FLOOD RISK ASSESSMENT

Proposed Residential Development
Seas End Road
Roman Bank,
Surfleet
Spalding
PE11 4DQ



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October 2020 Version 1

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FLOOD RISK ASSESSMENT PROPOSED RESIDENTIAL DEVELOPMENT SEAS END ROAD, SURFLETT, SPALDING. PE11 4DQ

INTRODUCTION

The Government has placed increasing priority on the need to take full account of the risk 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 Feb 2019, (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.

The NPPF provides that development in areas at risk of flooding should be avoided and seeks to direct development away from areas at highest risk. There is a sequential, risk-based approach to the location of development avoiding where possible, flood risk to people and property managing any residual risk and taking account of the impacts of climate change.

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APPLICATION SITE

The site is located on land at Seas End Road, Surfleet, Spalding PE11 4DQ within the administrative area of South Holland District Council. The National Grid Reference is TF26794 28722. **Plan 1**

This flood risk assessment has been prepared for the erection of a two-storey detached dwelling. **Plans 2, 3 4 & 5**

The National Planning Policy Framework Guidance NPPG 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%)

Part of the proposed development site is shown to be within Flood Zone 1 'Low Probability' with the remainder being in Flood Zone 3 ' More Vulnerable' as detailed on the Environment Agency's Flood Zone Maps **without defences**.

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 the site is considered to be 'More Vulnerable'. Table 2 of NPPG states that such uses are permitted in these zones.

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.

Site Levels

From the topographical survey the site of the new dwelling has a slight fall from the roadside to the rear, the levels on the southern boundary are at 4.4.23mODN and the northern boundary lower at 3.64mODN. Seas End Road at the site entrance varies from 5.12mODN and the ground floor level of the property next door is 4.47mODN. **Plan 2**

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

- River Glen (Fluvial)
- River Welland (Tidal)
- Welland & Deepings Internal Drainage Board system

Flood Zones

The Flood Zone Map indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. In some locations, there are many kilometres of raised flood defences. To meet the requirements of the National Planning Policy Framework, these defences are removed in their entirety to produce the Flood Map for Planning (Rivers and Sea). The map therefore shows the full extent of areas that would be at risk of flooding if no defences existed and water could spread out across the floodplain.

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

The Flood Map represents areas at risk of flooding for present day only and does not take account of climate change. In this area the main risk of flooding is from a breach to the tidal defences along the coastline that could affect the site These maps show that the majority of the proposed development site is considered at no risk from flooding as it is all located within an area zoned as Flood Zone 1. **Map 1**

Risk of Flooding from Rivers & Sea

The Risk of Flooding from Rivers and Sea Map shows that the site for the proposed building is at Very Low risk of flooding. Very low means that each year, this area has a chance of flooding of less than 1 in 1000 (0.1%). This takes into account 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 overtopped or fail. **Map 2**

River Glen

The River Glen is located some 70m south of the site, which discharges into the tidal River Welland at Surfleet Seas End. To stop tidal/saltwater entering the River Glen there is a tidal sluice (Surfleet Sluice) located adjacent to Reservoir Road. There are high embankments along the tidal Welland to defend against flooding from extreme high tides and surge.

There are no formal flood defences reducing the risk of flooding to this site. The nearby 'river' channel provides a nominal level of protection.

The site lies within the Anglian River Basin District, Peak River flows should be adjusted to reflect the latest climate change allowances, the guidance now indicates for 'more vulnerable' uses, that the 35% Higher Central and Upper End 65% should be considered for residential developments in Anglian RBD.

The flood levels for the return periods have been taken from data supplied by the Environment Agency from the Welland Catchment Strategic Model 2016, shown in the table below.



Fluvial Flood Levels & Fluvial Flood Flows

Fluvial Flood Levels (mODN)

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

			Annual Exceedance Probability - Maximum Water Levels (mODN)										
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
GLEN 1415	527090	328734	3.92	4.04	4.13	4.20	4.19	4.20	4.20	4.78	4.22	4.33	4.83
GLEN 1652	526915	328597	3.92	4.04	4.12	4.20	4.20	4.20	4.21	4.78	4.22	4.33	4.83
GLEN 1889	526690	328669	3.92	4.04	4.12	4.20	4.21	4.21	4.22	4.78	4.23	4.34	4.83
GLEN 2116	526491	328747	3.92	4.04	4.12	4.20	4.22	4.22	4.23	4.78	4.24	4.34	4.82

Fluvial Flood Flows (m^3/s)

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

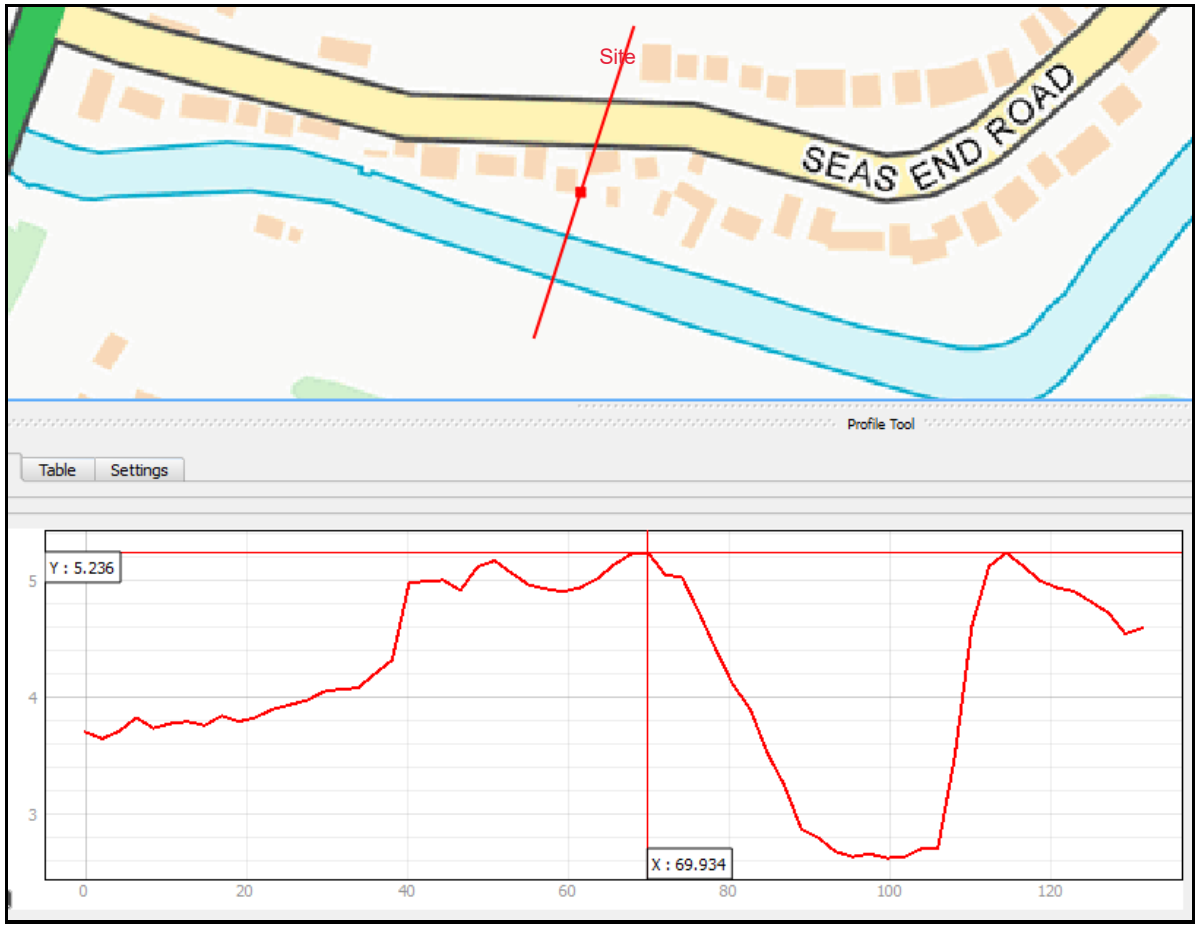
			Annual Exceedance Probability - Maximum Flows (m^3/s)										
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
GLEN 1533.5	527014	328643	47.95	50.00	51.71	54.57	55.25	56.01	56.52	66.78	59.51	67.35	76.26
GLEN 1770.5	526802	328634	46.16	48.17	50.13	52.98	53.82	54.57	55.06	65.04	58.11	65.87	74.63
GLEN 2002.5	526578	328679	44.60	46.68	48.84	51.68	52.61	53.24	53.88	63.47	56.94	64.61	73.18
GLEN 2215.5	526408	328801	43.03	45.42	47.58	50.29	51.41	51.85	52.70	62.22	55.79	63.38	71.63

Using the Peak River Flows in NPPG Climate change allowances shown in Table 1 (Climate Change Allowances) in the spread sheet. **Document 1.**

The graph and data show a prediction for the increase in river levels for the 35% and 65% increase in river level.

