FLOOD RISK ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT
LAND OFF LIME WALK,
LONG SUTTON,
SPALDING,
PE12 9HG



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INTRODUCTION

The National Planning Policy Framework (NPPF) 2018 sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. A supporting Planning Practice Guidance is also available. The guidance uses four Flood Zones to characterise flood risk which refer to the probability of river and sea flooding, ignoring the presence of defences.

This Flood Risk Assessment, (FRA), is compliant with the requirements set out in the National Planning Policy Framework, (NPPF), and the associated Planning Practice Guidance. (NPPG)

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 consider of the presence of defences or the likelihood that flood return intervals will be reduced by climate change.

This Flood Risk Assessment and Drainage Statement has been prepared with reasonable skill, care and diligence, in support of a 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.

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APPLICATION SITE

The site is situated at land, off Lime Walk, Long Sutton, Spalding PE12 9HG which lies within the South Holland District Council's administrative area. The National Grid Reference for the site is TF 43065 23566 **Plan 1**

The site which is currently in agriculture use is roughly rectangular in shape, has an approximate 95m width and an approximate 235m length totalling 2.23 Hectares.

This flood risk assessment has been prepared for an outline planning permission for the erection of up to 70 No two storey dwellings together with the construction of adopted access roads. **Plan 2**

The Site would be classed as Major Development applying the National Planning Policy Guidance (NPPG) as the site is to be developed for 10 or more dwellings.

The National Planning Policy Framework 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 residential 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 NPPG.

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

Flood Zone 3- High Probability
Definition 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. The water-compatible and less vulnerable uses of land are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable and essential infrastructure uses 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 uses in times of flood **Flood Risk Assessments requirements** All proposals in this zone should be accompanied by a Flood Risk Assessment. **Policy aims** 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 techniques; • relocate existing development to land with a lower probability of flooding; • create space for flooding to occur by allocating and safeguarding open space for flood storage

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPG the proposed development use for

residential is classified as “More Vulnerable”, with Table 1 of NPPG stating that such uses are permitted in this zone subject to the Exception Test.

Table 2: Flood Risk Vulnerability Classification

More Vulnerable
• Hospitals • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels • Non-residential uses for health services, nurseries and educational establishments • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravan and camping, subject to a specific warning and Evacuation Plan.

From the topographical survey, the site has a gradual gradient from south-east to north-west. Levels at the north-west boundary (Lime Walk) 2.40mODN and on the south-eastern boundary at 2.75mODN. Lime Walk at the site entrance is at a level of 3.25mODN **Plan 3**

DRAINAGE AUTHORITIES

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 source of flooding affecting the development site has been identified as:

- From the River Nene (Tidal)
- The Wash (Tidal)
- South Holland IDB Drains (Fluvial)

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.

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

The risk of flooding from Rivers and Sea map shows that the site is at Low Risk of Flooding, Low means that

each year, this area has a chance of flooding of less than 1 in 100 (1%) but greater or equal to 1 in 1000 (0.1%). **Map 2**

The tidal defences protecting this site consist of earth embankments. They are in good condition and reduce the risk of flooding to a 0.67% (1 in 150) chance of occurring in any year. The Environment Agency inspect these defences routinely to ensure potential defects are identified.

There is also an old Roman Sea Bank which runs north to south to the east of Long Sutton which would also impede the flow of water from a breach to the primary defences. The crest level along this bank is circa 5.0mODN

Breach Analysis to the Tidal Defences

From Lincolnshire & Northampton shire Area Tidal Modal Analysis (June 2006) **Map 3**

Levels for the Humber Estuary have an assessment date of 2014, with others having an assessment date of 2006, which should be used in any consideration of future increases due to climate change.

> Peak tide levels Present Day (2006) at West Lighthouse (Tidal) 0.5% (1 in 200) = 6.01mODN
> Peak tide levels (2115) at West Lighthouse (Tidal) 0.5% (1 in 200) = 6.01mODN plus climate change of 1141mm = 7.15mODN

River Nene

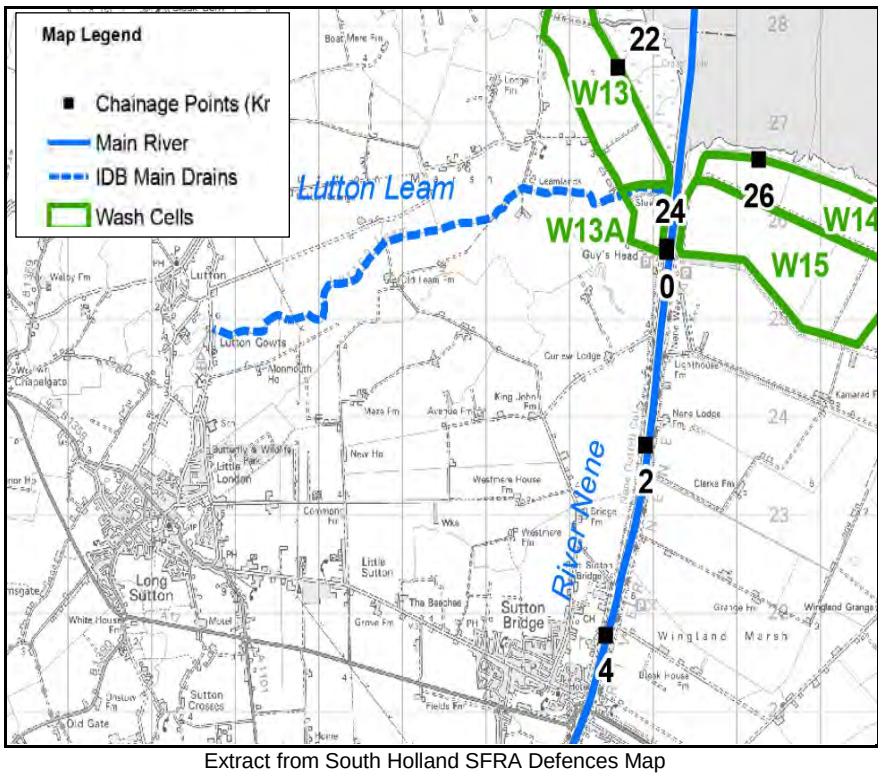
The site is located some 6.0Km from the left bank of the River Nene. The 1 in 200-year flood level present day in the river channel is 5.91mODN and including for climate change (2115) is 7.39mODN. The left bank defence level along the dock frontage is 6.35mODN and at this point has no raised defences. The average width of the dock area, which has a concrete surface, from the river edge is 55m therefore the chance of a breach to this area is minimal.

With climate change (2115) the increase in tide level would overcome the present level of defence along the Port frontage. Therefore, it will be necessary for these defences to be improved to accommodate climate change. The current earth banks to the River Nene downstream of the site are marginally above the increased level in tidal levels

Wash Frontage

The site is located some 6.0Km from the Wash. Behind the coastal flood defence along the wash frontage from Guys Head to the River Welland is an 18th century sea defence which provides a secondary flood barrier should there be a failure to the primary defence although this is not maintained by the Environment Agency, they have powers to prevent its removal. The secondary defence embankments are linked at intervals to the primary defences by a series of cross banks. This divides the frontage area into several cells bounded by

embankments. The map below shows these cells (13, &13A) which have an average crest levels for the primary embankment for the 2115, 1 in 200-year tide level of 7.70mODN and & 7.25mODN respectively, taken from the South Holland SFRA Update.



