood defences.

The Environment Agency categorise land into one of three Flood Zones.

- Flood Zone 1 is land outside the 0.1% floodplain (with a chance of flooding of less than 0.1 % chance in any given year);
- Flood Zone 2 is land that falls between the 1 in 100 year extent and the 1 in 1000 year extent (a chance of flooding between 1% and 0.1% in any given year);
- Flood Zone 3a is land which falls within the 1 in 100 year flood extent (has a 1 %chance of a flood occurring in any given year).

The Sequential Test is defined in NPPF with the principal aim of steering new development to areas of the lowest probability of flooding (Flood Zone 1). Where there are no reasonably available sites in Flood Zone 1 then decision makers should first consider Zone 2 and then Zone 3a taking into account the flood risk vulnerability of land uses as categorised in Table 2 of NPPF.

The proposed use for a caravan permanent use development for the site falls within "Highly Vulnerable" uses of land in Table 3 Flood Risk Vulnerability Classification and Table 1 shows that developments of this nature are appropriate in this zone. All development is permitted in Zone 1. Development in Zones 2 and 3 is restricted based on Table 3 of NPPF replicated below

TABLE 3: Flood risk vulnerability and flood zones 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	✗	✗	✗

The proposed permanent caravan use site is shown on the flood maps to be within Flood Zone 2 and highly vulnerable uses are permitted subject to passing the Exception Test.

The Local Planning Authority's opinion, for the current approval, was that there are no other sequentially preferable

sites available for a caravan site of this nature, the principle has been established, therefore the Exception and Sequential Test is passed.

CLIMATE CHANGE

Global warming is now recognised that it is likely to affect the frequency and severity of extreme events as both tidal and fluvial flooding.

The annual sea rise due to climate change is given in the NPPF and the recommended contingency allowances are stated in Table 4.

TABLE 4: Recommended contingency allowances for net sea level rises

	Net sea level rise (mm per year) relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

The effect of global warming on fluvial flood peaks is given in Table 5. It is expected that the overall effect up to 2025 will result in an increase of rainfall of 5%, 2025-2055 10%, 2055-2085 20% and 2085-2115 of 30% with Peak River flows increasing by 20%.

Table 5: Recommended National Precautionary Sensitivity Ranges for Peak Rainfall Intensities.

Peak River Flows, Offshore Wind Speeds and Wave Heights.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

INFRASTRUCTURE

Surface Water Drainage

The rainwater from the roof of the existing caravans fall on to the grassed areas and infiltrates into the ground, all the existing parking/driveways is constructed using permeable materials. There are no proposals to change this as no problems have been experienced

Foul Water

As the site is not within an area served by public foul sewers therefore there are no public sewers in the vicinity of the site, the existing foul drainage is connected to the existing package sewage treatment plant. There are no proposals to change this arrangement.

As there is a positive drainage system to cater for the run-off from the development, the development proposal will not have adverse impact on the wider catchment elsewhere.

FLOOD PROTECTION

Any impact of damage to the properties can be foreseen and mitigated against by relatively simple design and construction techniques. There are two forms of flood protection works:-

- **Flood-resistance or proofing works:** - these try to reduce the amount of water actually entering a building.
- **Flood-resilient works:** - these reduce the amount of damage caused by water entering the building.

The proposed properties will have the following resilient measures incorporated in the construction in accordance with "Improving the flood performance of new buildings" CLG (2007).

- The ground floor of the caravans is raised 500mm above the existing ground level to a minimum of 2.80mODN.
- The Site Owner is already registered with the Environment Agency's Floodline to receive advance warning of flooding by telephone, mobile, fax, SMS text, email or pager.
- A Flood Evacuation Plan has previously been drawn up and accepted as being suitable for the site by South Holland's Emergency Planning officer.

