# FLOOD RISK ASSESSMENT

## PROPOSED GLASSHOUSE
## POPLAR FARM,
## OLD FENDYKE
## SUTTON ST. JAMES
## SPALDING
## PE12 0HE




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RMA

# FLOOD RISK ASSESSMENT FOR PROPOSED GLASSHOUSE POPLAR FARM, OLD FENDYKE, SUTTON ST. JAMES, SPALDING, PE12 0HE.

## 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 (NPPF) March 2012, which identify 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.

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-year 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. 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.

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**APPLICATION SITE**

The site is located at Poplar Farm, Old Fendyke, Sutton St. James, Spalding, PE12 0HE within the South Holland District Council's administrative area. The National Grid Reference for the site is TF38221 17549 and the area for development is 1.525 Hectares or thereabouts. **Plan 1**

This flood risk assessment has been prepared for a full planning application to erect commercial glasshouses, 88m x 134.4m, at an existing horticultural business site. The surface water run-off from the new glasshouses is to be attenuated to discharge at Greenfield rate of discharge into the watercourse on the north eastern boundary. All new accesses and circulation areas to serve the site will be constructed with permeable materials. **Plans 2 & 3**

The Site would be classed as Major Development applying the National Planning Policy Guidance (NPPG) as the site is to be developed for more than 1 Hectare.

The National Planning Policy Framework Technical Guidance NPPF 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 3a 'High Probability' as detailed on the Environment Agency's Flood Zone Maps without defences, and as defined in Table 1 of NPPF**.**

**Table 1: Flood Zones Definition (Ignoring the presence of defences)**

| **Flood Zone 3 – High Probability** |
|---|
| **Definition**<br>This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. |
| **Appropriate uses**<br>The water-compatible and less vulnerable uses of land (Table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood. |
| **Flood Risk Assessment requirements**<br>All development proposals in this zone should be accompanied by a Flood Risk Assessment. |
| **Policy aims**<br>In this zone, developers and Local Authorities should seek opportunities to:<br>• 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;<br>• Relocate existing development to land in zones with a lower probability of flooding; and<br>• Create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage. |

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPF the proposed use is classified as "Less

Vulnerable", with Table 1 of NPPF stating that such uses are appropriate in this zone.

**Table 2: Flood Risk Vulnerability Classification**

| Less Vulnerable |
| --- |
| • Police, ambulance and fire stations that are not required to be operational during flooding.<br>• Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure.<br>• Land and buildings used for agriculture and forestry.<br>• Waste treatment (except landfill and hazardous waste facilities).<br>• Minerals working and processing (except for sand and gravel working).<br>• Water treatment works that do not need to remain operational during times of flood.<br>• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). |

From the topographic survey the site is roughly rectangular in shape and is reasonably level with the average ground level to Ordnance Datum varying from1.30mODN to 1.70mODN averaging 1.50mODN. **Plan 4**

**Environment Agency**

The Environment Agency has permissive powers 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 Wash/ River Nene.
- From the South Holland Internal Drainage Board's drainage system.

The Flood Zone Maps identify river catchments over 3 sq. km. These maps are a theoretical estimate of areas of land that could be inundated by floodwater during a flooding event was it not for the presence of flood defences. 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

These maps indicate that the area would be flooded without flood defences, which are in place along the coastal edge (with an annual probability of more than 0.5% return frequency of less than 1 in 200 years for tidal flooding). The site is shown to lie in Flood Zone 3a (High Probability). **Map 1**

The Environment Agency Risk of flooding from Rivers and Sea Map shows that the site is at Medium risk of flooding. Medium means that each year, this area has a chance of flooding of less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%).This considers the effect of any flood defences that may be in this area. Flood defences reduce, but do not completely stop the chance of flooding as they can be over-topped or fail. **Map 2**

In this area, the main risk of flooding is from a breach to the Tidal defences along the coastline and the River Nene that could affect the site, and the nearest is the River Nene some 4.7Km to the south-east of the site

There are no primary main river flood risk sources in the Sutton St James area. Therefore, the site would only be affected by tidal flooding from the Wash / River Nene. The Wash Banks constitute the first line of defence against any tidal flooding. These consist of earth embankments along the shores of the Wash and are invariably behind an area of intertidal salt marsh which protects them against damage from wave action, though in the relatively sheltered environment of the Wash this is less of a hazard than the North Sea coastline. The site lies behind two lines of earth sea defences.

Coastal flooding may be caused by seasonal high tides such as those driven by the spring neap tide cycle, storm surges and where increase in water level above the astronomical tide level is created by strong on shore winds or by storm driven wave action and a deep atmospheric low pressure. Extreme conditions leading to coastal flooding are most commonly a result of a combination of two or more of these mechanisms.

**River Nene**

The River Nene lies some 8.1Km to the south-east of the site and is tidal for 35Km up to the Dog in a Doublet Lock and the scenario year 2115 the 1 in 200-year tide flood level is 7.26mODN. The tidal flood defences of the tidal River Nene consist of earth embankments which are in good condition and the crest heights are circa 7.30mODN.

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<br>'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)<br>'Danger: flood zone with deep or fast flowing water' | Up to 0.5 m |
| 1.25 – 2.0 | Severe | Danger for most<br>'Danger: flood zone with deep fast flowing water' | 0.5 m to 3 m |
| > 2.0 | Extreme | Danger for all<br>'Extreme danger: flood zone with deep fast flowing water' | 0.5 m to over 3 m |

**HR = d x (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 must be <0.75.

From the Residual Flood Hazard, Depth and Velocity District - Year 2115 the1% Fluvial, 0.5% Tidal Event Probability maps, from the 2017 update of strategic flood risk assessment for South Holland District Council the site is not affected from a breach to the flood defences and has been used in the findings of this assessment. **Maps 4, 5 & 6.**

**Surface Water Flooding**

The published Environment Agency surface water flood maps (Low Risk) shows that the site is not at risk from surface water flooding. LOW means the chance of flooding each year is 1 percent (1 in 100-year chance) or less, but greater than 0.1 per cent (1 in 1000-year chance). **Map 7**

**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 and updated in 2010.This was further updated for the South-East Lincolnshire local Plan in 2017

This Flood Risk Assessment has taken the results of the (2017) updated South Holland Strategic Flood Risk Assessment (SHSFRA) into account in its findings.

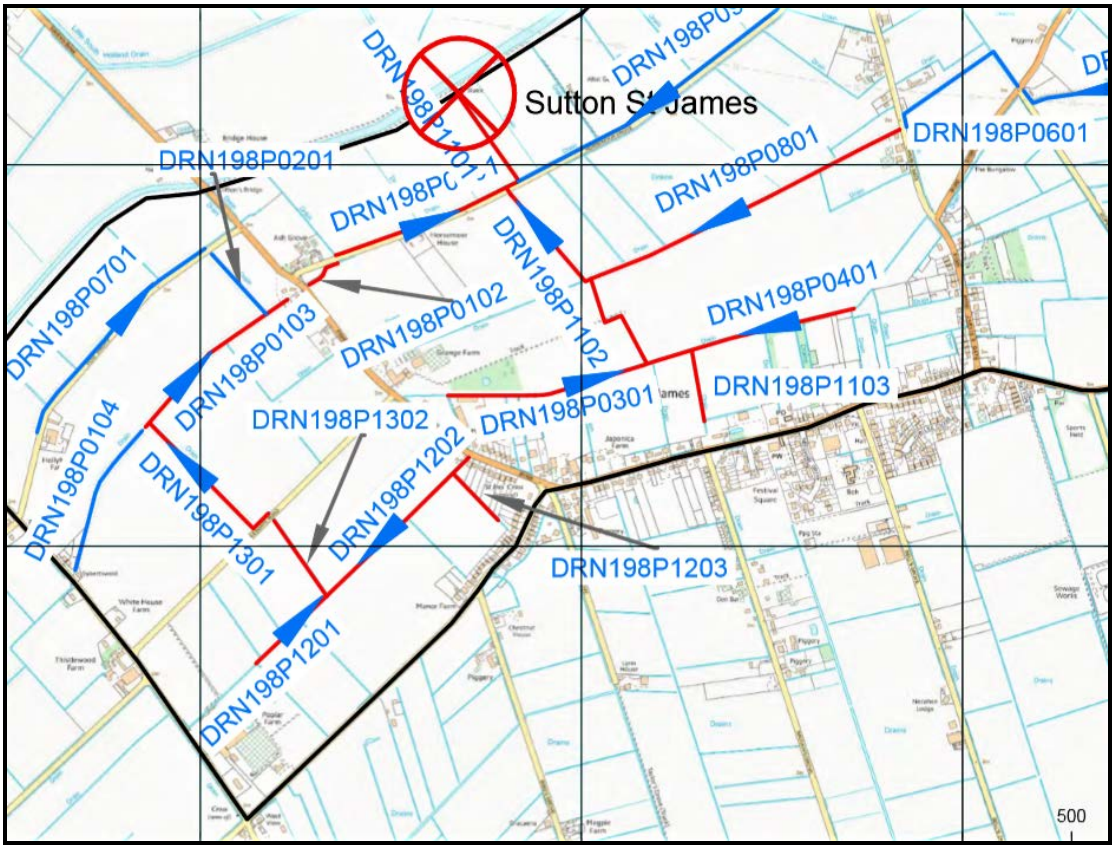
The whole of the tidal flooding information has been replaced by the mapping from the latest Environment Agency Tidal Hazard mapping. Where the mapping for an area contains both fluvial and tidal components, the more severe of the two has been presented.