EXTRAPOLATED WATER LEVEL OUTPUTS AT NODE Glen 1889		
Upper End Scenario	5.29	mODN
Higher Central Scenario	4.80	mODN
Central Scenario	4.64	mODN

The level of flooding with 35% Climate Change at Node point Glen 1889 would be 4.80mODN.



Lidar 2m DTM Section

From the Lidar 2m DTM Section the land levels adjacent to the river and the site are in the region of 5.27mODN, which is well above the predicted Higher Central (35%) flood level of 4.80mODN.

Surfleet Reservoir

Surfleet Reservoir lies downstream of the site, immediately upstream of Surfleet Sluice on the River Glen, located close to the confluence of the River Glen and River Welland, and is classified as Flood Zone 3b or Functional Floodplain.

During periods of high tide, the River Glen cannot discharge water into the River Welland as it is 'tide-locked' – the tide levels in the River Welland are higher than the level of water in the River Glen. During periods of tide-lock the water from the River Glen catchment cannot discharge into the River Welland and it is stored in Surfleet Reservoir to avoid flooding of agricultural land. In most conditions this water remains within the channel flowing through the reservoir, however there are occasions where the reservoir fills, and flooding occurs. This is typically when high flows in the River Glen (such as following prolonged rainfall) coincide with high or surge tides. In these instances, flooding of the berm can and does occur.

River Welland.

The River Welland is located some 700mm to the south east of the site. The flood defences reducing the risk of flooding to this site consist of earth embankments , which are inspected regularly to identify any defects.

From Lincolnshire & Northamptonshire Area Tidal Modal Analysis, levels for East Coast and Wash: Immingham to the West Lighthouse have an assessment date of 2017, which should be used in any consideration of future increases due to climate change. **Map 3**

Peak tide levels (2017) for the 1 in 200-year 50% confidence bound tide level is 5.98mODN at Marsh Road
Peak tide levels (2120) tide level a is 5.82mODN plus Higher Central climate change of 1025mm would be 7.01mODN.

Breach Analysis to River Welland Tidal Defences

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.

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

Flood Hazard			Description
	<0.75	Low	**Caution –** Flood Zone with shallow flowing water or deep standing water.
	0.75 – 1.25	Moderate	**Danger for Some -** (i.e. children) Danger Flood Zone with deep or fast flowing water.
	1.25 – 2.0	Significant	**Danger for Most –** Danger Flood Zone with deep fast flowing water.
	>2.0	Extreme	**Danger for All** – Extreme Danger Flood Zone with deep fast flowing water.

The 2017 Update to SHDC, SFRA has carried out a Tidal & Fluvial Hazard Mapping, for Surfleet, following a breach to the defences. The present-day Residual Flood Hazard, Depth and Velocity Surfleet – present day 1% fluvial and 0.5% Tidal Event Probability Maps show that the site where the proposed development is to be located is within a low hazard area. **Map 4**

With climate change, up to year 2115 the maps show that the site is party l within a Low Hazard Rating Area, and partly in an area 0.75 – 1.25 (Danger for Some)Greater than 2.0 (Danger for All)., Depth 0m – 0.25m and velocity 0 –0.3m/sec. **Maps 5, 6 & 7.**

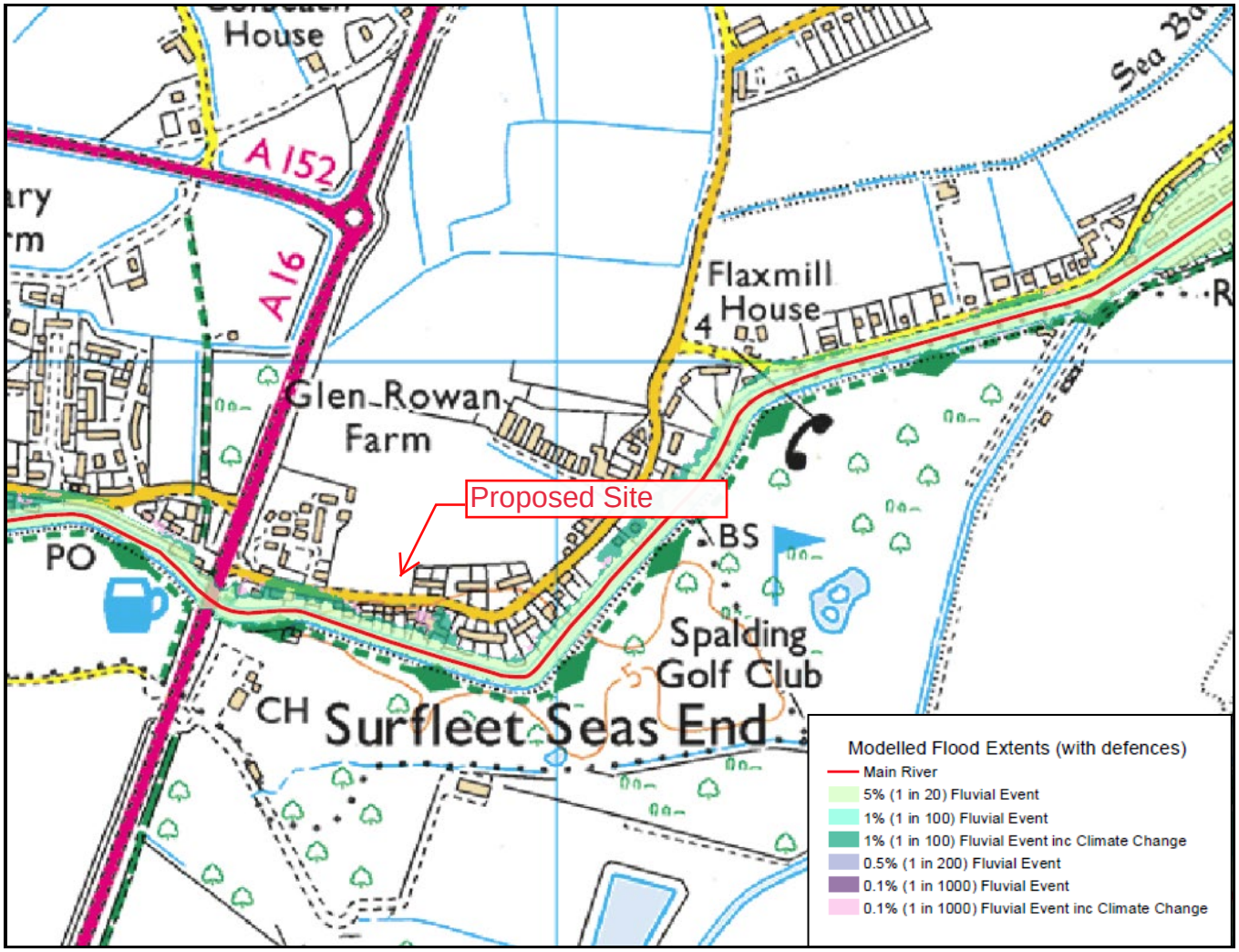
The Environment Agency recommended that for housing developments the minimum mitigation measures required for single storey developments or developments that do have any ground floor sleeping shall be determined by the flood depths arising from the 2115 (0.1%) breach scenario. Any proposals that do not 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 – 0.25m the FFL should be set 300mm above the ground level.