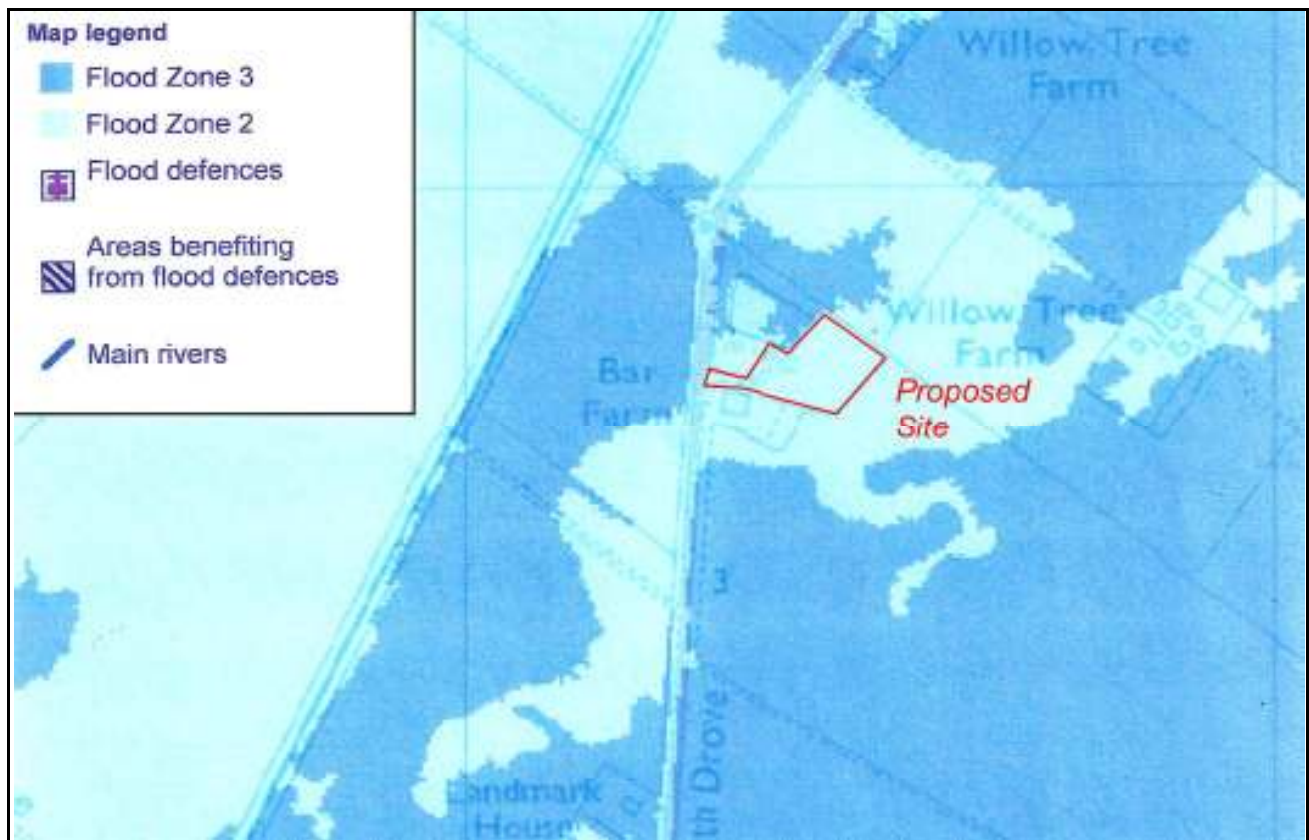
CONCLUSIONS

- The site does have the benefit of protection from tidal/fluvial flooding by existing defences which are properly maintained to a 1 in 200 /100year standard of protection from tidal/fluvial flooding.
- The proposal is for the retention of the existing caravans and facilities for migrant workers in connection with the business for a further five years.
- The Actual Risk of flooding maps contained in South Holland's Strategic Flood Risk Assessment 2010 shows that the site is unaffected from flooding from a breach to the defences.
- The proposed residential use falls within the "Highly Vulnerable" uses of land as defined in Table 2 NPPF for Flood Risk Vulnerability Classification and the proposed development for residential use is appropriate in Flood Zone 2 subject to the Exceptions Test. The Local Planning Authority's opinion, for the current approval, was that there are no other sequentially preferable sites available for a caravan site of this nature, the principle of use has been established, and therefore the Exception and Sequential Test is passed.
- Flooding from other sources is unlikely to affect the site.

APPENDICES

Map 1	Environment Agency Flood Plain Map.
Map 2	Environment Agency Risk of Flooding from Rivers and Sea Map.
Map 3	SHDC SFRA Actual Flood Extent 2115 District Map
Map 5	SHDC SFRA Actual Flood Velocity 2115 District Map
Map 6	SHDC SFRA Actual Flood Depth 2115 District Map
Plan 1	Site Location Plan
Plan 2	Site Layout Plan
Plan 3	Site Levels

Extract from Environment Agency Flood Plain Map without Defences.