**South Holland Internal Drainage Board**

The proposed development site is located within the catchment area of South Holland Internal Drainage Board, the Board are therefore responsible to operate and maintain the arterial fluvial system.

The site is situated close to the boundary of two SHIDB sub-areas as shown on the SHIDB asset map. The proposed development site is located within Catchment K East Main Drain drainage area of South Holland Drainage Board.

The IDB has a watercourse on the northern boundary of the site alongside Ref DRN198P1201 (Taylors Drain) as shown on the SHIDB asset map below.




Extract from South Holland IDB Drainage Map Catchment G Sutton St. James

This drain eventually outfalls to Sutton St. James Pumping Station which discharges into South Holland Main Drain.

The Board's prior written consent will be required for any of the following works:

- No person without the previous consent of the Board shall erect any building or structure, whether temporary or permanent, or plant any tree, shrub, willow or other similar growth within 9 metres of the landward toe of the bank where there is an embankment or wall or within 9 metres of the top of the batter where there is no embankment or wall, or where the watercourse is enclosed within 9 metres of the enclosing structure.

- No person shall, without the previous consent of the Board, for any purpose, by means of any channel, siphon, pipeline or sluice or by any other means whatsoever, introduce any water into the District or, whether directly or indirectly, increase the flow or volume of water in any watercourse in the District.

- The erection or alteration of any mill dam, weir or other like obstruction to the flow, or erection or alteration of any culvert within the channel of a riparian watercourse.

**FLOODING FROM OTHER SOURCES**

Flooding is a natural process and can happen at any time from sources other than watercourses and the sea.

Flooding from land can occur from intense rainfall, often over short duration of time that is unable to soak into the ground or enter the drainage system. How ever with the natural topographic nature of the ground being flat, falling slightly southwards this will not cause any rapid inundation of the site and is likely only lead to local ponding of shallow depth and low velocity and will discharge into the surrounding watercourses.

The area is not known to suffer from any groundwater problems.

Flooding from sewers can occur from over loading from heavy rainfall caused by blockages or having inadequate capacity. There are no sewers within the vicinity of the site.

Non-natural or artificial sources of flooding such as reservoirs, lakes or canals where water is stored above natural ground level could cause flooding if the structure fails or is over topped. There are no known facilities close by which would affect the site.

**SEQUENTIAL APPROACH**

When applying the sequential approach for flood risk in accordance NPPF the site would fall into Zone 3a (High Probability) as the site is shown to be within the fluvial flood plain as shown on the Environment Agency's Flood Map without defences in place.

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPF, the proposed agricultural development is classified as "Less Vulnerable", with Table 1 of NPPF stating that such uses are appropriate in this zone (as summarised in Table 3 NPPF).

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).

| Flood Zone | Shading | Risk | Flood Risk Probability |
|---|---|---|---|
| 1 | Clear | Low | Less than 0.1% (1 in 1000 yrs) |
| 2 | Light blue | Medium | Rivers: between 1% (1 in 100 yrs) and 0.1% (1 in 1000 yrs)<br>Sea: between 0.5% (1 in 200 yrs) and 0.1% (1 in 1000 yrs) |
| 3 | Dark Blue | High | Rivers: greater than 1% (1 in 100 yrs)<br>Sea: greater than 0.5% (1 in 200 yrs) |

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

| Flood risk vulnerability classification | | Essential infrastructure | Water compatible | Highly vulnerable | More vulnerable | Less vulnerable |
|---|---|---|---|---|---|---|
| Flood Zone | Flood Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Flood Zone 2 | ✓ | ✓ | Exception Test required | ✓ | ✓ |
| | Flood Zone 3a | Exception Test required | ✓ | ✗ | Exception Test required | ✓ |
| | Flood Zone 3b Functional Floodplain | Exception Test required | ✓ | ✗ | ✗ | ✗ |

NPPF Guidance Paragraphs 100 - 104 requires development within high areas of flood risk be determined using 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 the impacts of climate change.

NPPF Planning Practice Guidance 2014 states: - *When applying the Sequential Test, a pragmatic approach on the availability of alternatives should be taken. For example, in considering planning applications for extensions to existing business premises it might be impractical to suggest that there are more suitable alternative locations for that development elsewhere.*

In this case, the existing business is centred on the land owned and operated by the applicant and to consider areas outside the holding would not be practical. The whole area is zoned as flood Zone 3a.

Therefore, the 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 Climate change allowances in the NPPF Guidance was updated on the 19th February 2016.

The site is located within the Anglian River Basin, for sites within Flood Zone 3a and for "Less Vulnerable" land uses the Central and Higher Central peak river flow allowances figures in Table 1 should be used.

| Table 1 Peak river flow allowances by river basin district (1961 to 1990 baseline) | | | | |
|---|---|---|---|---|
| River basin District | Allowance category | Total potential change anticipated for '2020s' (2015 to2039) | Total potential change anticipated for '2050s' (2040 to2069) | Total potential change anticipated for '2080s' (2070 to2115) |
| Anglian | Upper End | 25% | 35% | 65% |
| | Higher central | 15% | 20% | 35% |
| | Central | 10% | 15% | 25% |

The effect of global warming on peak rainfall allowances is given in Table 2.

| **Table 2** Peak rainfall intensity allowance in small and urban catchments (1961 to 1990 baseline) | | | |
|---|---|---|---|
| Applies across all of England | Total potential change anticipated for 2010 to 2039 | Total potential change anticipated for 2040 to 2059 | Total potential change anticipated for 2060 to 2115 |
| Upper End | 10% | 20% | 40% |
| Central | 5% | 10% | 20% |

The annual sea rise due to climate change is given in NPPF and the recommended contingency allowances are stated in Table 3

| **Table 3** Peak sea level allowance for each epoch in (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline) | | | | | |
|---|---|---|---|---|---|
| Area of England) (Use River Basin maps | 1990 to 2025 | 2026 to 2050 | 2051 to 2080 | 2081 to 2115 | Cumulative Rise 1990 to 2115 (m) |
| East, Midlands, London, South East | 4 (140mm) | 8.5 (212.5mm) | 12 (360mm) | 15 (525mm) | 1.24m |

The site lies within the Anglian River Basin District Peak River flows should be adjusted to reflect climate change. It must also be assumed, to provide a worst-case scenario, that flood defences have been raised during this period to cater for the rise in sea level.

With the major risk of flooding affecting the site being from tidal flooding following a breach to the defences, any flooding from fluvial sources has been mitigated against.

**DRAINAGE STATEMENT**

This drainage statement, for the site, is an overview and it is proposed to utilise attenuation techniques to reduce the storm water discharge from the proposed development and to minimise the impact of the development on the surrounding area and to comply with EA guidelines, which require at least one workable solution for managing surface water.

The British Geological Society mapping indicates the bedrock beneath the site to comprise of West Walton Formation Mudstone and Siltstone. The superficial deposits are Tidal Flat Deposits Clay and Silt.

In accordance with recognised guidance, National Planning Policy Framework 2012, there is a hierarchy of where surface water should discharge. This hierarchy should be followed where practicable, and is as follows:

1) Infiltration
2) Watercourse
3) Public sewer

With the proposal being related to horticulture, water is a valuable asset and the applicant intends to store as much of the run-off as possible for reuse in watering the plants.

**Infiltration**

No infiltration methods are to be utilised on this development as the site is located on superficial deposits of clay.

**Watercourse**

Surface water runoff and storage calculations have been undertaken using a software tool developed by HR Wallingford and a summary is included below with the full results included in **Appendix A**.

The total glasshouse area is approximately 1.18ha that will be served by the development drainage system.