Extract from South Holland SFRA Defences Map

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.

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

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 0.25m
0.75 – 1.25	Moderate	Danger for Some (i.e. children) Danger; flood zone with deep or fast flowing water	Up to 0.5m
1.25 – 2.0	Severe	Danger for Most Danger Flood Zone with deep fast flowing water	0.5 -3.0m
>2.0	Extreme	Danger for All Extreme Danger; flood zone with deep fast flowing water	0.5 to over 3.0m

The Environment Agency has carried out a Tidal Hazard Mapping following a breach to the defences. The Lincolnshire & Northamptonshire Area Tidal Hazard Maps for Scenario year 2006 for the 1 in 200-year event show that the site is not within a Hazard Rating area.

With climate change, up to year 2115 the 1 in 200-year event maps show that the site is within a Hazard Rating Area of 1.25 – 2.0 (Danger for Most), the maximum depth is between 0.5 and 1.0m and velocity 0 – 0.3m/sec. **Map 4**

The Environment Agency has confirmed that the site is not affected from overtopping of the defences for both the present day (2006) and with climate changes (2115) scenarios.

The Environment Agency recommended that for housing developments the minimum mitigation measures required for single storey developments or developments that do have any ground floor sleeping shall be determined by the flood depths arising from the 2115 (0.1%) breach scenario. Any proposals that do not included ground floor sleeping shall be determined by the flood depths arising from the 2115 (0.5%) breach scenario.

They also recommended that for housing development the finished floor level should be informed by the predicted flood depth maps. For depths of between 0.5 – 1.0m the FFL should be set 1000mm above the ground level with flood resilient construction 300mm above the flood level.

It is therefore proposed that the lowest ground floor for the dwellings will have a finished floor level of 3.40mODN which is 1000mm above the existing lowest ground level of 2.40mODN.

SURFACE WATER FLOODING

The site is not shown on the Surface Water flood maps to be affected by surface water flooding for the 1 in 1000-year event.

Very Low risk means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can

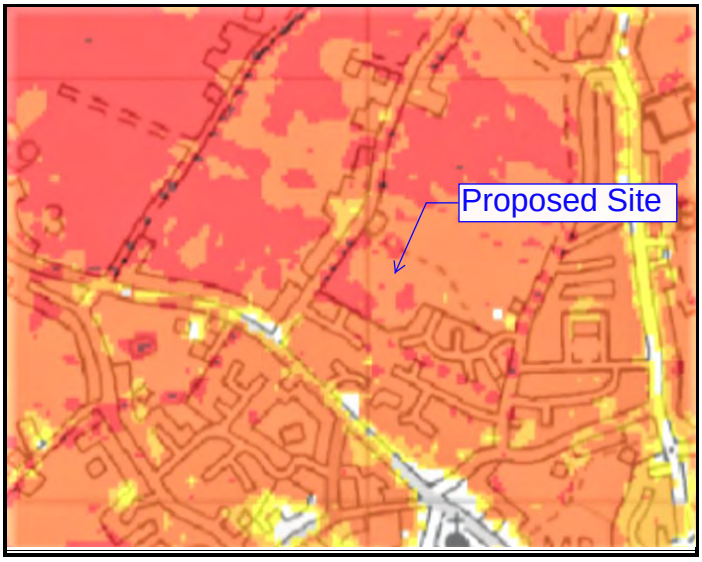
greatly affect the chance and severity of flooding. With the property being raised 1.0m above the existing ground level the property will not be affected **Map5**

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.



Residual Flood Depth – South Holland District 2115 (1% Fluvial/0.5% Tidal)

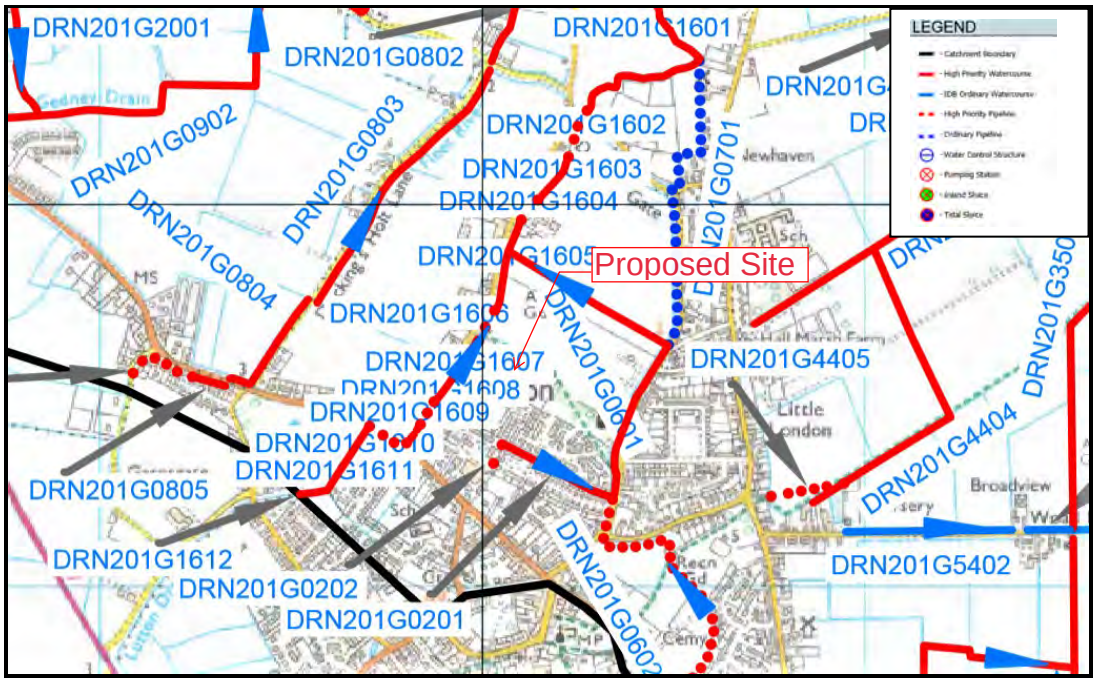
South Holland Internal Drainage Board

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 proposed development site is located within Catchment K Lutton Leam drainage area of South Holland Drainage Board. The IDB has a high priority watercourse on the western boundary of the site, alongside Lime Walk, Ref DRN201G1606 Lutton Eau as shown on the SHIDB asset map below.



SHIDB Watercourse Lutton Eau



Extract from South Holland IDB Drainage Map Catchment K West

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.

The culverted road crossing and the outfall from the attenuation pond will require the Board's consent.

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. However, with the natural topographic nature of the ground being flat and no high ground around the development and with the floor level for the dwellings being 1000mm above the existing ground level, this will not cause any rapid inundation of the site and is likely only lead to local ponding of shallow depth and low velocity which will drain away from the site.
- 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. Again, this would flow following the natural ground contours northwards to the IDB watercourse and with the floor level of the dwellings being 1000mm above the existing ground level, this will not cause any rapid inundation of the site and is likely only lead to local ponding of shallow depth and low velocity which will drain away from 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 other known facilities close by which would affect the site.

SEQUENTIAL APPROACH

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

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

Sequential Test

The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. The NPPF states that development should not be permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. It is important to note that the

Sequential Test does not specifically mean that sites such as this cannot be developed, rather that sites at less risk should be developed first.