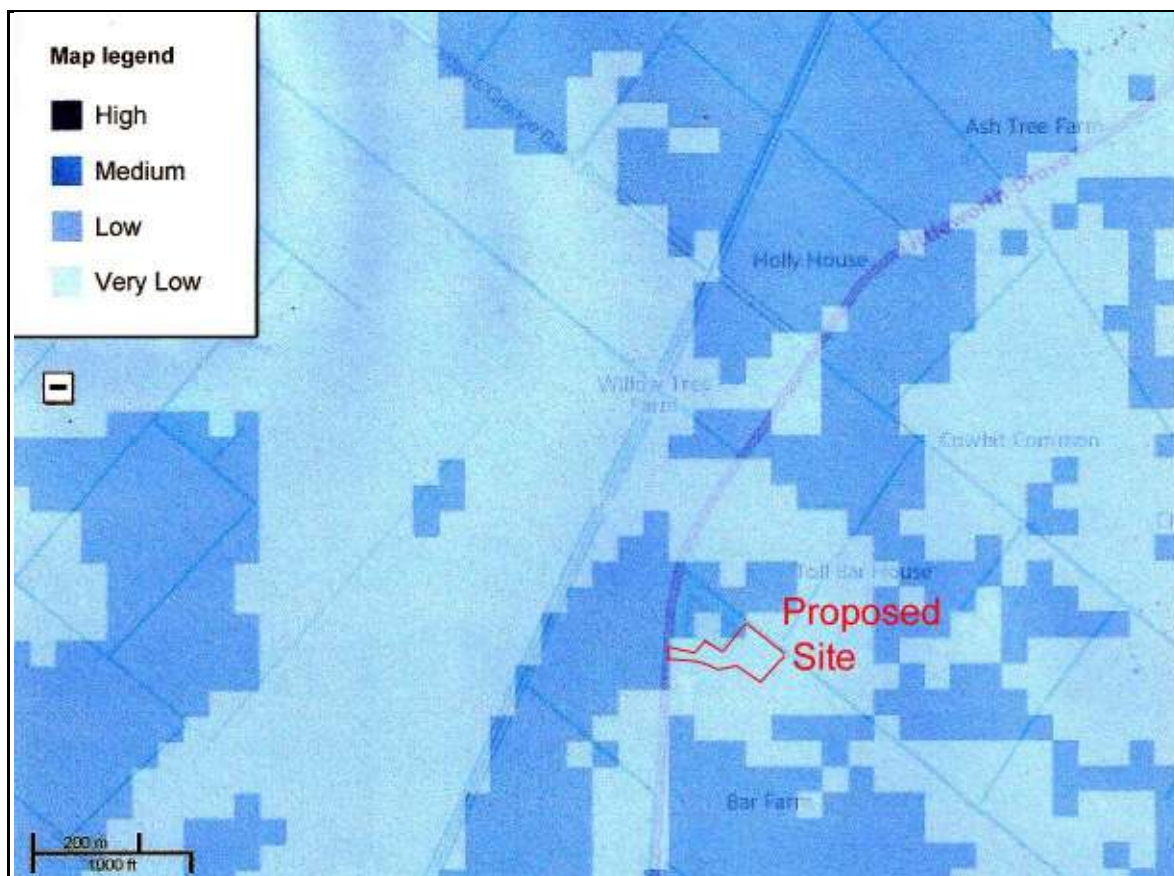
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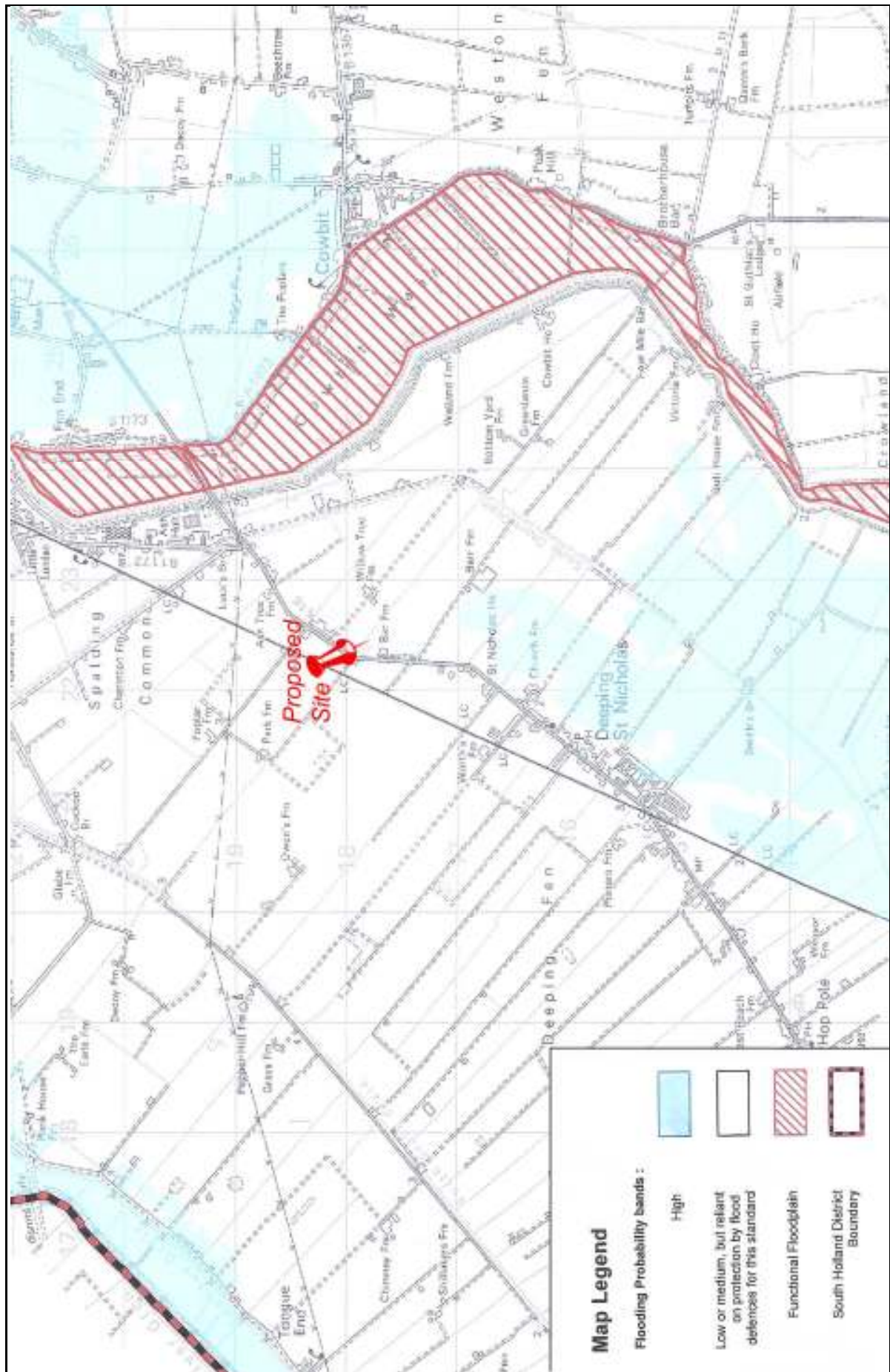
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