The IH124 (1994) approach has been used to assess the greenfield run off rate below;

| | |
|---|---|
| Qbar | 2.18 l/sec |
| 1 in1 year | 1.69 l/sec |
| 1 in 30 years | 5.0 l/sec |
| 1 in 100 years | 6.0l/sec |

For this site, the flow control has been limited to Qbar. A minimum discharge of 5 l/sec applies to any site

The existing watercourse on the western boundary which outfalls into the IDB drain to the North, will be used as the method of disposal of surface water from the impermeable area and the maximum discharge will be 5 litres/sec. (default Greenfield rate).

Area of glasshouse to Storage Lagoons =1.18Ha. Area of site 1.525Ha.

The area to be provide for storage will be within two lagoons, which will have an interconnecting pipe and will have a common discharge point into the dyke controlled by a hydrobrake, as shown on the layout plan amounts to circa 4239$m^2$.

The storage volume for the storage lagoon has been calculated for the 40% climate change allowances in peak rainfall intensity to be 1176$m^3$, therefore, total depth of storage is 280mm plus a 300mm freeboard equals 580mm.

Storage will be provided in the attenuation ponds, above the retained water for recycling, with the outfall to the receiving watercourse controlled by a Hydro Brake or similar, to greenfield rate 5.0 l/sec. All new access roads and hardstandings are to be constructed with permeable materials.

As there is a positive drainage system capable of receiving flows from the development there is no likely impact on neighbouring property.

Any drainage routes through the site will be maintained both during the works on Site and after completion of the works. The upstream and downstream riparian owners and any areas that are presently served by any drainage routes passing through or adjacent to the Site, will not be adversely affected by the development, as there are no changes to these, proposed by the development.

**FLOOD PROTECTION**

Any impact of damage to the properties can be foreseen and mitigated against by relatively simple design and construction techniques.

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

- The base of all electrical switchgear will be raised 1.00m above the existing ground level.

- As this site is in an area that can receive flood warnings from the Environment Agency Floodline Warning Direct system. It is recommended that the property Owner contact the Environment Agency's Floodline on 0845 988 1188 to register the property to receive advance warning of flooding by telephone, mobile, fax, SMS text, email or pager. The Environment Agency aim to issue a 'severe flood warning' approximately 2 hours before existing defences are overtopped.

**CONCLUSION**

- The site does have the benefit of protection from tidal flooding by the existing flood defences which are properly maintained to a 1 in 200-year standard of protection from tidal flooding.

- The proposed Horticultural Use falls within the "Less Vulnerable" uses of land as defined in Table 2 NPPF.

- The proposed floor level for the new glasshouses is to be a minimum of 1.50mODN.

- The Residual Flood Hazard District - Year 2115 1% Fluvial / 0.5% Tidal Event Probability Maps, show that the site is not within a Hazard Rating area at the site of the new glasshouses.

- When applying the Sequential Test, a pragmatic approach on the availability of alternatives should be taken. For example, in considering planning applications for extensions to existing business premises it might be impractical to suggest that there are more suitable alternative locations for that development elsewhere.

- If any flooding of the site did occur water would flow in and out of the greenhouses which would cause minimal damage.

- The Drainage Board have no records of any history of flooding in the area from their drainage system and their system provides an adequate standard of protection from fluvial flooding.

- The drainage strategy for the development is the utilisation of on- site Suds attenuation methods. The surface water run-off from the new glasshouse for a 1 in 100-year storm including climate change is to be attenuated in storage lagoons. The rate of discharge into the nearby watercourse will be at rates agreed with the South Holland Internal Drainage Board and be subject to their consent.

- Any impact of damage to the development can be foreseen and mitigated against by relatively simple design and construction techniques.

- Flooding from other sources is unlikely to affect the site.

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APPENDIX

| | |
|---|---|
| Map 1 | Extract from Environment Agency Flood Zone Map |
| Map 2 | Flooding from Rivers & Sea Map |
| Map 3 | Lincolnshire& Northamptonshire Area Tidal Model Analysis 2006 Map |
| Map 4 | Residual Flood Hazard District - Year 2115 1% Fluvial / 0.5% Tidal Event Probability |
| Map 5 | Residual Flood Velocity District - Year 2115 1% Fluvial / 0.5% Tidal Event Probability |
| Map 6 | Residual Flood Depth District - Year 2115 1% Fluvial / 0.5% Tidal Event Probability |
| Map 7 | Surface Water Flood Map |
| Plan 1 | Location Plan |
| Plan 2 | Site Layout Plan |
| Plan 3 | Greenhouse Layout Plan & Elevations |
| Plan 4 | Topographical Survey |
| Document 1 | HR Wallingford Site Greenfield Calculation and for Lagoon @ 40% CC Suds Storage Report |

# Flood map for planning

| Your reference | Location | Created |
| --- | --- | --- |
| **Poplar Farm** | **538236/317540** | **28 Feb 2018 4:08** |

**Your selected location is in flood zone 3, an area with a high probability of flooding.**

## This means:

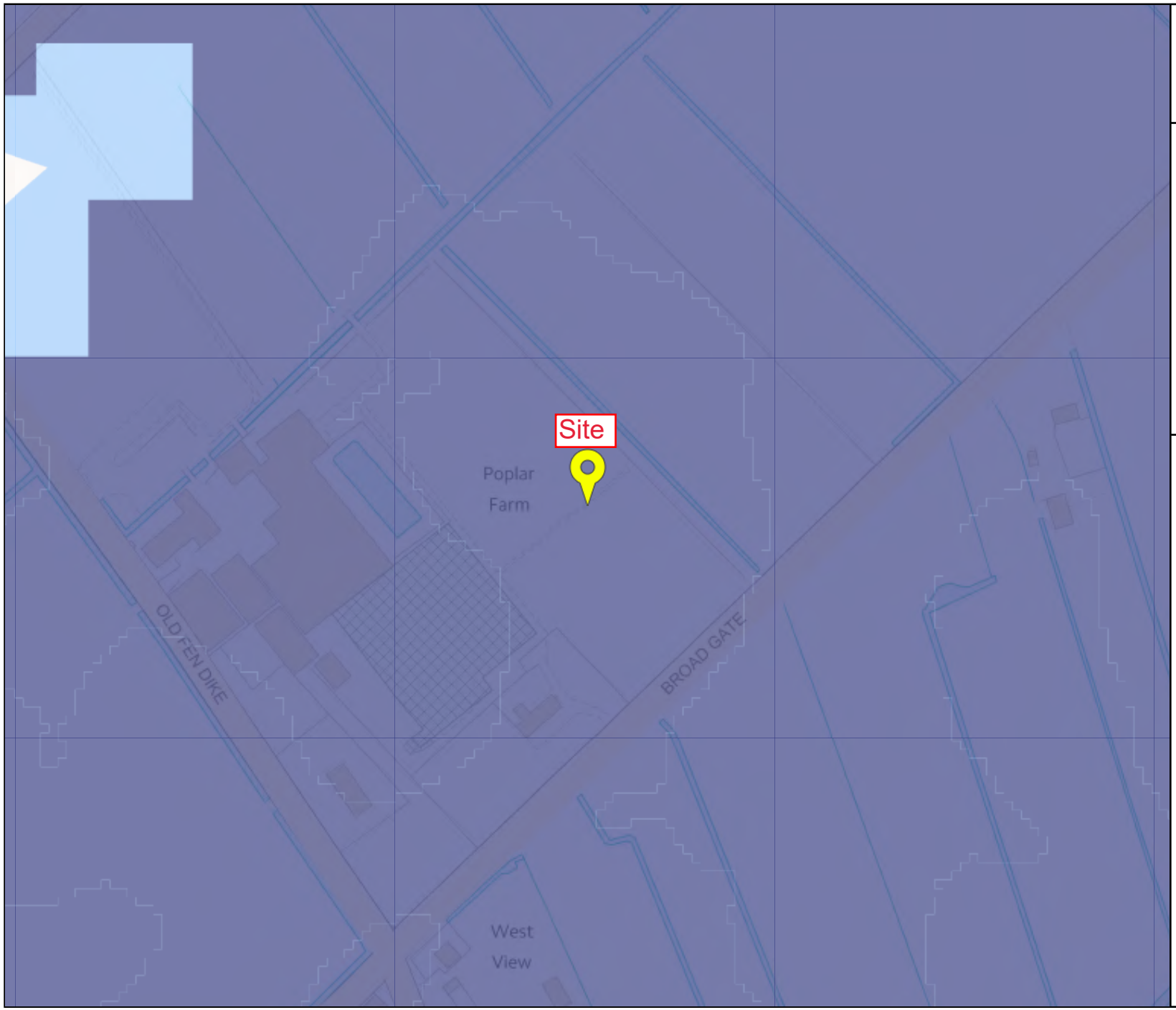
- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