Table 3: Flood risk vulnerability and flood zone '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	✓	✗	✗	✗

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 Zone3 and for "More Vulnerable" land uses the Upper End 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'	Total potential change anticipated for '2050s'	Total potential change anticipated for '2080s'
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

With the main risk of flooding affecting the site being from the tidal source and the development has been designed to cater for the climate change for scenario year 2115 any flooding caused by fluvial flooding has been mitigated against

MANAGEMENT OF SURFACE WATER RUN-OFF

Surface Water

In accordance with the NPPF there is a preference for SuDS to be incorporated for residential developments unless demonstrated to be inappropriate. Furthermore, in accordance with recognised guidance, Part H of the Building Regulations 2010 and 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

Any proposed surface water drainage system will need to be designed to account for the effects of climate change over the lifetime of the development. Based on the recommendations in Paragraph 13 - Table 5 of the Technical Guide to National Planning Policy Framework 2012 (NPPF) the proposed drainage systems should be sized to allow for a 30% increase in rainfall intensity.

The 2014 DEFRA Draft National Standards and Specified Criteria for Sustainable Drainage states that:
'The drainage system must be designed and constructed so surface water discharged does not adversely impact the water quality of receiving water bodies, both during construction and when operational.'

The following is a preliminary overview and will be subject to the detailed design being undertaken when planning permission and final layout has been determined. It is proposed to utilise infiltration techniques to reduce the storm water discharge from the proposed development in order 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.

Existing Greenfield Conditions.

Existing green field runoff values, calculated in accordance with the H R Wallingford greenfield runoff estimation for sites) in accordance with DEFRA / Environment Agency Report SC030219 rev E and Interim National Procedure Principle 17, confirm that the impermeable area of the site (1.1Ha) generates a 1 year run off value of 5.0 l/s, 30-year of 5.0 l/s and 100-year of 5.0 l/s. These are all classified as default values.

Infiltration

An initial site investigation and desk study has identified that the land is shown on the British Geology Survey maps to consists Superficial deposits of Tidal Flat Deposits – Clay- Silt and the bedrock Ampthill Clay Formation – Mudstone. Therefore, infiltration techniques have not been adopted.

The proposal includes for the construction of adoptable access roads, which are to be accessed from Lime Walk. Serving up to 70 detached and semi-detached 2, 3 and 4-bed dwellings together with domestic curtilage permeable individual and communal driveways and parking courtyards. The total impermeable area is assumed to be to 45%.

The Design – SuDS.

Given the topography of the site and with the underlying soils not being suitable for infiltration SuDS it is not proposed to incorporate any infiltration SuDS into the scheme design.

It is however possible to incorporate source control (water quality) SuDS into the scheme design, for example, and not limited to

i) *fit water butts to domestic curtilage rainwater downpipes on all rear elevations.*

ii) *construct domestic curtilage individual and communal driveways in permeable block paving with a type 3 granular sub base layer providing source control prior to discharge*

iii) *construct development access roads with one footway, a single cross-fall carriageway and an under-drained swale to promote sheet flow and source control prior to discharge.*

iv) *Construct an on-line surface water balancing pond prior to discharge to provide attenuation and sedimentation control features.*

Watercourse

There is an existing South Holland IDB maintained drain forming the western boundary of the site which flows

away from the site in a north-easterly direction.

Watercourse can be used as the method of disposal of all surface water from the adoptable road together with the domestic curtilage roof areas and the individual and communal driveways and parking courtyards.

The suggested location of proposed under-drained swales and an on-line balancing pond have been incorporated in the site layout. These together with the use of permeable materials within domestic curtilage provides source control (quality) and storage volume (quantity) together with amenity and biodiversity SUDS.

Surface water runoff and storage calculations have been undertaken using a software tool developed by HR Wallingford. **Document 1**

SOIL types (1 to 5) are defined in the Flood Studies Report and broadly describes the maximum runoff potential. SOIL type 1 is sandy highly permeable material with permeability reducing as the SOIL value increases. SOIL type 4 is heavy clay and 5 (which is rarely applied) is exposed rock.

The existing site is greenfield and whilst the software considers the site to be located on SOIL type 2 this is not the case and therefore a SOIL type 4 has been used.

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

- Qbar 3.91 l/sec
- 1 in 1 year 5.0 l/sec
- 1 ion 30 years 5.0 l/sec
- 1 in 100 years 5.0 l/sec

For this Site the flow control has been limited to Qbar to utilise lower discharge rates, as the available capacity in the receiving system is not known. A minimum default discharge of 5 l/sec applies to any site.

The volume for attuation has been calculated to be for 40% increase in peak rainfall allowance = 1087m^3

Public Sewer

There are no proposals for any surface water to discharge to public sewer.

Foul Water Drainage

Foul sewers designed and laid in accordance with Sewers for adoption 6th edition, to be adopted by Anglian Water Services Ltd, under Section 104 of the Water Industry Act 1991, (as amended by the Water Act 2003) will be provided to serve the development and connected into the existing Anglian Water Services Ltd foul water sewer network in Lime Walk

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

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 entering a building.
- **Flood-resilient works: -** these reduce the amount of damage caused by water entering the building.

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

- The lowest ground floor level for the properties is to be raised 1000mm above existing average ground level at 3.40mODN. If a beam type floor is to be used, provision should be incorporated for draining the under-floor voids. The wall vents are to be fitted with 'Flood Angel' air bricks which allow air to free pass through as a usual, (complying with BS493:1995) but under flood conditions it shuts down when in contact with water. A removable mesh prevents the passage of debris which may otherwise impinge on the moving part.

- External doors to be of construction not susceptible to moisture.

- Avoid the use of absorbent cavity insulation to the ground floor level and use the closed cell type and provide concrete ground floors.

- Treated and sealed timber skirting and architraves.

- Arrange for all service circuits at ground floor level to be routed at first floor level and fed downwards, where practical socket outlets, boilers etc. to be a minimum of 0.5m above the raised ground floor 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 at present have the benefit of protection from tidal flooding by the existing defences

which are properly maintained to a 1 in 200-year standard of protection from tidal flooding.

- The site for the new dwellings is shown to lie within the Flood Zone 3a (High Probability), land assessed as having a less than 1 in 100-year annual probabilities of river flooding (1%) or 1 in 200-year sea flooding (0.5%) in any year (without defences on the Agency's flood maps). There are no local site-specific risks that would adversely affect this categorisation.

- Applying the Flood Risk Vulnerability Classification in Table 2 of NPPF. The proposed use of the land and buildings for residential use falls within the 'More Vulnerable' uses of land shown in Table 2 Flood Risk Vulnerability Classification and buildings used for all purposes are appropriate in Flood Zone 3a subject to passing the exception Test.

- Following a breach to the defences. The Lincolnshire & Northamptonshire Area Tidal Hazard Maps (2009) for Scenario year 2006 for the 1 in 200-year event show that the site is not within a Hazard Rating area. With climate change, up to year 2115 the maps show that the site is within a Hazard Rating area between 1.25 - 2.0 (Danger for Most) with a velocity of 0 -0.3m/sec and depth of flow 0.5 – 1.0m.

- The ground floor living accommodation is to be raised 1000mm above the 1 in 200-year Breach flood level, for scenario year 2115, for the Wash, to a minimum of 3.40mODN.

- No obvious constraints have been identified that may impact the proposed development and the type of mitigation measures that can be used to reduce the flood risk.

- A drainage strategy report has been undertaken for the site using storm attenuation techniques.