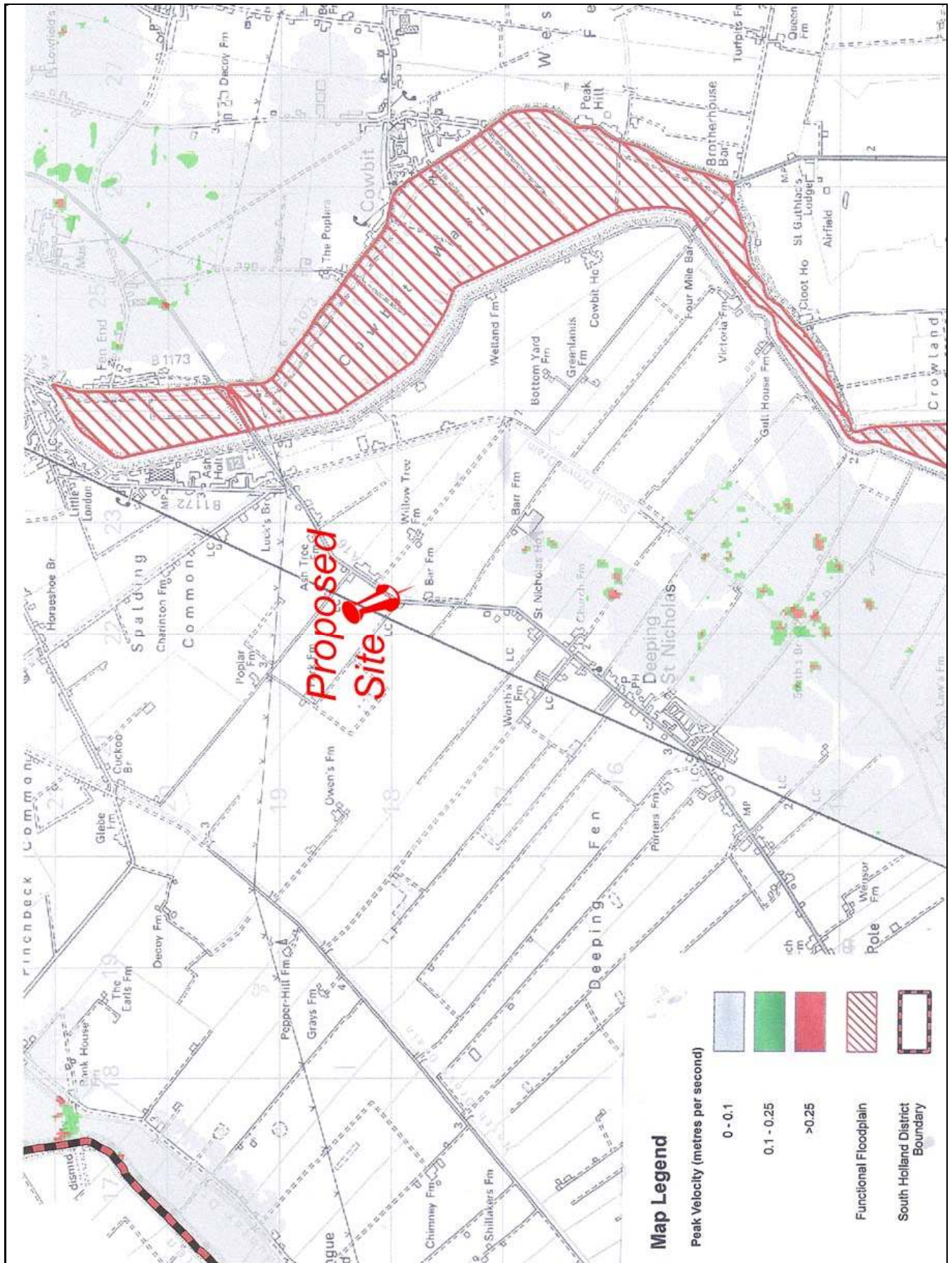
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Extract from Environment Agency Risk of Flooding from Rivers & Sea