It is therefore proposed, in accordance with the Environment Agency's recommendations that the ground floor habitable accommodation for the dwelling will have a finished floor level of 4.30mODN which is 500mm above the existing ground level of 3.80mODN. This will raise the property out of a local low area and have a ground floor level similar to that of the neighbouring property. The site will be landscaped to suit.

MODELLED FLOOD EXTENTS MAP

The site is not shown to be affected from any event scenario.



Modelled Flood Extents Map with Defences

SOUTH HOLLAND DISTRICT COUNCIL

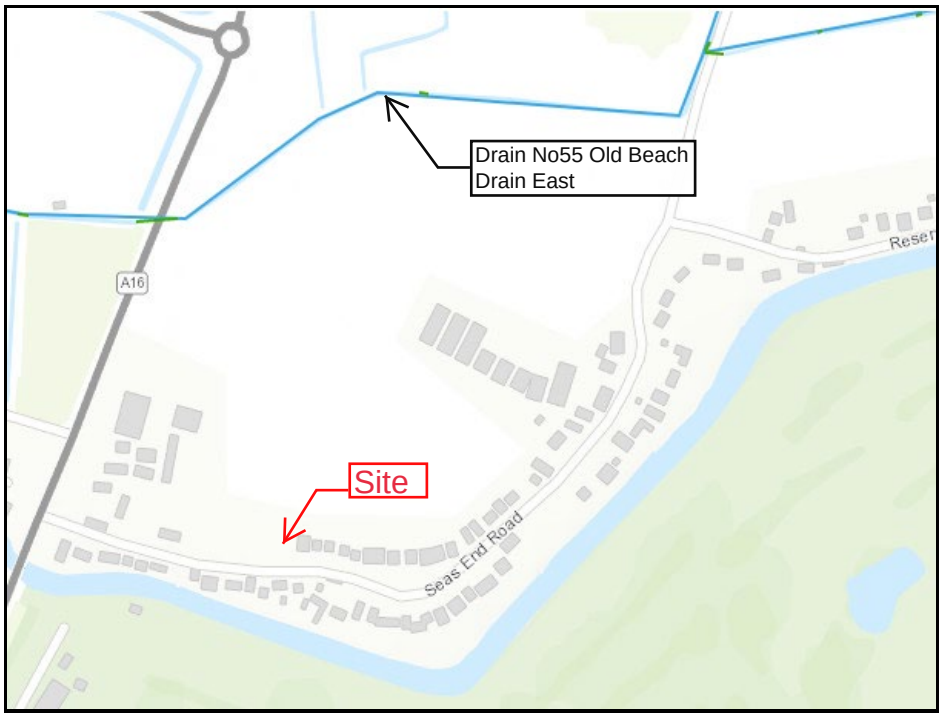
In order to inform the process of risk assessment and site selection the District Council commissioned Haskoning UK Ltd Consultants to prepare a Strategic Flood Risk Assessment in December 2002.They have carried out an update of this report and this report was published in January 2010 and this was further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

WELLAND & DEEPINGS INTERNAL DRAINAGE BOARD

The proposed development site is located within the catchment area of Welland & Deepings Internal Drainage Board. The Board is responsible to operate and maintain the arterial fluvial system.

The site is within Board's catchment No 11 Surfleet and the nearest watercourse to the site is Drain No 55 Old Beach Drain East, located well to the north of the site of the site.



Welland & Deepings IDB Drainage Map

IDB systems are designed to provide a freeboard of between 600mm and 1000mm to all land in a 1 in 10-year return period rainfall event. This normally provides a standard of service of between 1 in 50 years and 1 in 100 years against flooding.

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 having no high ground around the site and with the proposed ground floor levels being set 500mm above the existing ground floor level this will not cause any rapid inundation of 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. However, with the natural topographic nature of the ground having no high ground around the site and with the proposed ground floor levels being set 500mm above the existing ground floor level this will not cause any rapid inundation 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

sources within the vicinity of the site.

SURFACE WATER FLOODING

The majority of the site for the proposed units is not shown on the Low Risk scenario Surface Water flood maps, for the 1 in 1000-year event, to be affected from surface water flooding. This type of flooding is usually short lived and associated with heavy downpours of rain, thunderstorms etc. **Map 8**

The maps for surface water and revised maps for river and sea flooding define the risk as High, Medium, Low and Very Low. The chance of flooding for the area defined in any given year is shown below:

- **High:** greater than 1 in 30 (3.3%).
- **Medium:** between 1 in 100 (1%) and 1 in 30 (3.3%).
- **Low:** between 1 in 1000 (0.1%) and 1 in 100 (1%).
- **Very Low:** less than 1 in 1000 (0.1%)

Unlike the fluvial mapping, which is based on a detailed hydraulic model, this mapping is based purely on applying rainfall to a digital terrain model. As such this mapping serves to represent a worst-case scenario which may well overstate the actual probability of flooding in this area.

There is a caveat on the Defra Data website, as to the use of these maps and that they are not to be used to identify that an individual property will flood. Because of the way they have been produced and the fact that they are indicative, these maps are not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

HISTORIC FLOOD EXTENT MAP

The Historic Flood Extent Map showing the extent of previous recorded flooding shows that the site has not been subject to flooding. The map shows that the Surfleet Reservoir stored water in 1998. It is also known to have stored water on other occasions, most notably in 1994, 2000, 2009 and 2013. **Map 9**

SEQUENTIAL APPROACH

When applying the sequential approach for flood risk in accordance NPPF the site would fall into Zone 1 (Low Probability) as shown on the Environment Agency's Flood Map without defences in place.

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

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

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

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

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPG, the proposed use is classified as, "More Vulnerable" use, Table 1 of NPPG states that such uses are appropriate in this zone subject to the exception test, (as summarised in Table 3 NPPG)

BLE 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	✓	✗	✗	✗

Sequential & Exception Test

NPPF Guidance Paragraphs 155 - 165 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.

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. The whole of the surrounding area is shown on the Flood Map for Planning to be in Flood Zone 3 and there are no other sites in a lower flood zone. The South East Lincolnshire Strategic Flood Risk Assessment (March 2017) concludes that the vast majority of South Holland District is in Flood Zones 2 and 3. Therefore, consistent with wider sustainability objectives, it is not realistically possible to direct all development to zones with a lower probability of flooding.

This windfall site is located within the settlement boundary for Surfleet, a Minor Service Centre as set out in the South East Lincolnshire Local Plan (2019). Policy 1 (Spatial Strategy) of the Local Plan. This states that within the settlement boundaries of these centres, development will normally be limited to allocated and committed sites and

infill.

The NPPF requires the application of the Sequential Test to steer new development to areas with the lowest probability of flooding. If, following the application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exceptions Test can be applied if appropriate.

The site is located within Environment Agency Flood Zone 3 and the South East Lincolnshire Strategic Flood Risk Assessment (March 2017) identifies that the site would be exposed to flood depths of up to 0.25m and is a combination of low hazard and danger for some. The Local Plan has allocated sequentially preferable sites in terms of flood risk that are capable of meeting the identified housing targets for individual settlements. Although the application site is not a housing allocation within the Local Plan (only suitable sites capable of accommodating 10+ dwellings have been allocated), the site does lie within the settlement boundary for Surfleet. In general, there is a presumption in favour of sustainable development within settlement boundaries and windfall sites are expected to have a contribution towards housing supply (and maintaining the 5-year supply of deliverable sites) in the district.