- With the properties being two storeys, a safe refuge is provided at first floor level.

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APPENDIX

Map 1	Environment Agency Flood Map
Map 2	River & Sea Flood Map
Map 3	Lincolnshire & Northamptonshire Area Tidal Modal Analysis 2115 Map
Map 4	Lincolnshire & Northamptonshire Area Tidal Breach Hazard Mapping 2115 –1 in 200 year
Map 5	Surface Water Flood Map
Plan 1	Site Location Plan
Plan 2	Site Layout
Plan 3	Topographical Survey
Document 1	Surface Water Storage Requirements

Flood map for planning

Your reference	Location (easting/northing)	Created
Lime Walk	**543049/323557**	**26 Oct 2018 8:22**

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

This means:

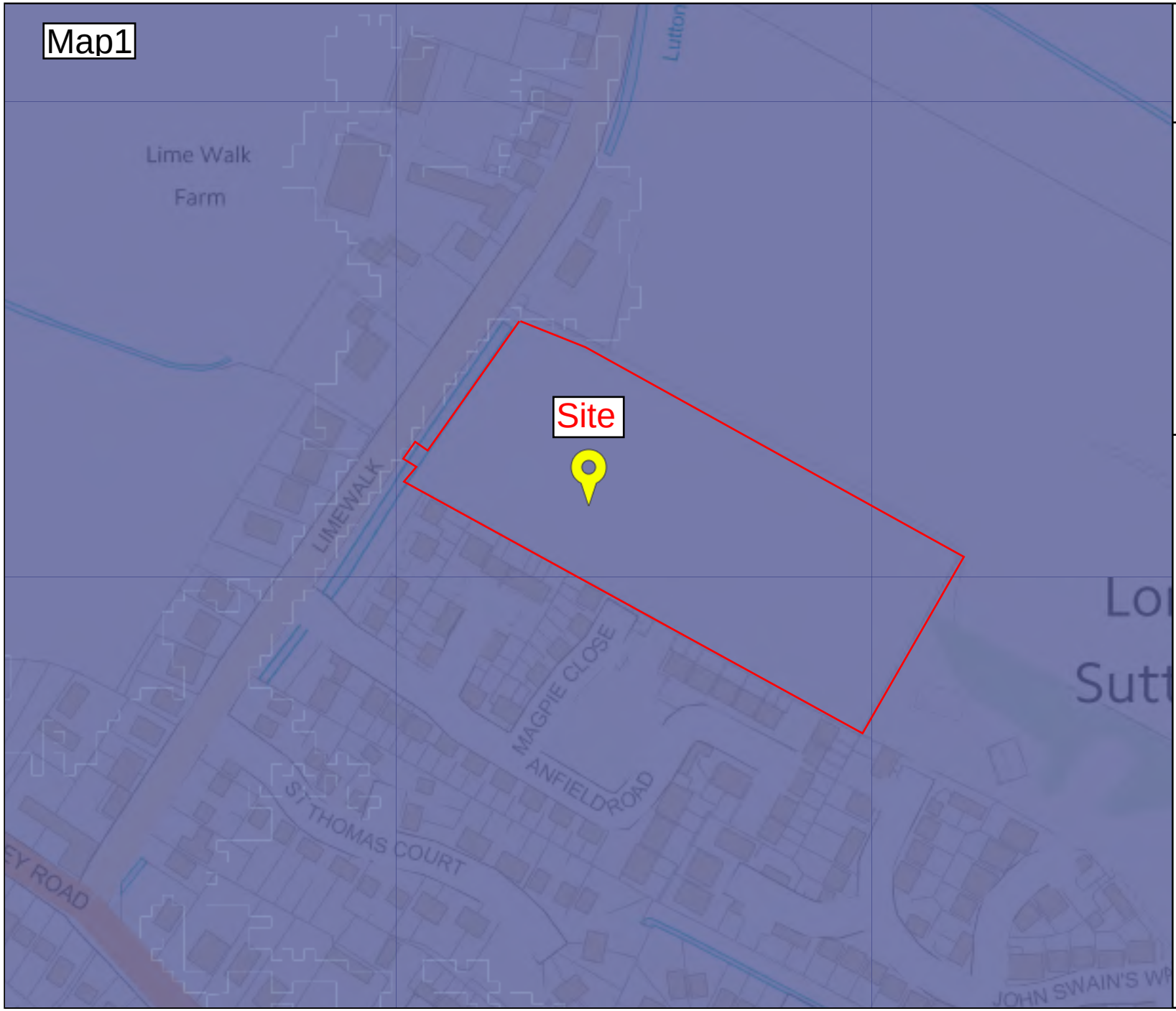
- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

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
Lime Walk

Location (easting/northing)
543026/323564

Scale
1:2500

Created
22 Nov 2018 3:00

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

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Basic view | Detailed view

Map 2

Location PE12 9HG

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



Tidal Level Location Map
Lincolnshire & Northamptonshire Area

Map 3



Produced May 2017

Produced by Partnerships & Strategic Overview Team

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

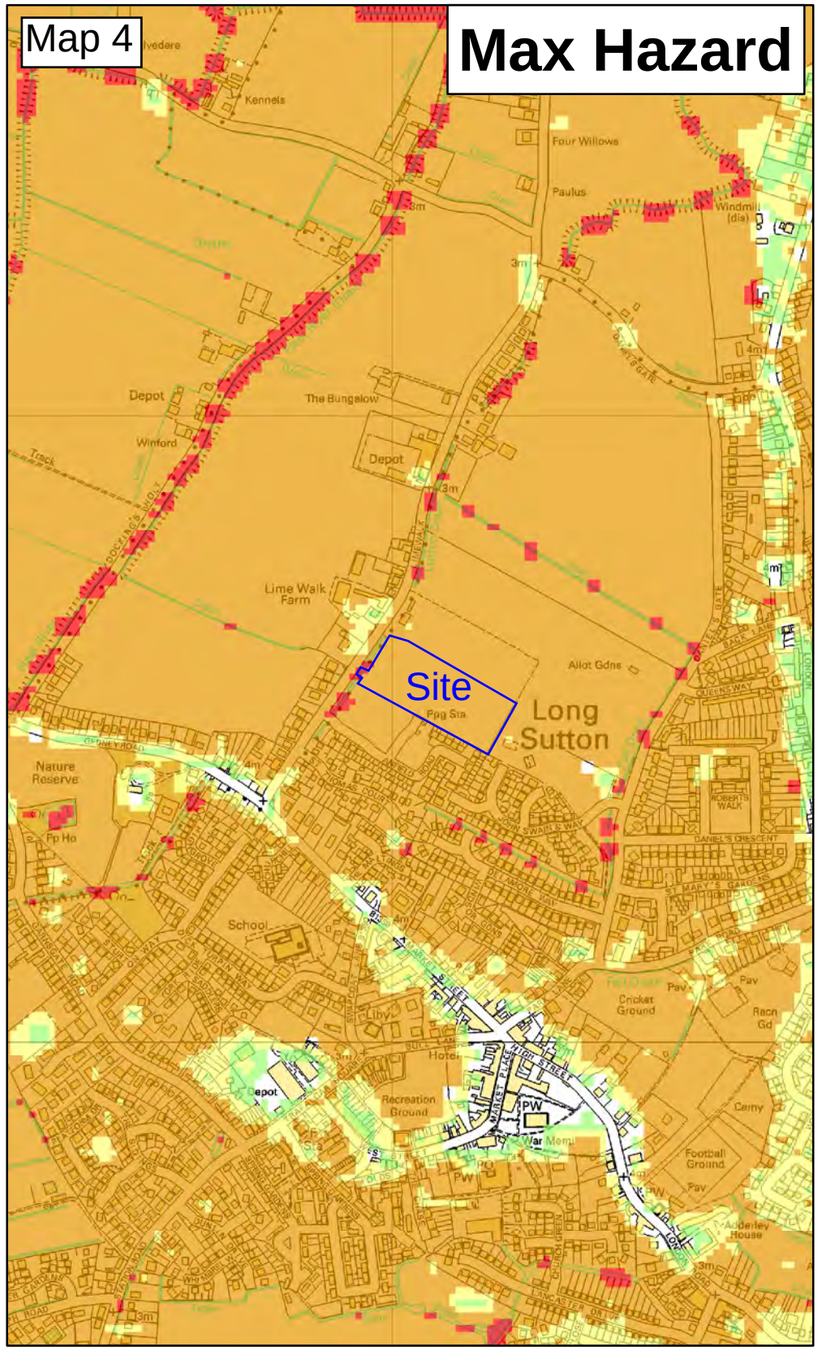
The table below shows still water levels for locations, from the above location map, around the South Humber Estuary, East Coast and The Wash. It is important to note the following:

- 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.

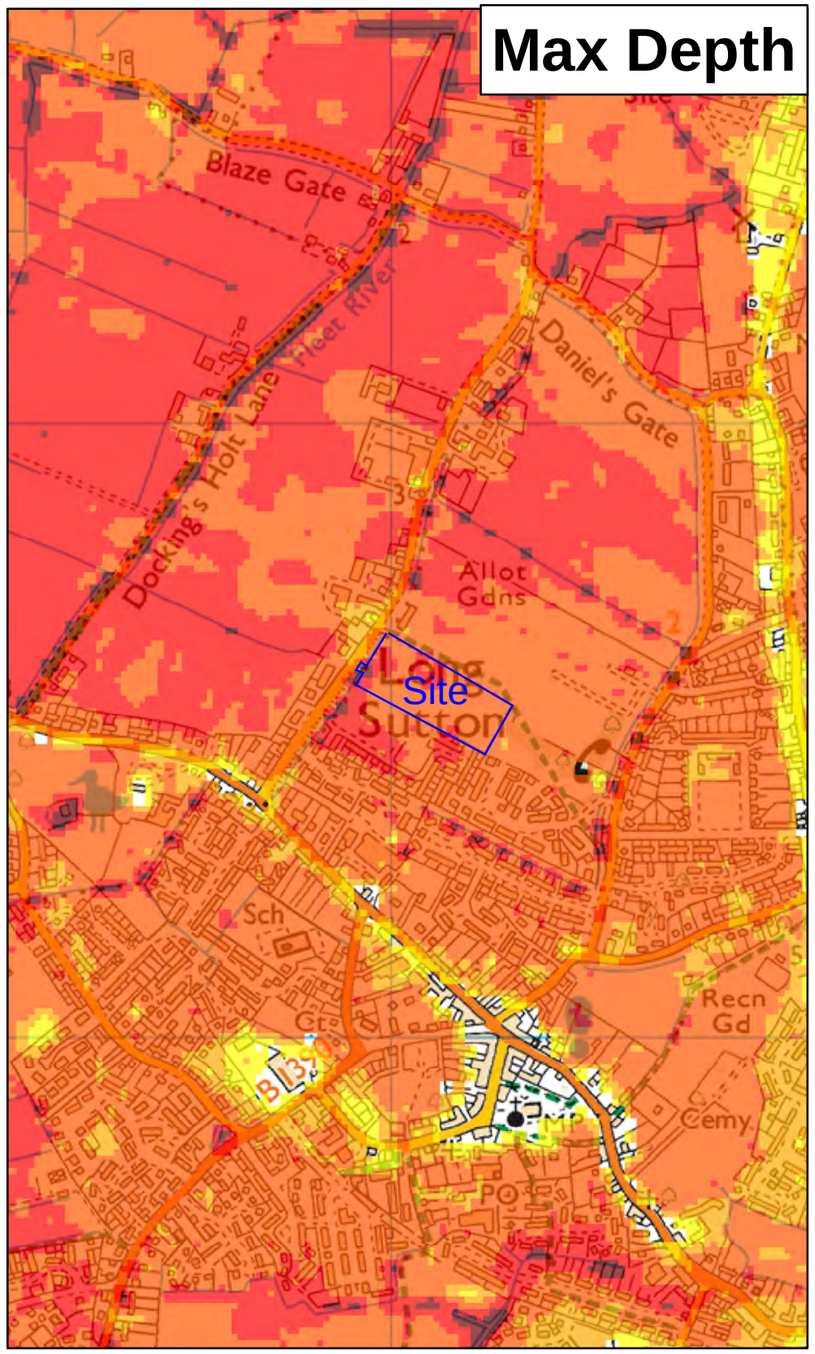
Ref	Location	Easting	Northing	Annual Chance (1 in x) of Tide Level					
				metres ODN					
				1	10	50	100	200	1000
HUMBER									
H030	Tetney	535420	403180	3.94	4.29	4.56	4.69	4.82	5.15
H050	Buck Beck	532700	406580	4.03	4.36	4.62	4.74	4.87	5.18
H060	Grimsby	527878	411346	4.10	4.43	4.70	4.82	4.95	5.27
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	~