**Notes**

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

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Environment Agency

## Flood map for planning

Your reference
**Poplar Farm**

Location
**538236/317540**

Scale
**1:3125**

Created
**28 Feb 2018 4:08**

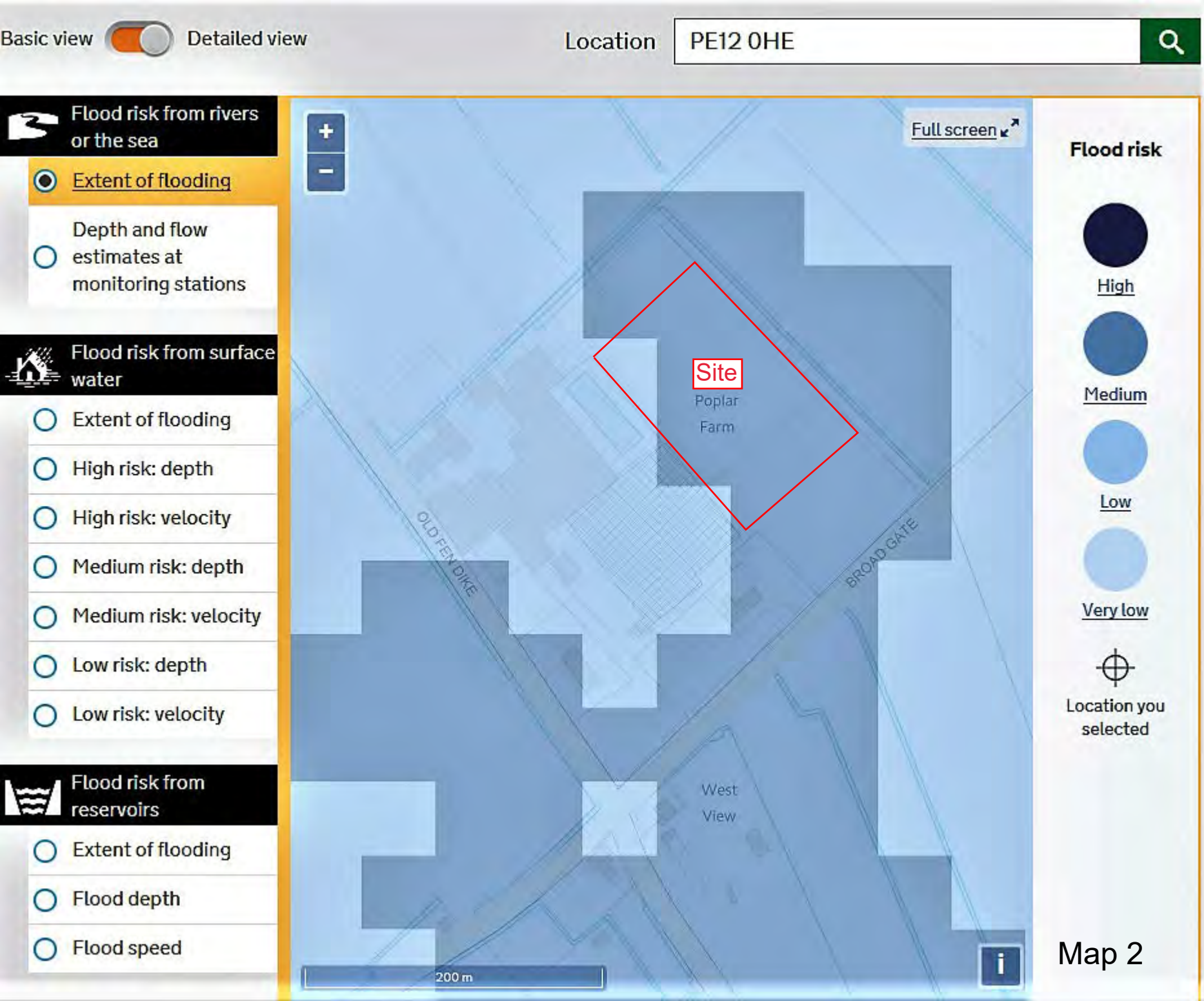
- Development location
- Flood zone 3
- Flood zone 3: areas from defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 50 100 150m



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Map 1


Basic view
Detailed view
Location
PE12 0HE
Flood risk from rivers or the sea
Extent of flooding
Depth and flow estimates at monitoring stations
Flood risk from surface water
Extent of flooding
High risk: depth
High risk: velocity
Medium risk: depth
Medium risk: velocity
Low risk: depth
Low risk: velocity
Flood risk from reservoirs
Extent of flooding
Flood depth
Flood speed
Full screen
Site
Poplar Farm
OLD FEN DIKE
BROAD GATE
West View
200 m
Flood risk
High
Medium
Low
Very low
Location you selected
Map 2

# Tidal Level Location Map
# Lincolnshire & Northamptonshire Area




**Produced May 2017**

**Produced by Partnerships & Strategic Overview Team**

Map 3

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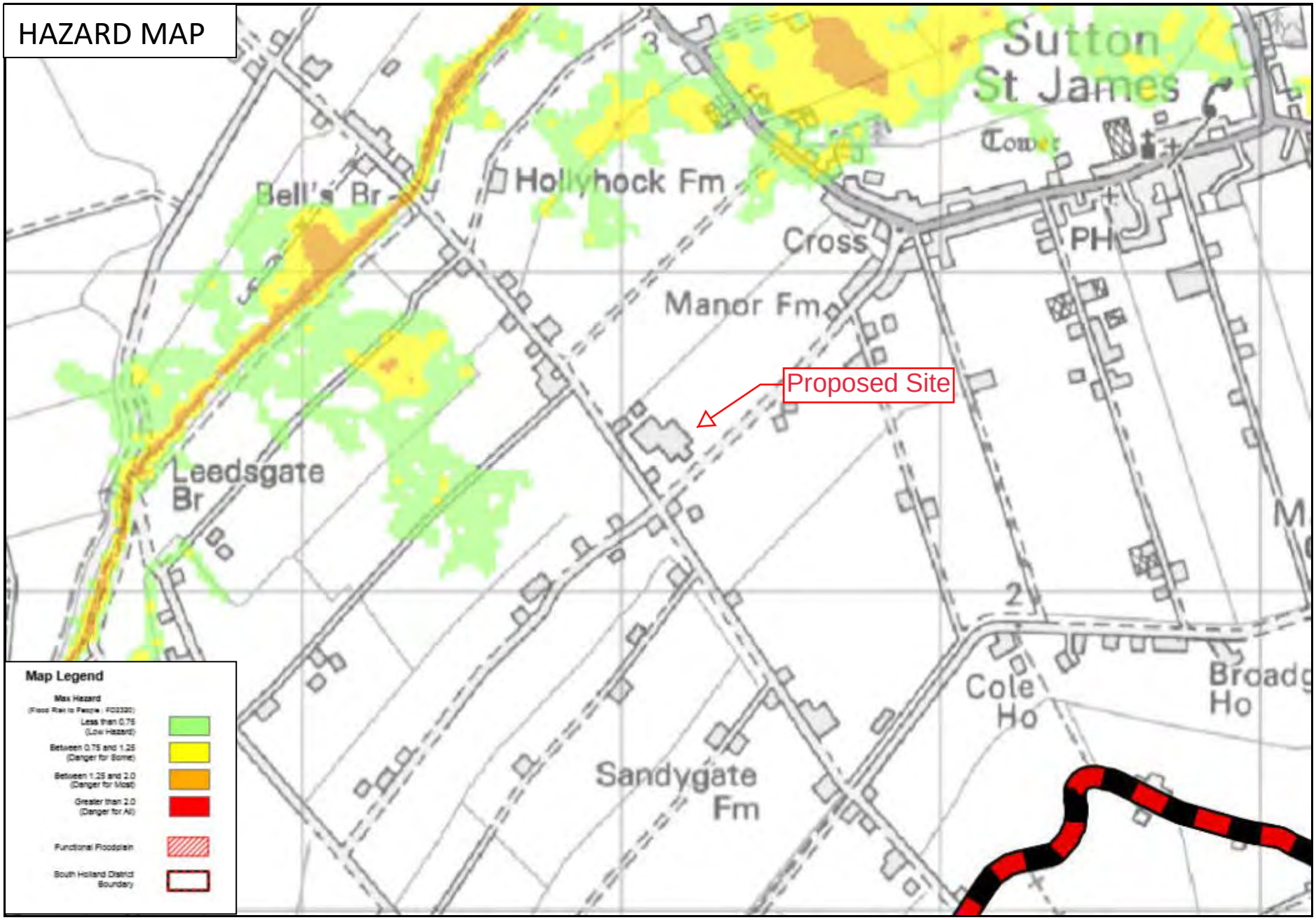
# Tidal Water Levels for the South Humber, East Coast and The Wash