In order for the Exceptions Test to be passed, it must be demonstrated that the proposed development will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

The development would provide some wider sustainability benefits to the community through its ability to help meet the housing need, and other benefits including generating employment during the construction period.

This Flood Risk Assessment in terms of making the development safe, would result in finished floor levels being set at 4.30mODN. This would be sufficient to mitigate against flood risk and demonstrates that the development will be safe for its lifetime and it will not increase flood risk elsewhere.

Given the above, it is concluded that the Sequential and Exceptions Test are satisfied.

DRAINAGE STATEMENT

Surface Water Drainage

This drainage statement, for the site, proposes to utilise infiltration 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 guidelines, which require at least one workable solution for managing surface water.

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

Infiltration

It is proposed that surface water from the roof of the proposed dwellings will be discharged to soakaways, designed in accordance with BRE Digest 365.

The access and car parking areas will be constructed with permeable materials to infiltrate into the ground.

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 and again on the 17th December 2019.

The site is located within the Anglian River Basin, for sites within Flood Zone 3a and for "More Vulnerable" land uses the Higher Central and Upper End 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%
Higher 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 1981to 2000 baseline)

Area of England) (Use River Basin	Allowance	2000 to 2035	2036 to 2065	2066 to 2095	2096 to 2125	Cumulative Rise 2000 to
Anglian	Higher Central	5.8 (203mm)	8.7 (261mm)	11.6 (348mm)	13 (390mm)	1.20m
Anglian	Upper End	7 (245mm)	11.3 (339mm)	15.8 (474mm)	18.1 (543mm)	1.6m

The tidal flood defences consist of earth embankments are, they are in good condition and are well maintained by the Environment Agency.

Climate Change using Higher Central allowances

Base year 2017 – 2035 @ 5.8mm/year (18 years x 5.8mm) = 104.4mm
2036 – 2055 @ 8.7mm/year (30 years x 8.7) = 261mm
2066 – 2095 @ 11.6mm/year (30 years x 11.6) = 348mm
2096 – 2120 @ 13mm/year (24 years x 13) = 312mm
Overall total = **1025mm**

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 amenity building 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 living accommodation for the two-storey dwelling is to be raised 500mm above the existing average ground level, to be set at a level of 4.30mODN.

- Water, electricity, and gas meters: should be located above the predicted flood level. Electrical services: electrical sockets, heating systems: boiler units and ancillary devices should be installed at least 500mm above the ground floor level to minimise damage to electrical services Electric ring mains should be installed at first floor level with drops to ground floor sockets and switches. Underfloor heating should be avoided on ground floors and controls such as thermostats should be placed above the flood level

- The ground floor to be constructed with a solid concrete floor with no voids beneath and no low-level wall vents. However, 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.

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

- Plasterboard to be fixed horizontally to the ground floor area, for ease of replacement.

- Where possible, all service entries should be sealed (e.g. with expanding foam or similar closed cell material). Closed cell insulation should be used for pipes which are below the predicted flood level.

- As this site is in an area that is capable of receiving 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 protection of flood defences which are well maintained by the Environment Agency.

- The proposed site or the proposed dwelling is shown to be within Flood Zone 3 'High Probability' as detailed on the Environment Agency's Flood Zone Maps without defences.

- The 2017 Update to SHDC, SFRA Tidal & Fluvial Hazard Mapping, for District following a breach to the defences, is within a low hazard area. With climate change, up to year 2115 the maps show that the site is party l within a Low Hazard Rating Area, and partly in an area 0.75 – 1.25 (Danger for Some), depth 0m – 0.25m and velocity 0 –0.3m/sec. The Higher Central climate change flood level for the River Glen is predicted to remain within channel.

- The ground floor living accommodation for the two-storey dwelling is to be raised 500mm above the existing average ground level, to be set at a level of 4.30mODN.

- The Flood Risk Vulnerability Classification in Table 2 of NPPG the proposed residential development is classified as "More Vulnerable", with Table 1 of NPPG stating that such uses are appropriate in this zone subject to the Exception Test.

- Any impact of damage to the property can be foreseen and mitigated against by relatively simple design and construction techniques. They will be constructed using materials which are flood resilient construction as outlined in the report.

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

- 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, there is no increase in the flood risk to others. Following the guidelines contained within the NPPF, the proposed development is considered to be suitable assuming appropriate mitigation is maintained for the lifetime of the development.

- Any impact of damage to the properties can be foreseen and mitigated against by relatively simple

design and construction techniques. They will be constructed using materials which are flood resilient construction a stated in the report.

Flood map for planning

Your reference	Location (easting/northing)	Created
Surfleet	**526801/328710**	**12 Oct 2020 14:55**

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

This means:

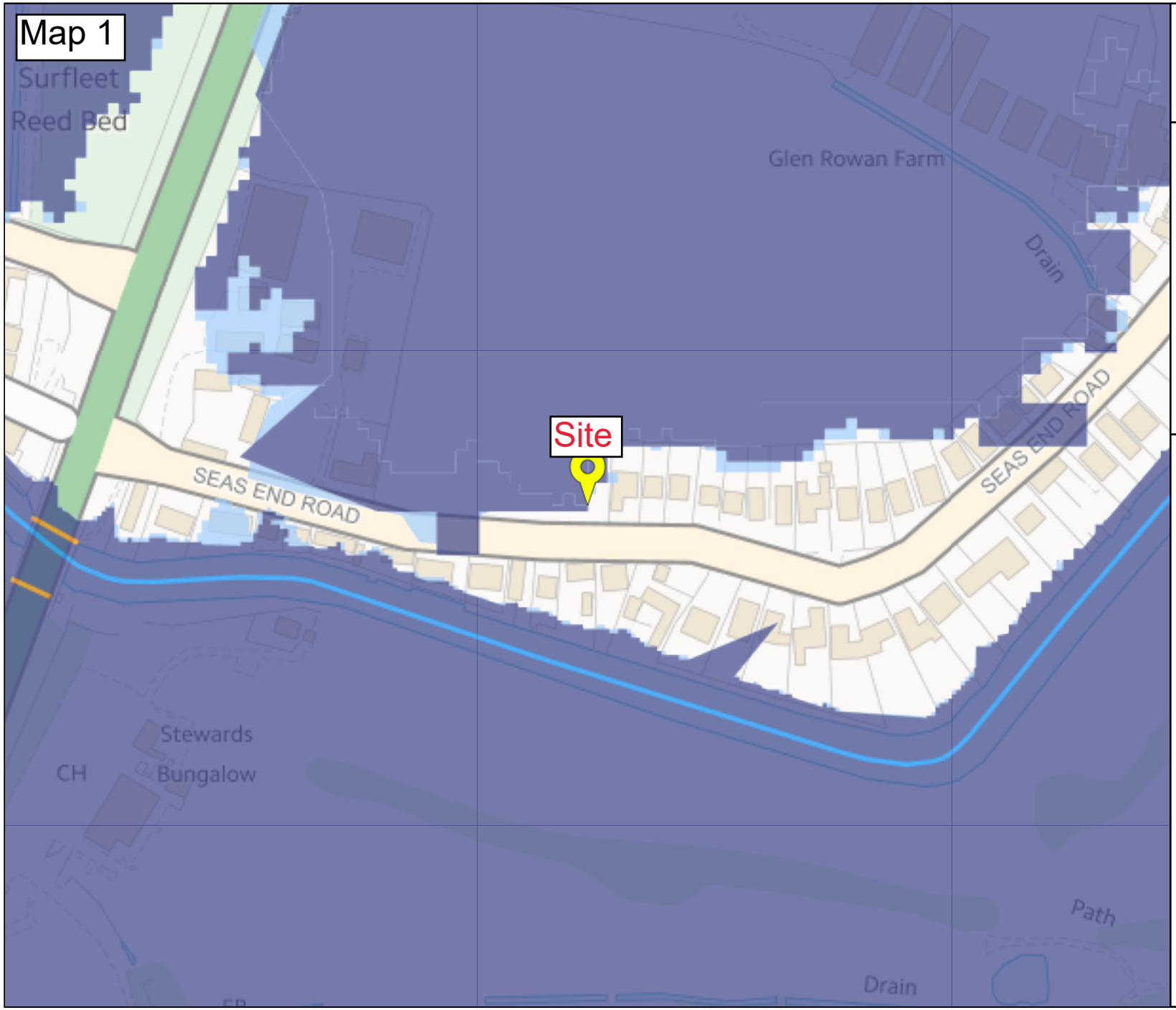
- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