Map 4

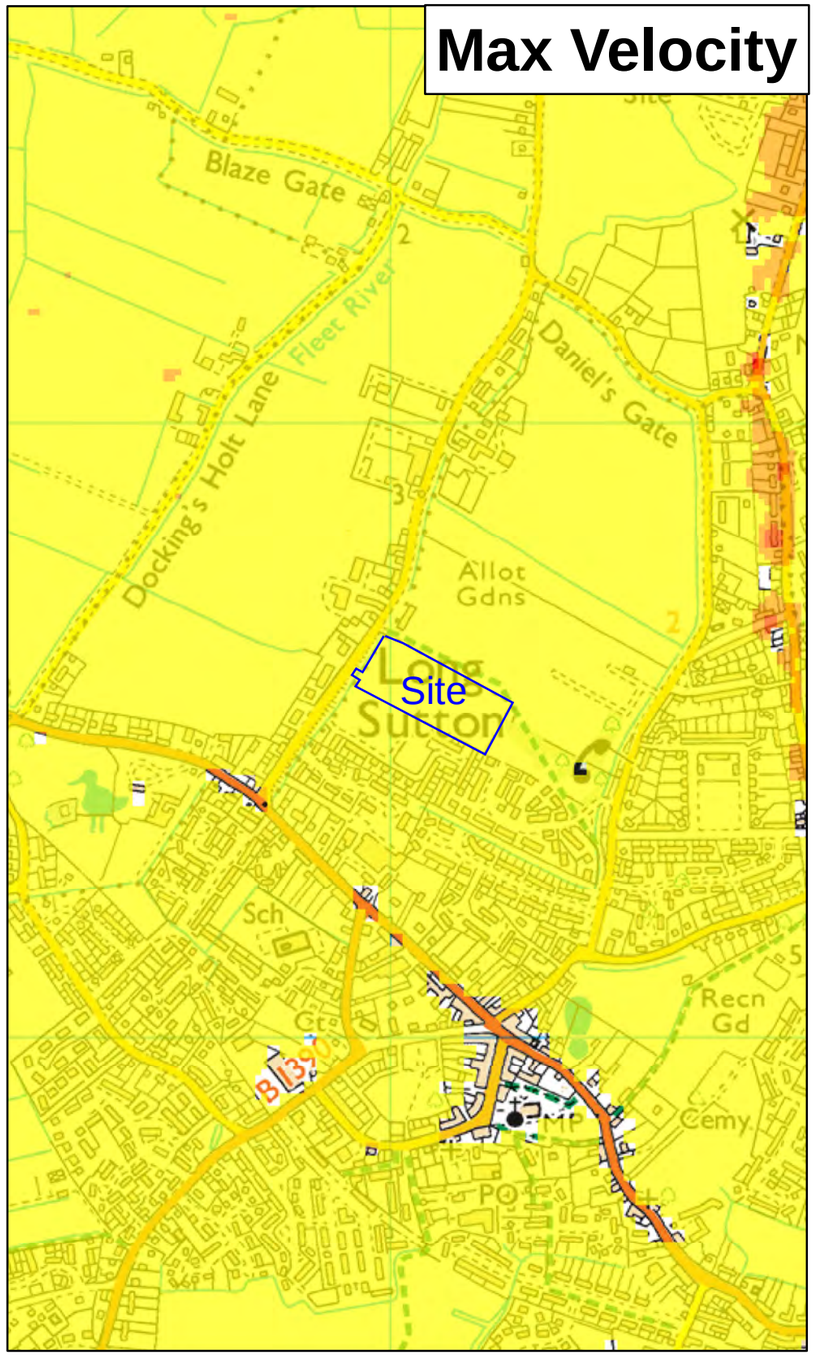
Max Hazard



Max Depth



Max Velocity



★ **Modelled Breach Locations** - see also the accompanying plan "Location of Modelled Breaches"

Max Hazard
(Flood Risk to People : FD2320)

- Less than 0.75 (Low Hazard)
- Between 0.75 and 1.25 (Danger for Some)
- Between 1.25 and 2.0 (Danger for Most)
- Greater than 2.0 (Danger for All)

Max Depth (m)

- 0 - 0.25
- 0.25 - 0.50
- 0.50 - 1.0
- 1.0 - 1.6
- 1.6 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 +

Date Printed	November 2018	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-104544

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.

General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

Environment Agency

Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF4302823584

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Basic view | Detailed view

Map 5

Location PE12 9EZ

Flood risk from rivers or the sea

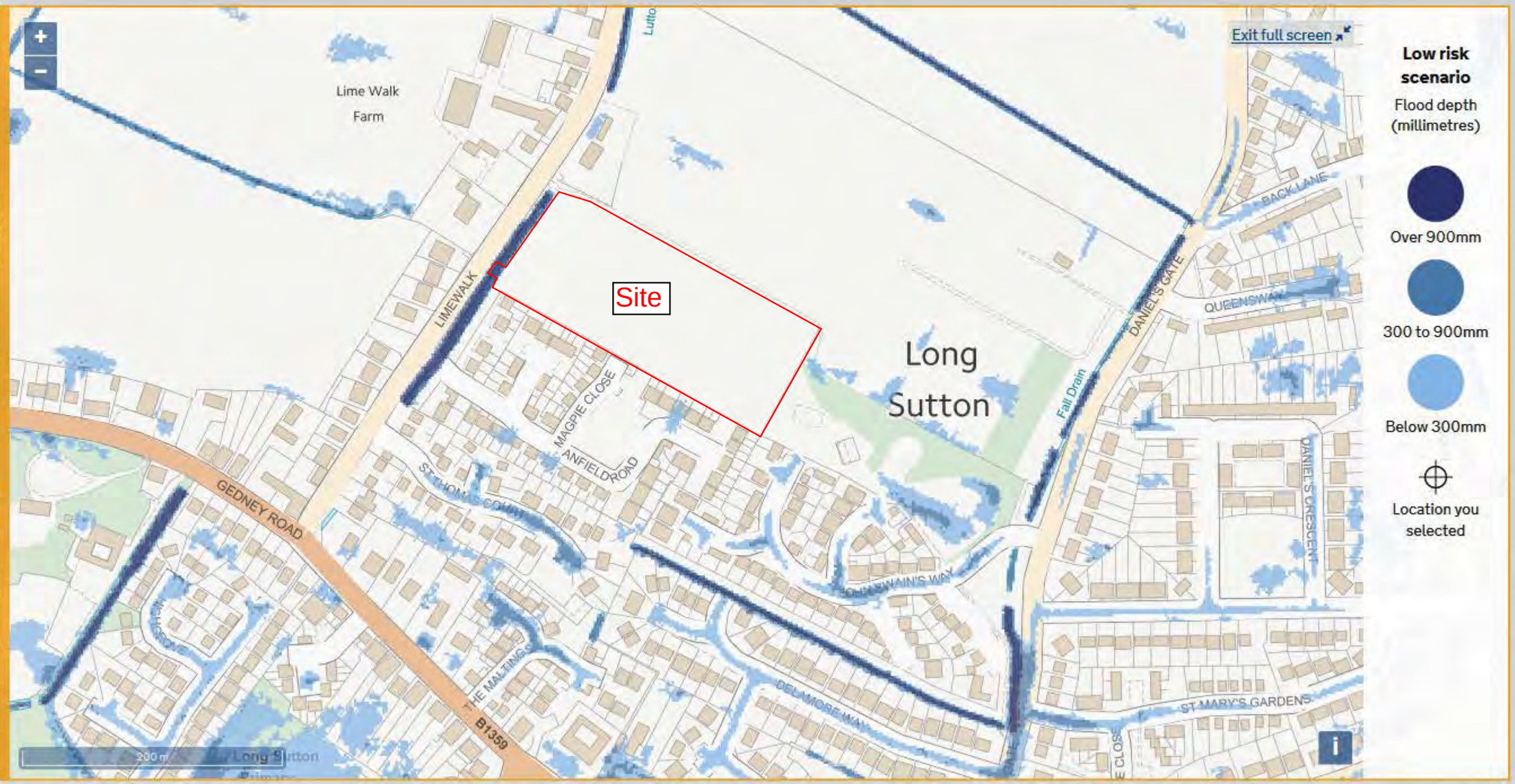
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