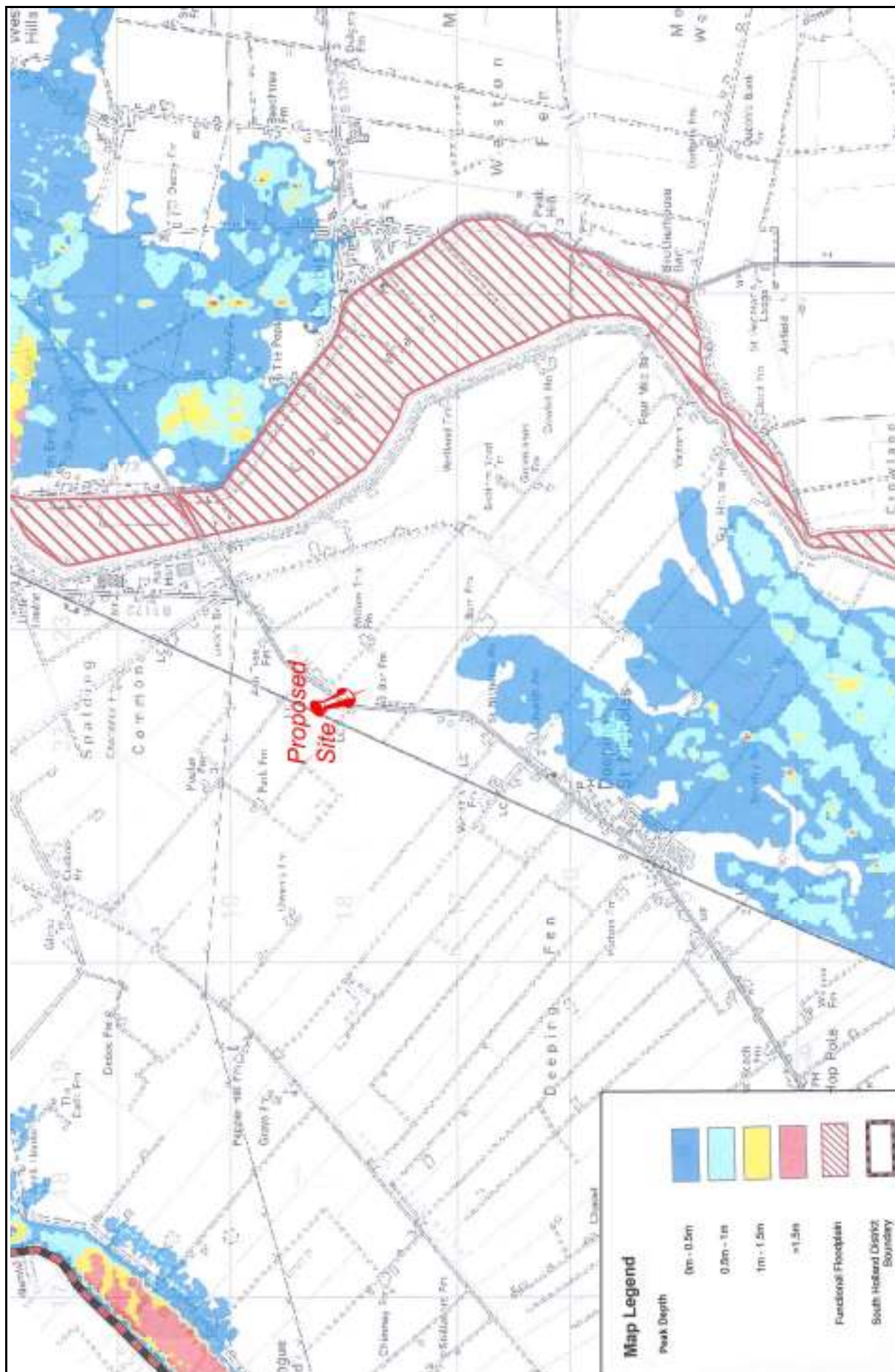
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