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
Surfleet

Location (easting/northing)
526801/328710

Scale
1:2500

Created
12 Oct 2020 14:55

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

0 20 40 60m

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Flood risk

Extent of flooding

Location

Surfleet Seas End

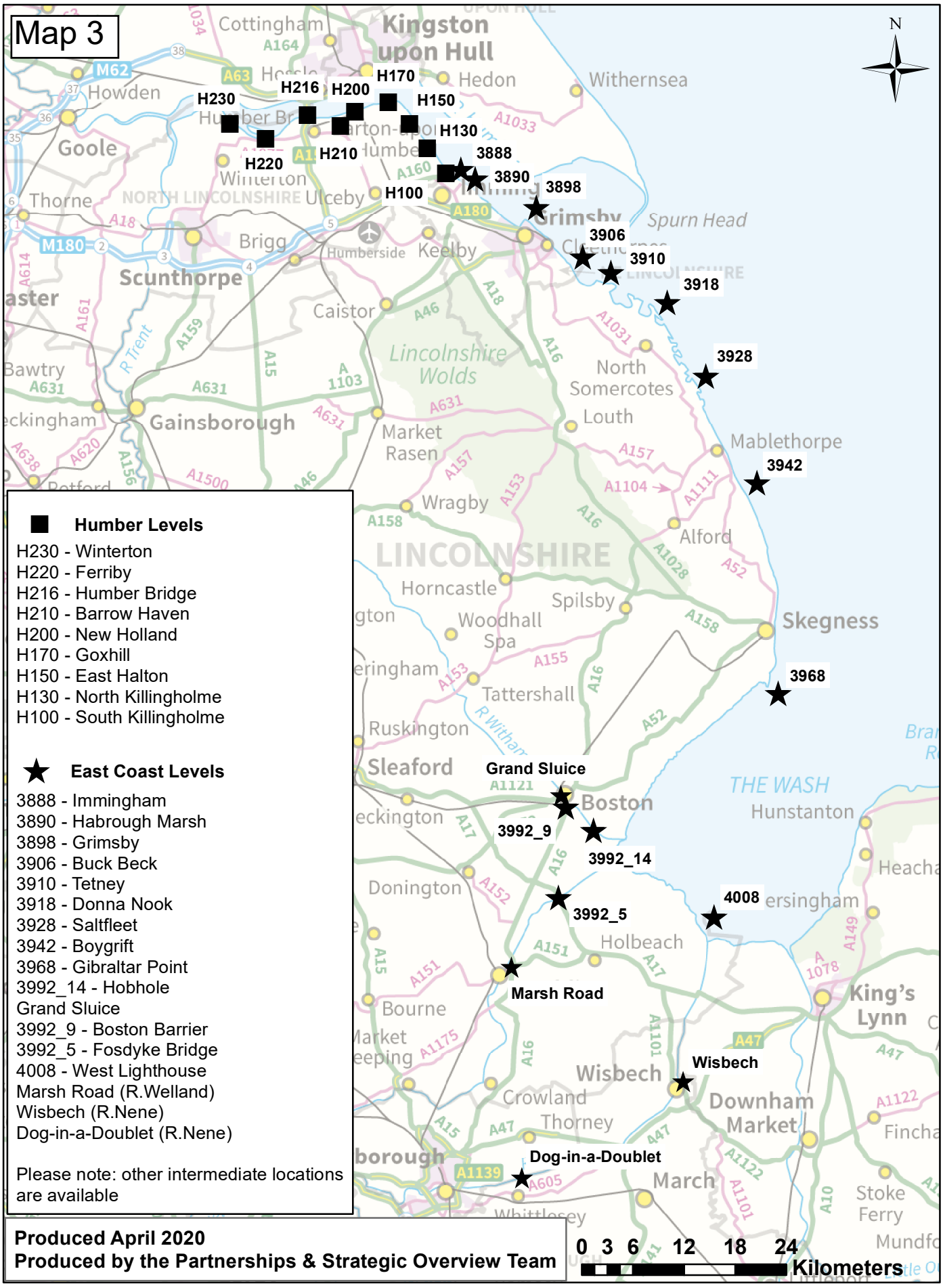


Extent of flooding from rivers or the sea

High Medium Low Very low

Tidal Level Location Map
Lincolnshire & Northamptonshire Area

Environment Agency



Humber Levels

H230 - Winterton
H220 - Ferriby
H216 - Humber Bridge
H210 - Barrow Haven
H200 - New Holland
H170 - Goxhill
H150 - East Halton
H130 - North Killingholme
H100 - South Killingholme

East Coast Levels

3888 - Immingham
3890 - Habrough Marsh
3898 - Grimsby
3906 - Buck Beck
3910 - Tetney
3918 - Donna Nook
3928 - Saltfleet
3942 - Boygrift
3968 - Gibraltar Point
3992_14 - Hobhole
Grand Sluice
3992_9 - Boston Barrier
3992_5 - Fosdyke Bridge
4008 - West Lighthouse
Marsh Road (R.Welland)
Wisbech (R.Nene)
Dog-in-a-Doublet (R.Nene)

Please note: other intermediate locations are available

Produced April 2020
Produced by the Partnerships & Strategic Overview Team

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Humber Estuary

2014 Interim Water Level Profile

Ref	Location	Easting	Northing	Annual Chance (1 in x) of Tide Level metres ODN																			
				1			10			50			100			200			300			1000		
				Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound		
				5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%
H230	**Winterton**	493420	422830	5.13	5.14	5.15	5.47	5.51	5.56	5.67	5.74	5.82	5.74	5.83	5.92	5.81	5.90	6.00	5.84	5.94	6.03	5.94	6.02	6.06
H220	**Ferriby**	497550	421150	5.03	5.04	5.05	5.38	5.42	5.47	5.59	5.67	5.77	5.67	5.77	5.89	5.74	5.86	6.00	5.78	5.91	6.06	5.91	6.04	6.19
H216	**Humber Bridge**	502478	423914	4.97	4.98	4.99	5.33	5.37	5.42	5.55	5.64	5.74	5.64	5.75	5.88	5.72	5.86	6.02	5.75	5.92	6.10	5.88	6.09	6.31
H210	**Barrow Haven**	506380	422620	4.91	4.92	4.93	5.27	5.31	5.36	5.50	5.60	5.72	5.60	5.73	5.89	5.69	5.86	6.08	5.74	5.94	6.18	5.87	6.17	6.51
H200	**New Holland**	508020	424330	4.86	4.87	4.88	5.21	5.26	5.31	5.45	5.55	5.67	5.55	5.68	5.84	5.64	5.81	6.03	5.68	5.89	6.13	5.82	6.12	6.47
H170	**Goxhill**	511970	425440	4.66	4.67	4.68	5.00	5.04	5.09	5.24	5.34	5.46	5.33	5.47	5.65	5.43	5.61	5.85	5.47	5.69	5.96	5.62	5.95	6.37
H150	**East Halton**	514450	422870	4.58	4.59	4.60	4.91	4.96	5.01	5.15	5.25	5.38	5.25	5.39	5.57	5.34	5.53	5.77	5.39	5.62	5.90	5.54	5.89	6.33
H130	**North Killingholme**	516530	420000	4.50	4.51	4.52	4.82	4.87	4.92	5.05	5.15	5.28	5.15	5.28	5.46	5.24	5.42	5.66	5.29	5.51	5.78	5.43	5.77	6.19
H100	**South Killingholme**	518700	417120	4.41	4.41	4.42	4.72	4.77	4.82	4.95	5.05	5.17	5.05	5.18	5.35	5.14	5.32	5.55	5.18	5.40	5.67	5.33	5.66	6.08
3888	**Immingham***	520440	417625	4.16	4.17	4.19	4.50	4.53	4.62	4.73	4.80	5.00	4.83	4.93	5.19	4.93	5.06	5.41	4.98	5.14	5.55	5.15	5.38	6.01

NOTE:

- The base date for the data is 2014.
- The levels 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.
- Levels for other annual chance probabilities are available if required.
- The information is due to be updated in mid-2020
- *The levels for Immingham are taken from the 2018 Coastal Flood Boundary dataset.