**The table below shows still water levels for locations, from the above location map, around the South Humber Estuary, East Coast and The Wash. It is important to note the following:**

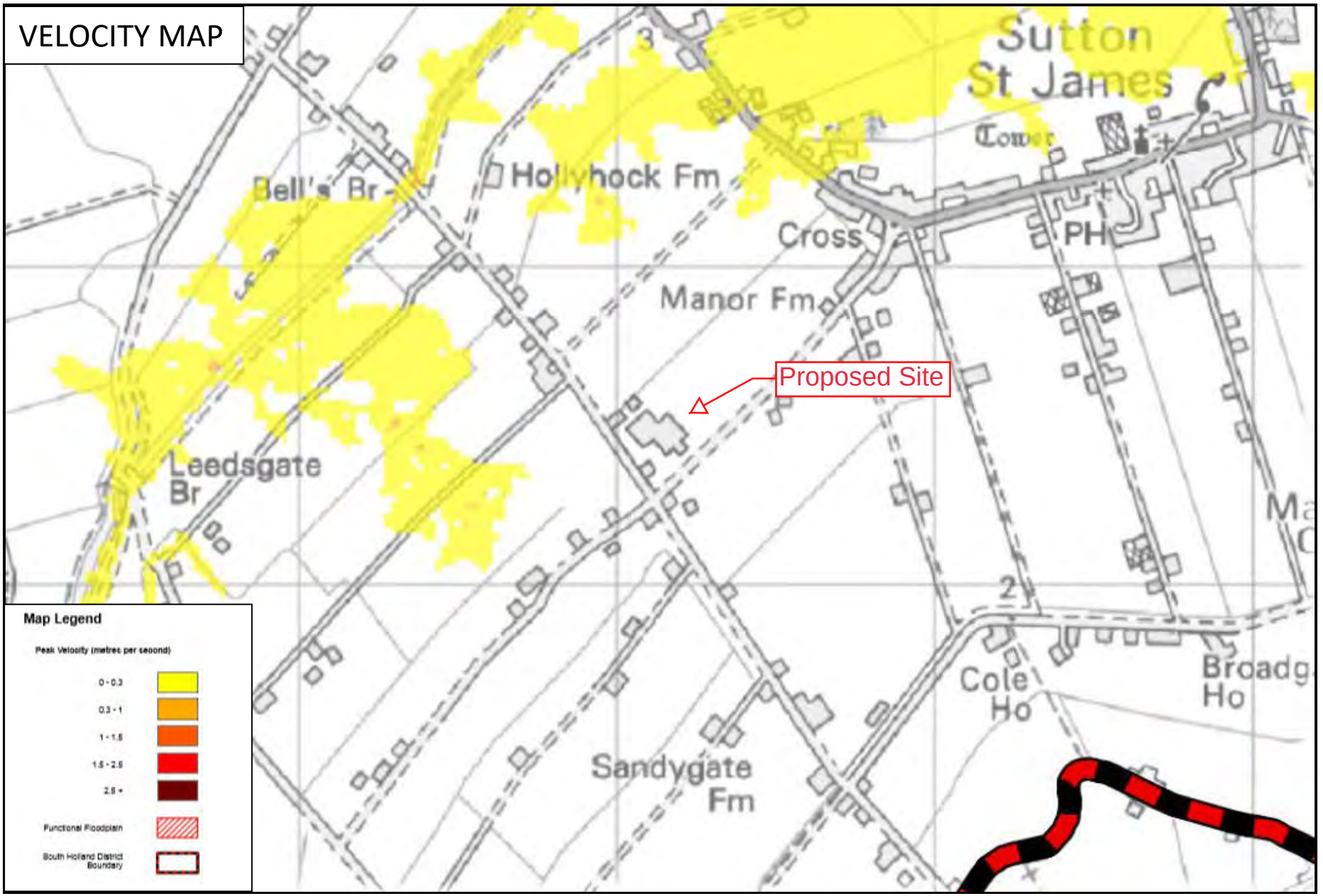
- The base date for the data is 2014 for the South Humber and 2006 for the East Coast and The Wash.
- The data are still water levels. Depending on the use of the data it may be necessary to consider wave heights and / or joint probability analysis of water level and other variables.
- The water level quoted is the 'Best Estimate' water level. Depending on the use of the data it may be necessary to carry out sensitivity testing. Upper and Lower 95% confidence bandings are available upon request.
- Levels for other annual chance scenarios are available if required.

| Ref | Location | Easting | Northing | Annual Chance ( 1 in x) of Tide Level metres ODN | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 10 | 50 | 100 | 200 | 1000 |
| **HUMBER** | | | | | | | | | |
| H030 | Tetney | 535420 | 403180 | 3.94 | 4.29 | 4.56 | 4.69 | 4.82 | 5.15 |
| H050 | Buck Beck | 532700 | 406580 | 4.03 | 4.36 | 4.62 | 4.74 | 4.87 | 5.18 |
| H060 | Grimsby | 527878 | 411346 | 4.10 | 4.43 | 4.70 | 4.82 | 4.95 | 5.27 |
| H080 | Haborough Marsh | 520790 | 415740 | 4.26 | 4.61 | 4.88 | 5.01 | 5.14 | 5.47 |
| H090 | Immingham | 519141 | 417449 | 4.26 | 4.61 | 4.88 | 5.01 | 5.14 | 5.47 |
| H100 | South Killingholme | 518700 | 417120 | 4.41 | 4.77 | 5.05 | 5.18 | 5.32 | 5.66 |
| H130 | North Killingholme | 516530 | 420000 | 4.51 | 4.87 | 5.15 | 5.28 | 5.42 | 5.77 |
| H150 | East Halton | 514450 | 422870 | 4.59 | 4.96 | 5.25 | 5.39 | 5.53 | 5.89 |
| H170 | Goxhill | 511970 | 425440 | 4.67 | 5.04 | 5.34 | 5.47 | 5.61 | 5.95 |
| H200 | New Holland | 508020 | 424330 | 4.87 | 5.26 | 5.55 | 5.68 | 5.81 | 6.12 |
| H210 | Barrow Haven | 506380 | 422620 | 4.92 | 5.31 | 5.60 | 5.73 | 5.86 | 6.17 |
| H220 | Ferriby | 497550 | 421150 | 5.04 | 5.42 | 5.67 | 5.77 | 5.86 | 6.04 |
| H230 | Winterton | 493420 | 422830 | 5.14 | 5.51 | 5.74 | 5.83 | 5.90 | 6.02 |
| H250 | Blacktoft | 484247 | 424190 | 5.25 | 5.62 | 5.83 | 5.90 | 5.96 | 6.04 |
| H270 | Goole | 474857 | 422960 | 5.46 | 5.85 | 6.07 | 6.15 | 6.21 | 6.29 |
| **East Coast** | | | | | | | | | |
| ~ | Great Eau | 545500 | 393800 | 3.80 | 4.19 | 4.46 | 4.57 | 4.69 | 4.96 |
| ~ | Boygrift | 553300 | 379800 | 3.84 | 4.24 | 4.53 | 4.65 | 4.77 | 5.05 |
| ~ | Burgh Sluice | 555190 | 358620 | 4.26 | 4.45 | 4.76 | 4.90 | 5.03 | 5.34 |
| **Wash** | | | | | | | | | |
| ~ | Hobhole | 536610 | 339940 | 4.82 | 5.30 | 5.64 | 5.78 | 5.93 | 6.27 |
| ~ | Lawyers Sluice | 540750 | 334550 | 4.84 | 5.32 | 5.66 | 5.80 | 5.95 | 6.29 |
| ~ | West Lighthouse | 549150 | 325750 | 4.88 | 5.37 | 5.71 | 5.86 | 6.01 | 6.35 |
| ~ | Grand Sluice | 532400 | 344500 | 4.88 | 5.33 | 5.65 | 5.78 | 5.93 | ~ |
| ~ | Fosdyke Bridge | 531700 | 332200 | 4.91 | 5.38 | 5.71 | 5.85 | 5.99 | ~ |
| ~ | Marsh Road | 526000 | 324000 | 5.04 | 5.44 | 5.73 | 5.85 | 5.98 | ~ |
| ~ | Wisbech | 546100 | 310000 | 4.83 | 5.25 | 5.53 | 5.66 | 5.78 | ~ |
| ~ | Dog In Doublet | 527300 | 299300 | 3.67 | 4.00 | 4.22 | 4.32 | 4.42 | ~ |