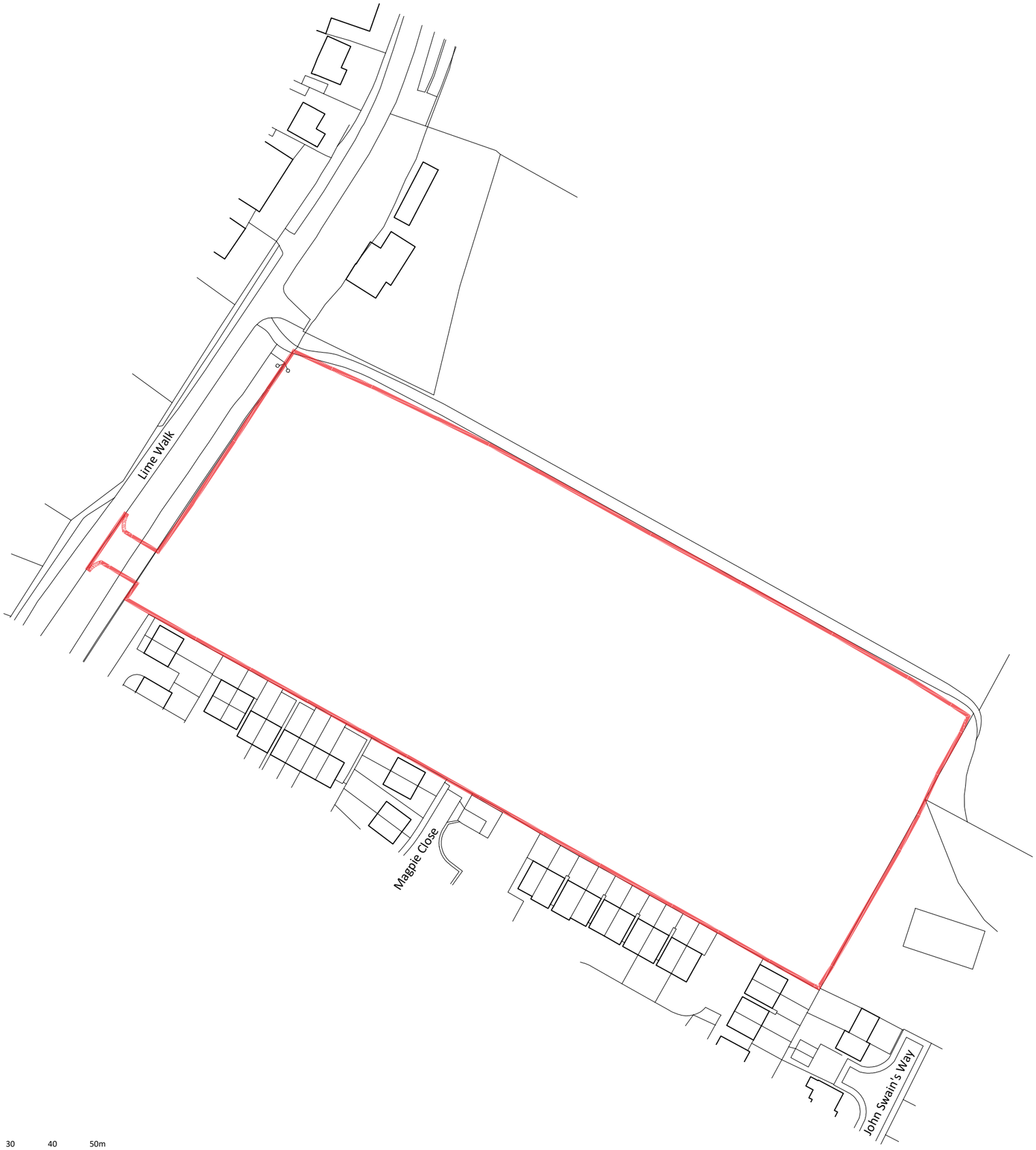
- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Plan 1