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East Coast and Wash: Immingham to the West Lighthouse

2018 Coastal Flood Boundary Extreme Sea Levels

CFB Ref	Location	Easting	Northing	Annual Chance (1 in x) of Tide Level in metres ODN																		
				1			10			50			100			200			300			1000		
				Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound		
				2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%
3888	**Immingham**	520440	417625	4.16	4.17	4.19	4.50	4.53	4.62	4.73	4.80	5.00	4.83	4.93	5.19	4.93	5.06	5.41	4.98	5.14	5.55	5.15	5.38	6.01
3890	**Haborough Marsh**	522100	416512	4.14	4.15	4.17	4.48	4.51	4.60	4.70	4.77	4.97	4.80	4.90	5.16	4.90	5.03	5.38	4.94	5.10	5.51	5.11	5.34	5.97
3898	**Grimsby**	529295	413162	3.98	3.99	4.01	4.31	4.34	4.43	4.53	4.60	4.80	4.61	4.71	4.97	4.71	4.84	5.19	4.74	4.90	5.31	4.88	5.11	5.74
3906	**Buck Beck**	534709	407369	3.87	3.88	3.90	4.19	4.23	4.31	4.41	4.50	4.68	4.50	4.61	4.86	4.61	4.75	5.10	4.64	4.82	5.22	4.80	5.05	5.66
3910	**Tetney**	538035	405537	3.85	3.86	3.89	4.17	4.22	4.30	4.40	4.50	4.67	4.49	4.61	4.86	4.60	4.75	5.10	4.63	4.82	5.21	4.80	5.06	5.66
3918	**Donna Nook**	544641	401997	3.82	3.83	3.86	4.14	4.19	4.27	4.38	4.48	4.65	4.47	4.60	4.85	4.58	4.74	5.10	4.63	4.82	5.22	4.81	5.08	5.68
3928	**Saltfleet**	549131	393360	3.78	3.79	3.82	4.11	4.16	4.26	4.36	4.46	4.64	4.47	4.59	4.86	4.57	4.74	5.11	4.63	4.83	5.25	4.83	5.11	5.74
3942	**Boygrift**	555131	380860	3.72	3.74	3.77	4.06	4.11	4.22	4.33	4.43	4.65	4.43	4.57	4.87	4.56	4.73	5.13	4.62	4.83	5.28	4.85	5.15	5.82
3968	**Gibraltar Point**	557652	356181	4.16	4.17	4.20	4.51	4.56	4.67	4.76	4.85	5.08	4.85	4.97	5.27	4.94	5.10	5.49	4.99	5.18	5.63	5.14	5.41	6.09
3992_14	**Hobhole**	535990	340116	4.96	4.97	5.01	5.40	5.44	5.56	5.66	5.76	5.98	5.78	5.90	6.20	5.88	6.04	6.44	5.92	6.11	6.57	6.03	6.31	6.99
	Grand Sluice*	532366	344510	4.93	4.94	4.98	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
3992_9	**Boston Barrier**	532754	342852	4.93	4.94	4.98	5.41	5.45	5.57	5.73	5.83	6.05	5.85	5.97	6.27	5.93	6.09	6.49	5.94	6.13	6.59	5.98	6.26	6.94
3992_5	**Fosdyke Bridge**	531886	332234	4.87	4.88	4.92	5.31	5.35	5.47	5.58	5.68	5.90	5.71	5.83	6.13	5.82	5.98	6.38	5.87	6.06	6.52	6.01	6.29	6.97
4008	**West Lighthouse**	550094	329971	4.87	4.88	4.91	5.21	5.26	5.37	5.46	5.56	5.78	5.56	5.68	5.98	5.66	5.82	6.21	5.71	5.90	6.35	5.86	6.14	6.81
-	**Marsh Road**	525988	324065	-	5.04	-	-	5.44	-	-	5.73	-	-	5.85	-	-	5.98	-	-	-	-	-	-	-
-	**Wisbech**	546110	309940	-	4.83	-	-	5.25	-	-	5.53	-	-	5.66	-	-	5.78	-	-	-	-	-	-	-
-	**Dog-in-a-Doublet**	527200	299287	-	3.67	-	-	4.00	-	-	4.22	-	-	4.32	-	-	4.42	-	-	-	-	-	-	-

See next page for notes

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East Coast and Wash: Immingham to the West Lighthouse

2018 Coastal Flood Boundary Extreme Sea Levels

NOTES:

The following notes apply to all CFB sites (ie all on table excluding Marsh Road, Wisbech, Dog-in-a-Doublet)

- The base date for the data is 2017.
- The levels 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.
- Levels for other annual chance probabilities are available if required.
- For additional information relating to the 2018 Coastal Flood Boundary Extreme Sea Levels or to access the full dataset for the above sites or intermediate locations refer to the Defra Metadata Catalogue at https://deframetadata.com/geonetwork/srv/eng/catalog.search#/metadata/84a5c7c0-d465-11e4-b0bd-f0def148f590

The following notes apply to all Marsh Road, Wisbech, Dog-in-a-Doublet

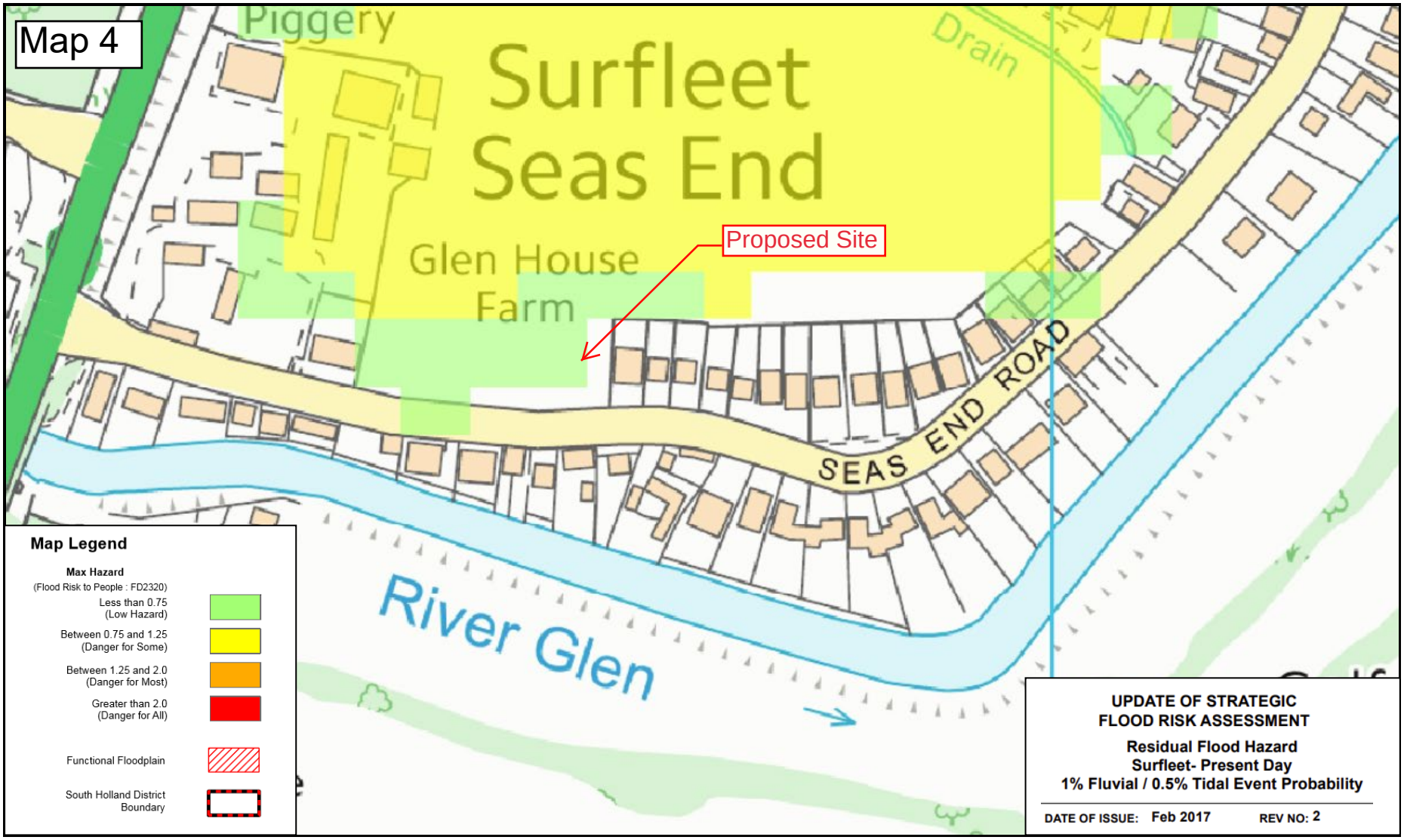
- The base date for the data is 2006
- The levels are still water levels. Depending on the use of the data it may be necessary to consider wave heights and / or joint probability analysis of water level and other variables.
- Levels for other annual chance probabilities are available if required.
- These levels will be updated as their respective tidal river models are updated.