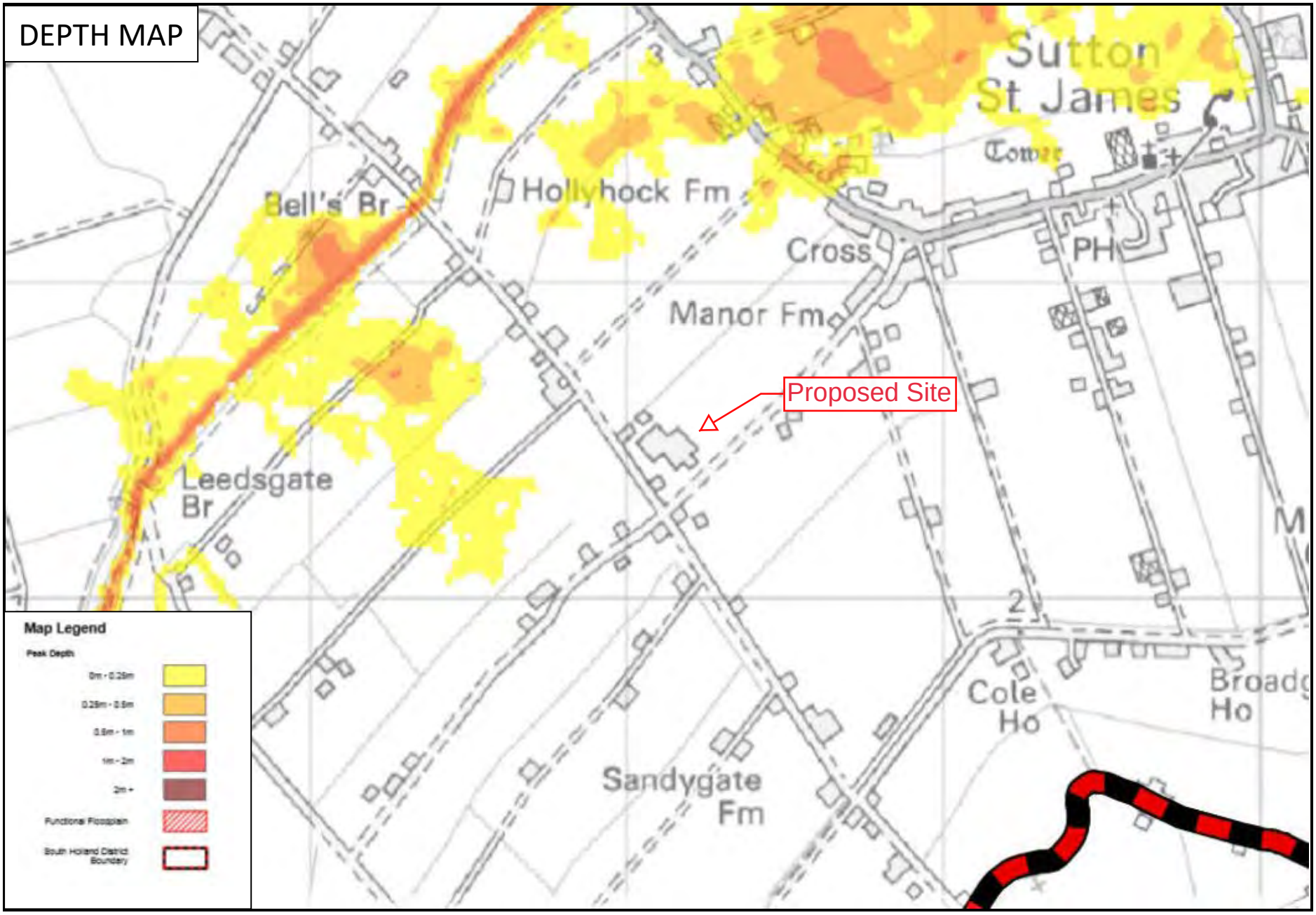
# HAZARD MAP



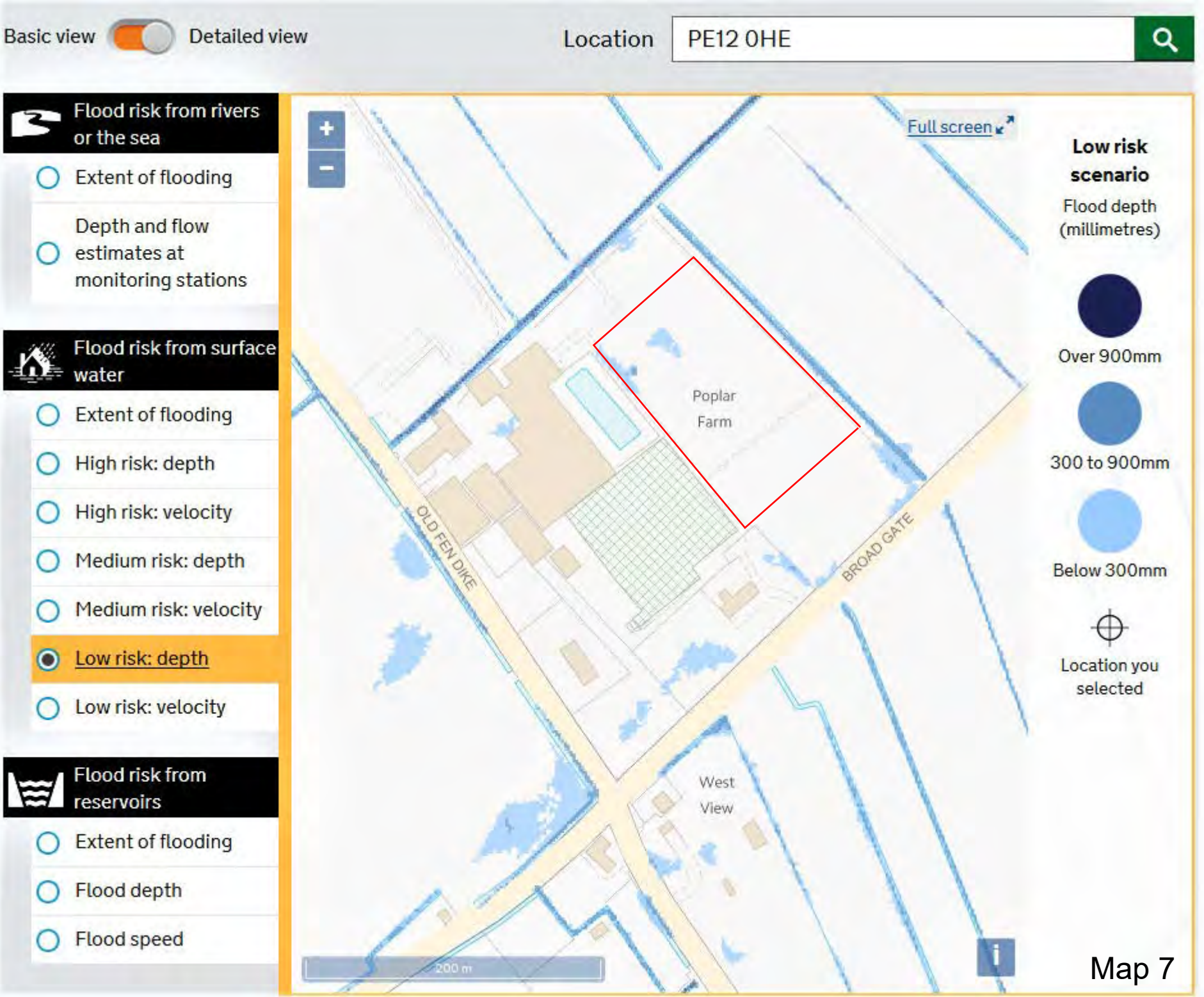

Map 4


VELOCITY MAP
Sutton
St James
Tower
Hollyhock Fm
Bell's Br
Cross
PH
Manor Fm
Proposed Site
Leedsgate
Br
Cole
Ho
Broadg
Ho
Sandygate
Fm
Map Legend
Peak Velocity (metres per second)
0 - 0.3
0.3 - 1
1 - 1.5
1.5 - 2.5
2.5 +
Functional Floodplain
South Holland District
Boundary