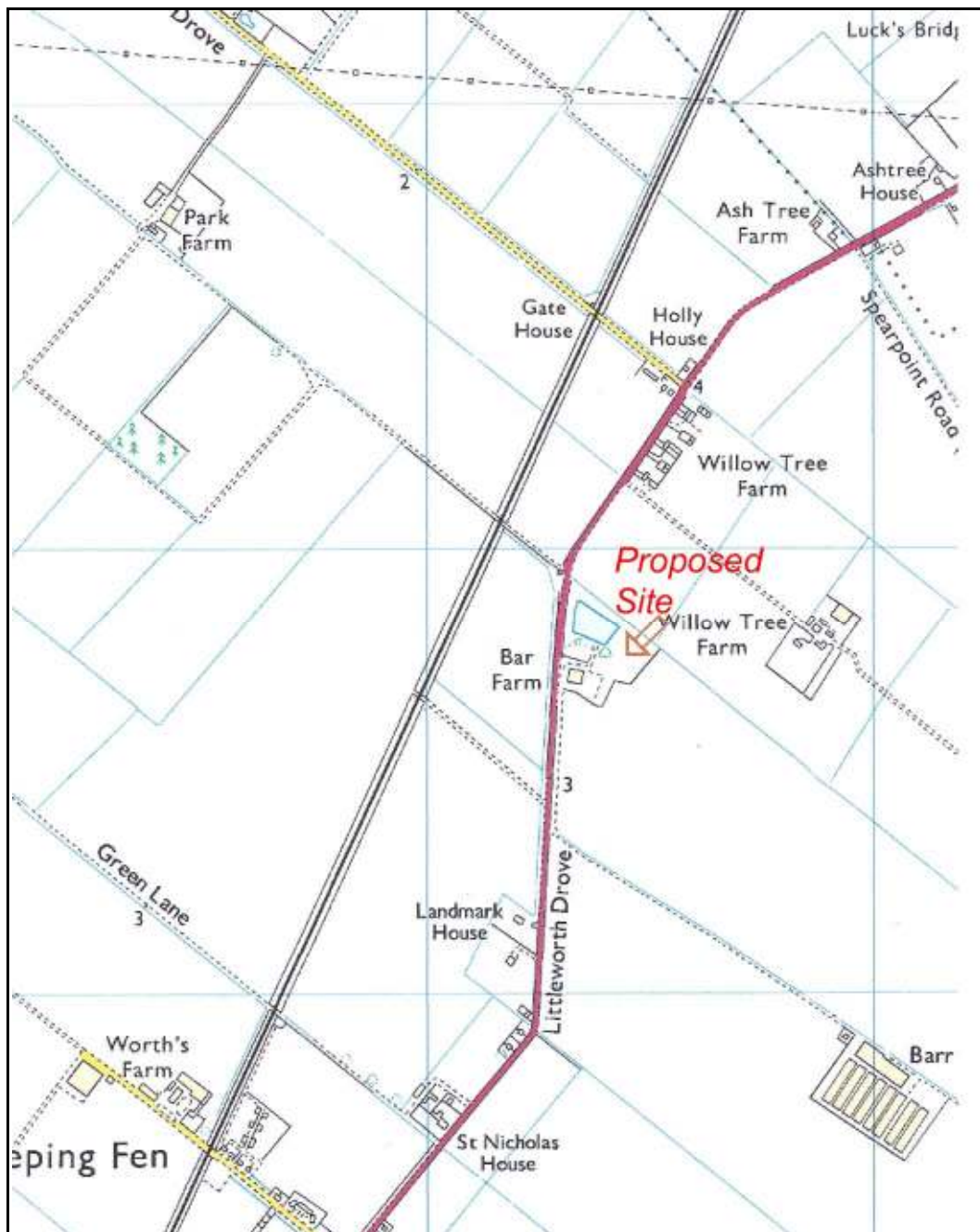