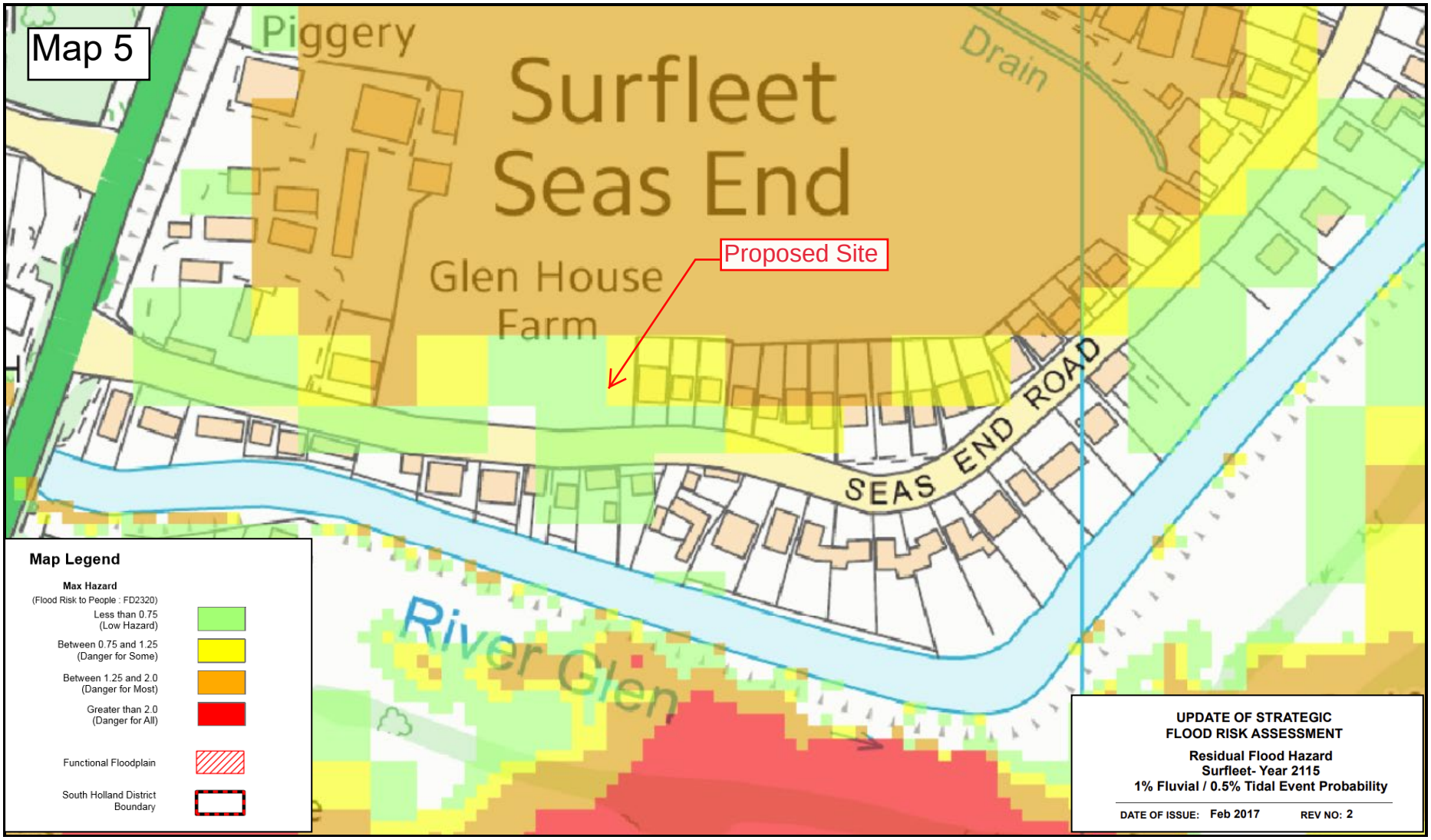
The following notes apply to Grand Sluice