Map 5

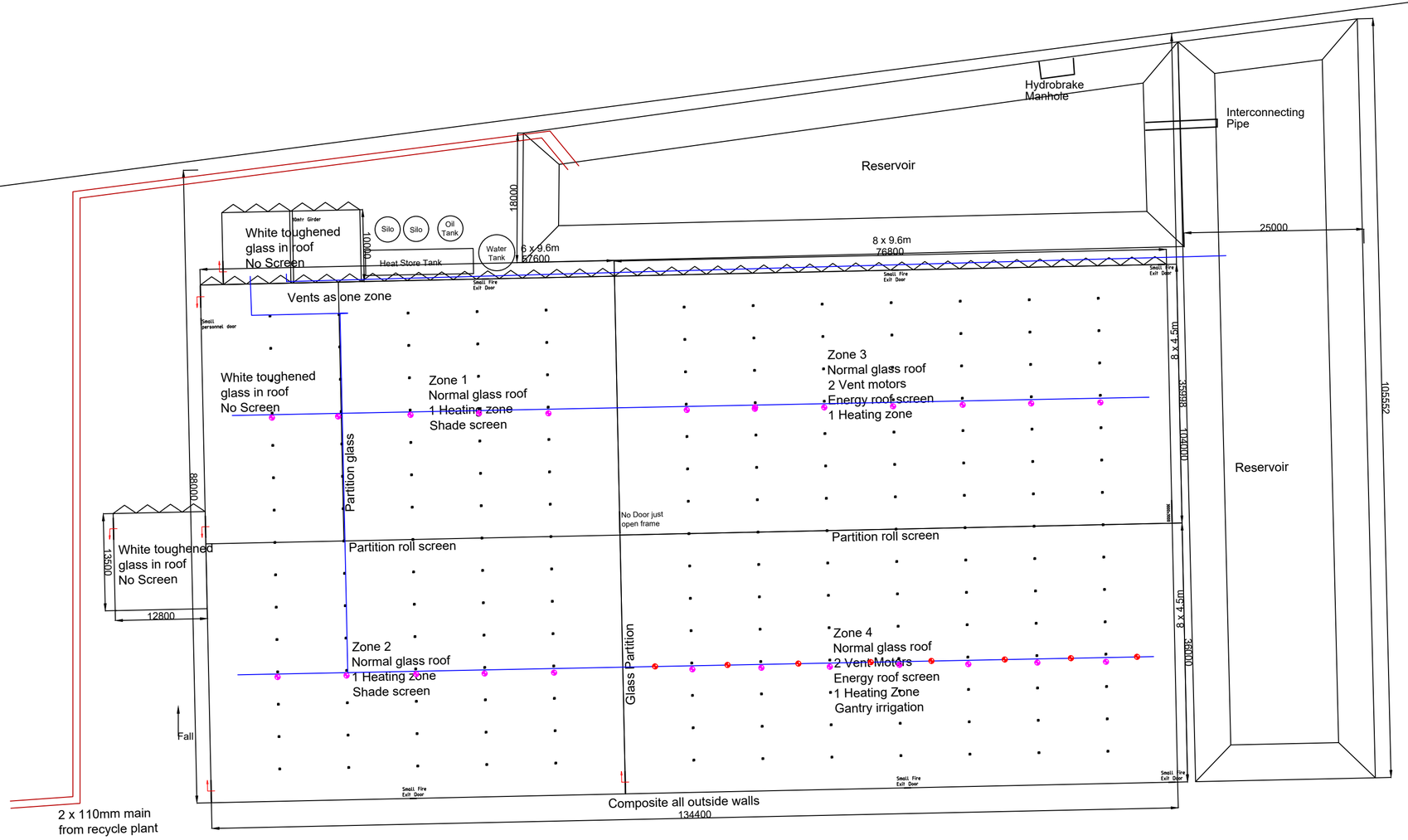

DEPTH MAP
Sutton St James
Tower
Bell's Br
Hollyhock Fm
Cross
PH
Manor Fm
Proposed Site
Leedsgate Br
Cole Ho
Broad Ho
Sandygate Fm
Map Legend
Peak Depth
0m - 0.25m
0.25m - 0.5m
0.5m - 1m
1m - 2m
2m +
Functional Floodplain
South Holland District Boundary

Map 6


Basic view
Detailed view
Location
PE12 0HE
Flood risk from rivers or the sea
Extent of flooding
Depth and flow estimates at monitoring stations
Flood risk from surface water
Extent of flooding
High risk: depth
High risk: velocity
Medium risk: depth
Medium risk: velocity
Low risk: depth
Low risk: velocity
Flood risk from reservoirs
Extent of flooding
Flood depth
Flood speed
Full screen
Poplar Farm
OLD FEN DIKE
BROAD GATE
West View
200 m
Low risk scenario
Flood depth (millimetres)
Over 900mm
300 to 900mm
Below 300mm
Location you selected
Map 7


N
Reservoir
Drain
Drain
Drain
Tanks
Tanks
Drain
Poplar Farm
Reservoir
Tank
Liberty Hall
Sunfield Lodge
Drain
Drain
Cross
GP
2.1m
West View
OLD FEN
A+H NURSERIES LTD
SCALE 1:2500
0
80m
200

Plan 1




## General Notes

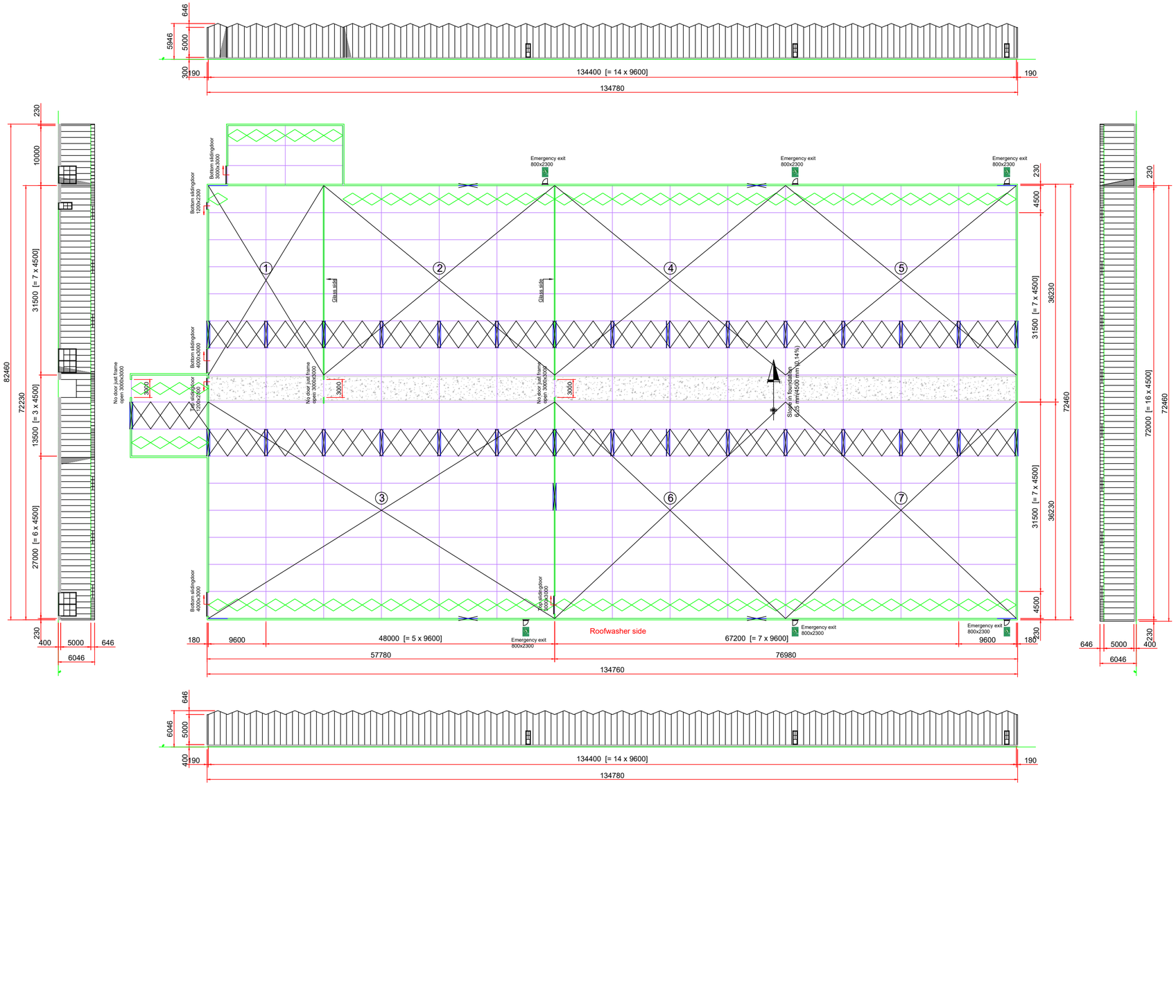
| No. | Revision/Issue | Date |
|---|---|---|
| | | |
| | | |

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wayne@hortechsystems.co.uk
www.irrigationonline.co.uk

Client
AWE Horticulture Ltd
Poplar Farm
Old Fendyke
Sutton St James
Lincs PE12 0HE

| | |
|---|---|
| Project | New Glasshouse |
| Date | 27 February 2018 |
| Scale | A2 - 1:500 |