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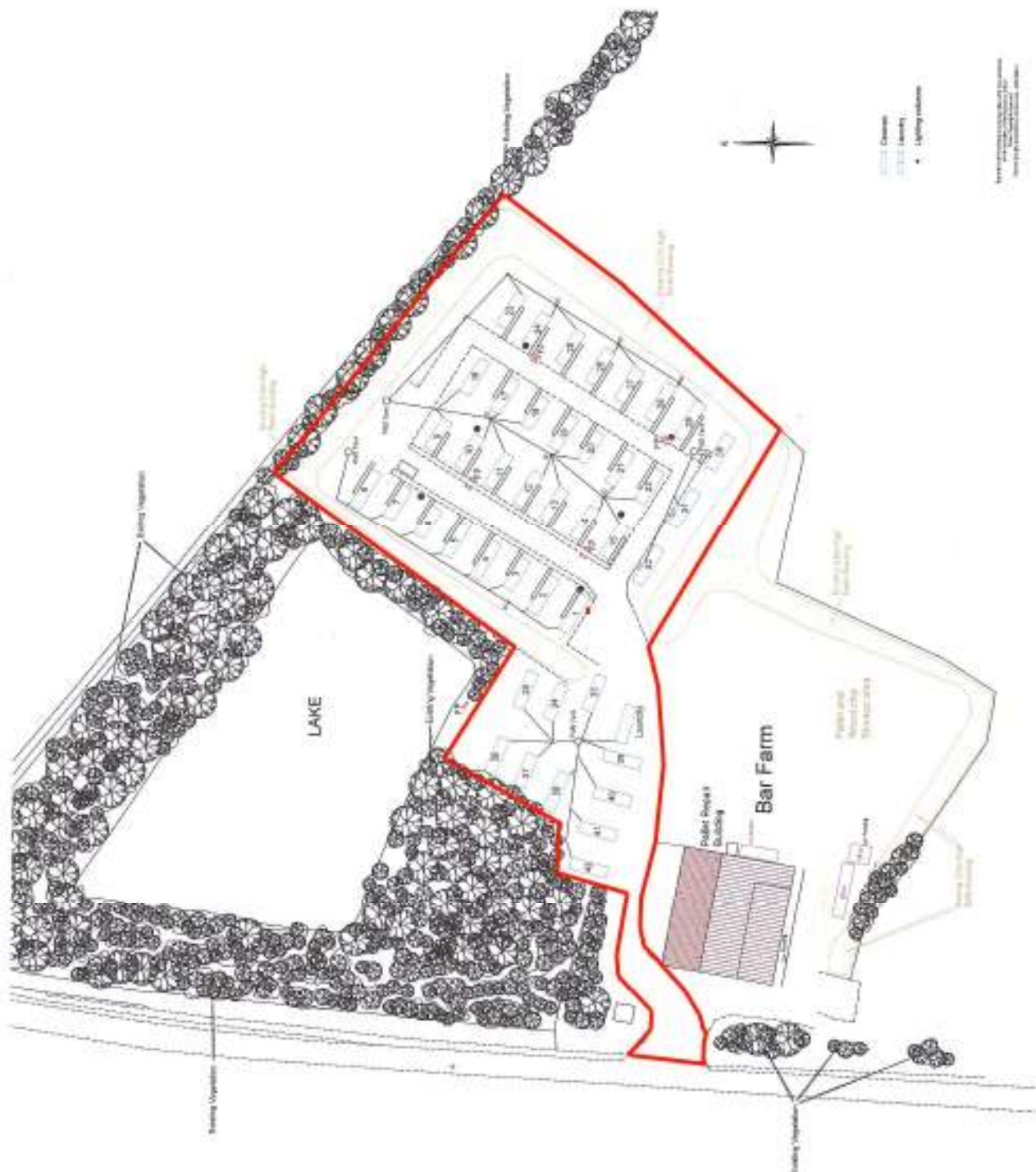
MAP 4