Notes

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Rev	Description	Date
-	-	-

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Client
Mr V Wells

Project
Land off Lime Walk
Long Sutton

Drawing
Location Plan

Scale @ A3	Date
1:1250	27/11/18

Drawn By	Checked By
WW	LMS

Job Number	Status	Purpose of Issue
818-3	OP	Outline Planning

Drawing No.	Rev
818-3_OP_LP01	-

Plan 2



©2018 Google

N

0 10 20 30 40 50m

Notes

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Rev	Description	Date

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Web: www.rdc-landplan.co.uk

Client
Mr V Wells

Project
Land off Lime Walk
Long Sutton

Drawing
Proposed Site Plan in context

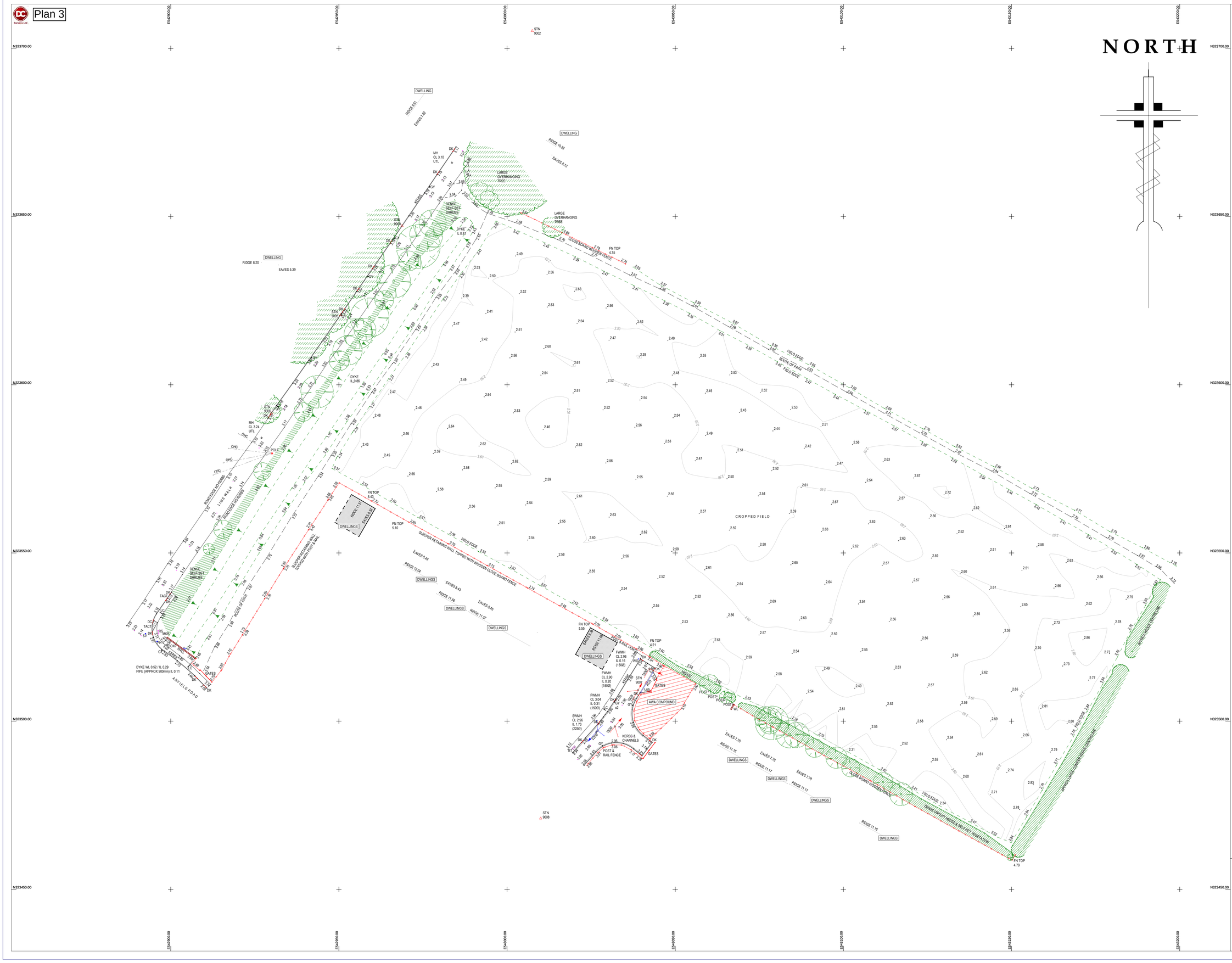
Scale @ A3	Date
1:1250	27/11/18

Drawn By	Checked By
WW	LMS

Job Number	Status	Purpose of Issue
818-3	OP	Outline Planning

Drawing No.	Rev
818-3_OP_SP02	-

Plan 3



NOTES

ABBREVIATIONS & SYMBOLS

AV	AIR VALVE	OHC	OVERHEAD CABLE
BH	BORE HOLE	PB	POST BOX
BOL	BOLLARD	PINV	PIPE INVERT LEVEL
CATV	CABLE TV MH	PM	PARKING METER
CCTV	SECURITY CAM	PO	POST
CL	COVER LEVEL	PT	PIPE TOP LEVEL
CH	CHANNEL	P/R	POST & RAIL FENCE
COL	COLUMN	P/W	POST & WIRE FENCE
DC	CABLE TV LID	RD	EDGE OF ROAD/NO KERB
DP	DOWN PIPE	RE	RODDING EYE/POINT
DR	DRAIN	RL	RIDGE LEVEL
EL	EAVES LEVEL	RP	REFLECTIVE POST
EP	ELECTRIC POLE	RS	ROAD SIGN
ER	EARTH ROD	SLVL	STONE LEVEL
FB	FLOWER BED	SOFF	SOFFIT LEVEL
FH	FIRE HYDRANT	SV	VALVE
FFL	FINISHED FLOOR LEVEL	SW	SURFACE WATER
FP	FLAG POLE	Tac	TACTILE PAVING
FW	FOUL WATER	TH	TRIAL HOLE
GV	GAS VALVE	TL	TRAFFIC LIGHTS
HW	HEADWALL	TLVL	TARMAC LEVEL
IC	INSPECTION COVER	TOW	TOP OF WALL LEVEL
IL	I NVERT LEVEL	TP	TELEGRAPH POLE
KB	KERB BOTTOM	TRK	TRACK
KO	KERB OFFLET	UTL	UNABLE TO LIFT
KT	KERB TOP	VP	VENT PIPE
LP	LAMP POST	WL	WATER LEVEL
LC	LIGHT COLUMN	WLVL	WATER LEVEL
MH	MANHOLE	WM	WATER METER
MP	MARKER POST	WO	WASH OUT POINT

FENCE, HEDGE, ELECTRIC, BANK EDGE, STORM LINE, FOUL LINE, TELECOM LINE, GAS LINE, LARSON PILES, CHANNELS, WATER MAIN

TREE, BOREHOLE, STATION, TBM, MANHOLE, GULLY, BATTER, WATER LVL, GATE

1. THE POSITION OF THIS SURVEY IS BASED ON GPS OSTN15 GRID.
2. ALL LEVELS RELATE TO GPS DATA ACQD. USING TRIMBLE VRS.
3. TREES SPREADS ARE DRAWN TO SCALE AND SHOW THE GENERAL/AVERAGE CANOPY SPREAD.
4. ALL BELOW GROUND LEVEL INFORMATION INCLUDING VOIDS, DRAINAGE & SERVICES HAVE BEEN IDENTIFIED FROM THE SURFACE LEVEL ONLY, THEREFORE PIPE SIZES ETC ARE ESTIMATIONS ONLY. ALL CRITICAL DIMENSIONS SHOULD BE CHECKED PRIOR TO THE COMMENCEMENT OF ANY SITE WORKS
5. EVERY EFFORT HAS BEEN MADE TO LOCATE AND SURVEY ALL VISIBLE FEATURES. IT SHOULD BE NOTED THAT SOME ITEMS MAY HAVE BEEN OBSCURED AT THE TIME OF THE SURVEY AND THEREFORE NOT SHOWN ON THIS DRAWING.
6. PHYSICAL BOUNDARY FEATURES SHOWN ON THIS DRAWING DO NOT NECESSARILY REPRESENT THE ACTUAL LEGAL BOUNDARIES. THIS INFORMATION SHOULD BE CONFIRMED WITH THE RELEVANT DOCUMENTATION.
7. THE CONTRACTOR MUST CHECK AND VERIFY ALL SITE LEVELS, DIMENSIONS, UTILITIES AND DRAINAGE DETAILS PRIOR TO THE COMMENCEMENT OF ANY SITE WORKS. ANY DISCREPANCIES MUST BE NOTIFIED TO DANIEL CHARLES SURVEYS LTD.
8. ALL SURVEY STATION CONTROL POINTS MUST BE CHECKED BY THE CONTRACTOR PRIOR TO STARTING ANY SITE WORKS.

SURVEY CONTROL POINT INFORMATION.

Point	Easting	Northing	Elevation
9000	542968.777	323647.277	3.282
9002	543007.487	323705.208	3.004
9005	542950.546	323620.792	3.330
9006	542929.937	323591.541	3.276
9007	543041.368	323511.503	2.931
9008	543009.997	323471.097	3.138

SURVEY DATE	27/06/2018	INITIALS	MJW/CR

REV	AMENDMENTS	DRN	DATE

Client: RDC

Project Title: LAND OFF - LIME WALK LONG SUTTON SOUTH LINCS

Drawing Title: TOPOGRAPHICAL SURVEY

Scale @ A1:	Date:
1:500	27/06/2018

Drawing No: **18 - 145 - 01** Rev:

C.A.D.Title: rdc lime walk long sutton\master topo (18-145-01).mjo

Drawn By:	Checked By:
MJW	SRW

Daniel Charles Surveys Ltd
Land Surveying & Engineering Services
Honeywood Barn, Honeyholes Lane,
Dunholme, Lincoln, LN2 3SU
Tel : 01673 860444 Fax : 01673 863362
E-mail : info@daniel-charles.co.uk
Website : www.daniel-charles.co.uk

Document 1

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

HR Wallingford
Working with water

Calculated by:	Ray Morgan
Site name:	Lime Walk
Site location:	Long Sutton

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 before finalising the drainage scheme.

Site coordinates

Latitude:	52.79087° N
Longitude:	0.11969° E

Reference:	6495031
Date:	2018-11-27T16:37:44

Methodology	IH124

Site characteristics

Total site area (ha)	2.25
Significant public open space (ha)	1.24
Area positively drained (ha)	1.01
Pervious area contribution (%)	30
Impermeable area (ha)	1.009999
Percentage of drained area that is impermeable (%)	100
Impervious area drained via infiltration (ha)	0
Return period for infiltration 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)	1.01
Net impermeable area for storage volume design (ha)	1.01

* Where rainwater harvesting or infiltration 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 other flow rates will have been reduced accordingly.

Design criteria

Volume control approach	Flow control to max of 2 l/s/ha or

	Default	Edited
Climate change allowance factor	1.4	1.4
Urban creep allowance factor	1.1	1.1
Interception rainfall depth (mm)	5	5
Minimum flow 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)	3.29	--
SOIL type	2	4
HOST class	N/A	N/A
SPR	0.3	0.47

Hydrology

	Default	Edited
SAAR (mm)	580	580
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	101.64	
FEH/FSR conversion factor	1.32	1.32
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)	3.29	8.72
Qbar net site area (l/s)	1.48	3.91
1 in 1 year (l/s)	5	5
1 in 30 years (l/s)	5	5
1 in 100 years (l/s)	5	5

Estimated storage volumes

	Default	Edited
Interception storage (m^3)	40	40
Attenuation storage (m^3)	1046	1046
Long term storage (m^3)	0	0
Treatment storage (m^3)	121	121
Total storage *(excluding treatment)* (m^3)	1087	1087

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.