Plan 2




## General Notes

| No. | Revision/Issue | Date |
|---|---|---|
| | | |
| | | |


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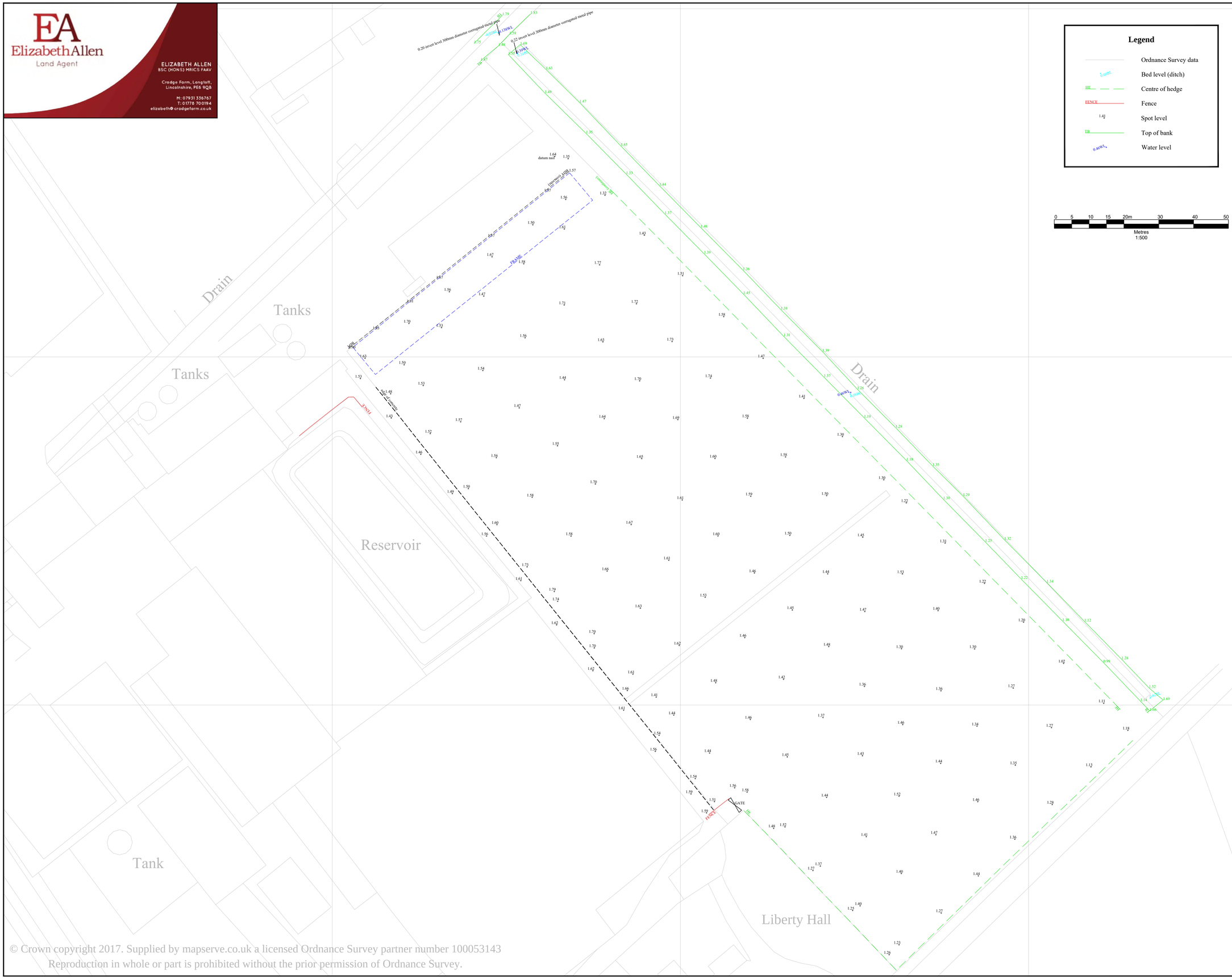
| | |
|---|---|
| Project | New Glasshouse Elevations |
| Date | 27 February 2018 |
| Scale | A2 - 1:500 |

EA
ElizabethAllen
Land Agent

ELIZABETH ALLEN
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*Client*

**AWE Horticulture**
**Poplar Farm**
**Old Fendyke**
**Sutton St. James**
**Spalding**
**PE12 0HE**

| *Rev* | *Description* | *Date* | *By* |
|---|---|---|---|

## Survey Control

The survey grid has been derived from GPS observations and related to Ordnance Survey National Grid (OSTN15).

All dimensions given in metres.

*Project*

Poplar Farm

*Title*

Proposed Glass House
Site Levels

| *Drawing No.* | *Rev.* |
|---|---|
| PF190917-002 | 00 |
| *Date* | *Drawn By* |
| 22/02/2018 | TWB |

*Drawing Scale*

1:500 @ A1

HR Wallingford
*Working with water*

# Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

| | |
|---|---|
| Calculated by: | Raymond Morgan |
| Site name: | Poplar Farm |
| Site location: | Sutton St James |

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details befor nalising the drainage scheme.

## Site coordinates

| | |
|---|---|
| Latitude: | 52.73778° N |
| Longitude: | 0.04531° E |

| | |
|---|---|
| Reference: | 6263647 |
| Date: | 2018-03-01T17:16:27 |

| Methodology | IH124 |
|---|---|

## Site characteristics

| | |
|---|---|
| Total site area (ha) | 1.525 |
| Signi cant public open space (ha) | 0.345 |
| Area positively drained (ha) | 1.18 |
| Pervious area contribution (%) | 30 |
| Impermeable area (ha) | 1.16 |
| Percentage of drained area that is impermeable (%) | 98 |
| Impervious area drained via in ltration (ha) | 0 |
| Return period for in ltration system design (year) | 10 |
| Impervious area drained to rainwater harvesting systems (ha) | 0 |
| Return period for rainwater harvesting system design (year) | 10 |
| Compliance factor for rainwater harvesting system design (%) | 66 |
| Net site area for storage volume design (ha) | 1.18 |
| Net impermeable area for storage volume design (ha) | 1.16 |

* Where rainwater harvesting or in ltration has been used for managing surface water runoff such that the effective impermeable area is less than 50 % of the 'area positively drained', the 'net site area' and the estimates of Qbar and othe ow rates will have been reduced accordingly.

## Design criteria

| | |
|---|---|
| Volume control approach | Use long term storage |

| | Default | Edited |
|---|---|---|
| Climate change allowance factor | 1.4 | 1.4 |
| Urban creep allowance factor | 1.1 | 1.1 |
| Interception rainfall depth (mm) | 5 | 5 |
| Minimu ow rate (l/s) | 5 | 5 |

| | |
|---|---|
| Qbar estimation method | Calculate from SPR and SAAR |
| SPR estimation method | Calculate from SOIL type |

| | Default | Edited |
|---|---|---|
| Qbar total site area (l/s) | 2.18 | -- |
| SOIL type | 2 | 2 |
| HOST class | N/A | N/A |
| SPR | 0.3 | 0.3 |

## Hydrology

| | Default | Edited |
|---|---|---|
| SAAR (mm) | 569 | 569 |
| M5-60 Rainfall Depth (mm) | 20 | 20 |
| 'r' Ratio M5-60/M5-2 day | 0.4 | 0.4 |
| Rainfall 100 yrs 6 hrs | 63 | |
| Rainfall 100 yrs 12 hrs | 96.25 | |
| FEH/FSR conversion factor | 1.25 | 1.25 |
| Hydrological region | 5 | |
| Growth curve factor: 1 year | 0.87 | 0.87 |
| Growth curve factor: 10 year | 1.65 | 1.65 |
| Growth curve factor: 30 year | 2.45 | 2.45 |
| Growth curve factor: 100 year | 3.56 | 3.56 |

## Site discharge rates

| | Default | Edited |
|---|---|---|
| Qbar total site area (l/s) | 2.18 | 2.18 |
| Qbar net site area (l/s) | 1.69 | 1.69 |
| 1 in 1 year (l/s) | 5 | 5 |
| 1 in 30 years (l/s) | 5 | 5 |
| 1 in 100 years (l/s) | 6 | 6 |

## Estimated storage volumes

| | Default | Edited |
|---|---|---|
| Interception storage ($m^3$) | 46 | 46 |
| Attenuation storage ($m^3$) | 1129 | 1129 |
| Long term storage ($m^3$) | 0 | 0 |
| Treatment storage ($m^3$) | 139 | 139 |
| Total storage *(excluding treatment)* ($m^3$) | 1176 | 1176 |

This report was produced using the Storage estimation tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at http://uksuds.com/terms-and-conditions.htm. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for use of this data in the design or operational characteristics of any drainage scheme.