Location Plan

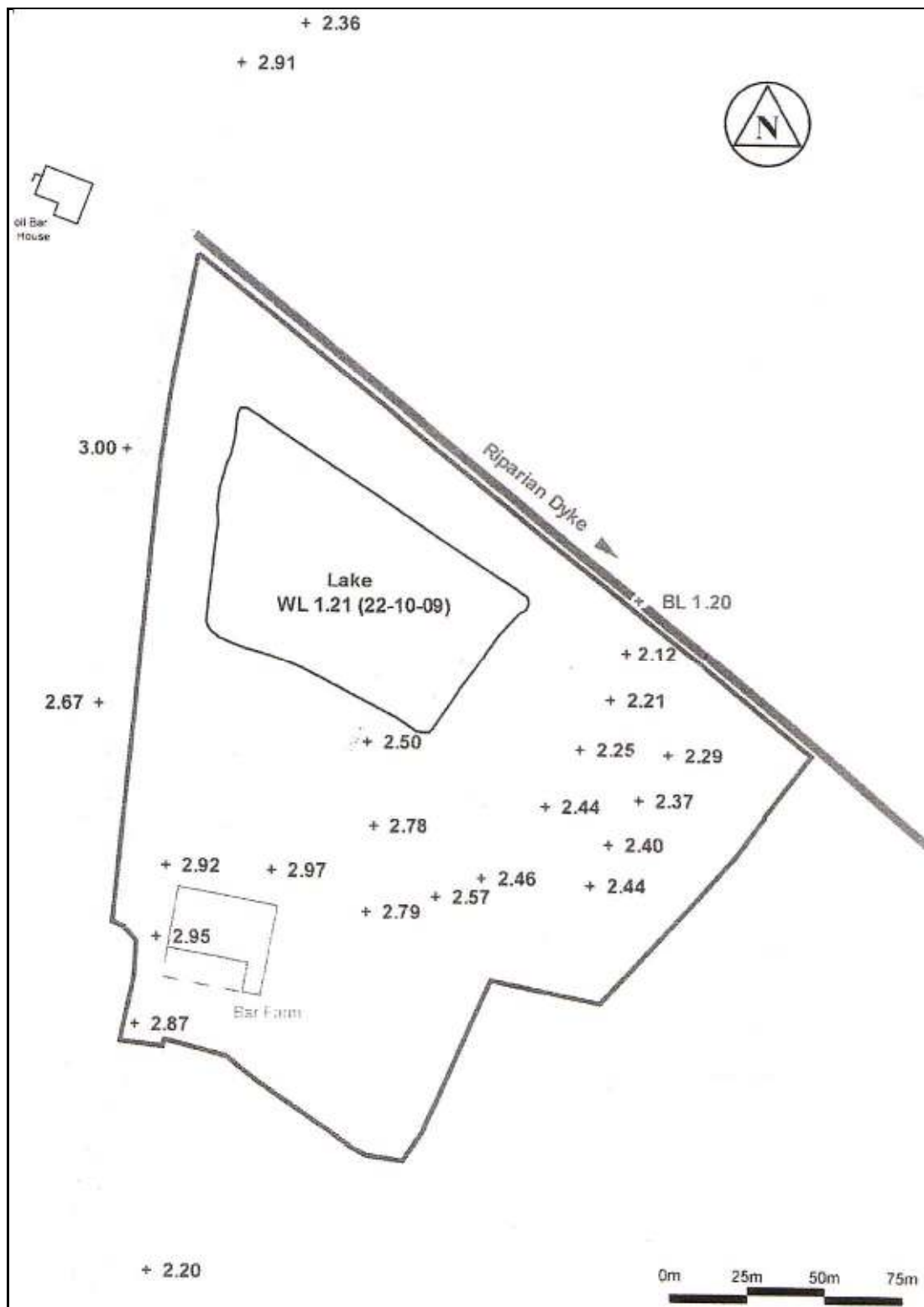


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Abstract

PLAN 2



PLAN 3