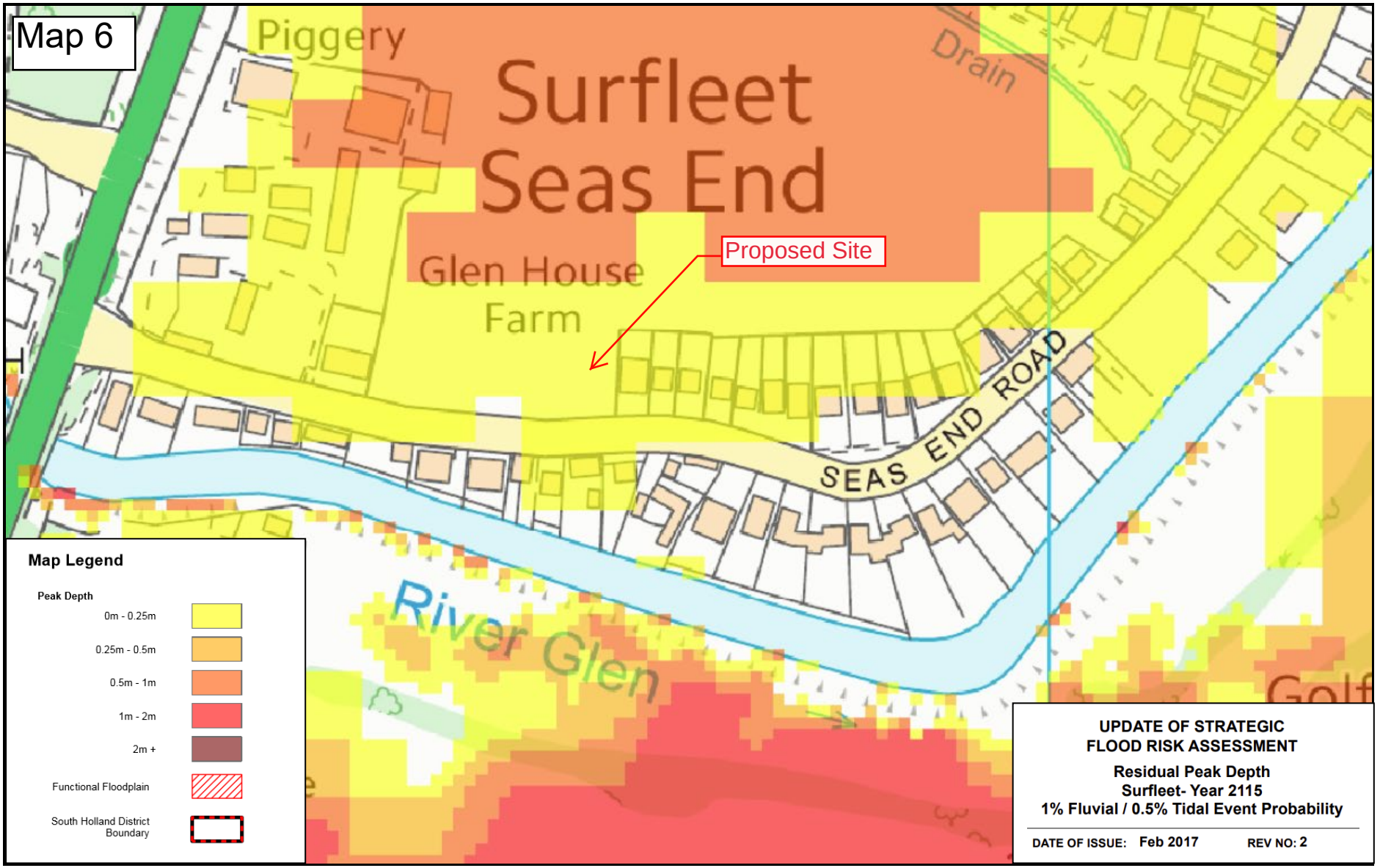
- The data is based on CFB 2018 data for Boston Barrier site, capped at 5.3mAOD to reflect use of the barrier.
- The base date for the data is 2017
- The levels are still water levels. Depending on the use of the data it may be necessary to consider wave heights and / or joint probability analysis of water level and other variables.
- For additional information relating to the 2018 Coastal Flood Boundary Extreme Sea Levels or to access the full dataset for the above sites or intermediate locations refer to the Defra Metadata Catalogue at https://deframetadata.com/geonetwork/srv/eng/catalog.search#/metadata/84a5c7c0-d465-11e4-b0bd-f0def148f590

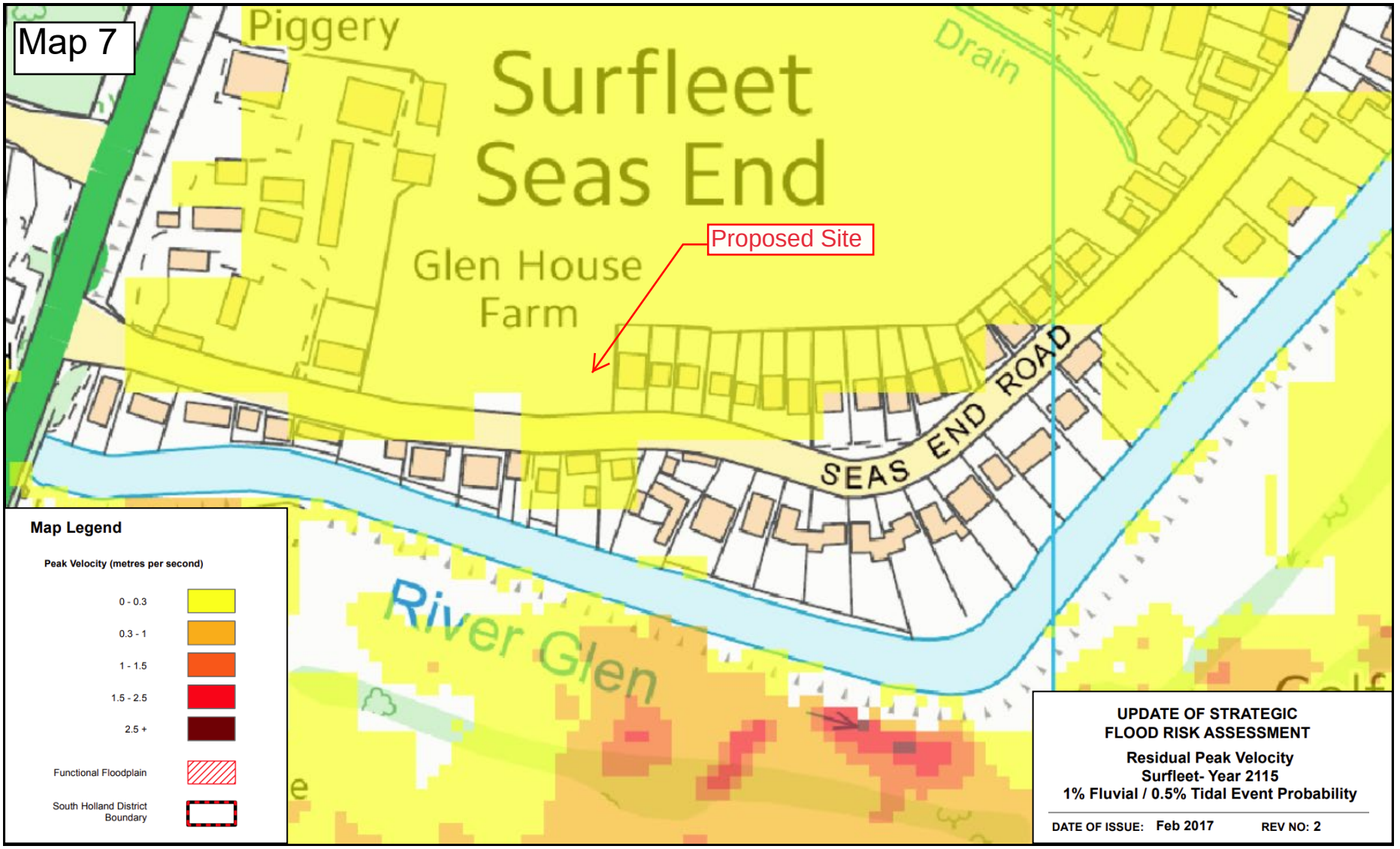
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Map 4
Piggery
Surfleet
Seas End
Drain
Glen House
Farm
Proposed Site
SEAS END ROAD
River Glen
Map Legend
Max Hazard
(Flood Risk to People : FD2320)
Less than 0.75
(Low Hazard)
Between 0.75 and 1.25
(Danger for Some)
Between 1.25 and 2.0
(Danger for Most)
Greater than 2.0
(Danger for All)
Functional Floodplain
South Holland District
Boundary
UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Flood Hazard
Surfleet- Present Day
1% Fluvial / 0.5% Tidal Event Probability
DATE OF ISSUE: Feb 2017
REV NO: 2


Map 5
Piggery
Surfleet
Seas End
Drain
Glen House
Farm
Proposed Site
SEAS END ROAD
River Glen
Map Legend
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)
Functional Floodplain
South Holland District
Boundary
UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Flood Hazard
Surfleet- Year 2115
1% Fluvial / 0.5% Tidal Event Probability
DATE OF ISSUE: Feb 2017
REV NO: 2


Map 6
Piggery
Surfleet
Seas End
Drain
Proposed Site
Glen House
Farm
SEAS END ROAD
River Glen
Golf
Map Legend
Peak Depth
0m - 0.25m
0.25m - 0.5m
0.5m - 1m
1m - 2m
2m +
Functional Floodplain
South Holland District Boundary
UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Peak Depth
Surfleet- Year 2115
1% Fluvial / 0.5% Tidal Event Probability
DATE OF ISSUE: Feb 2017
REV NO: 2

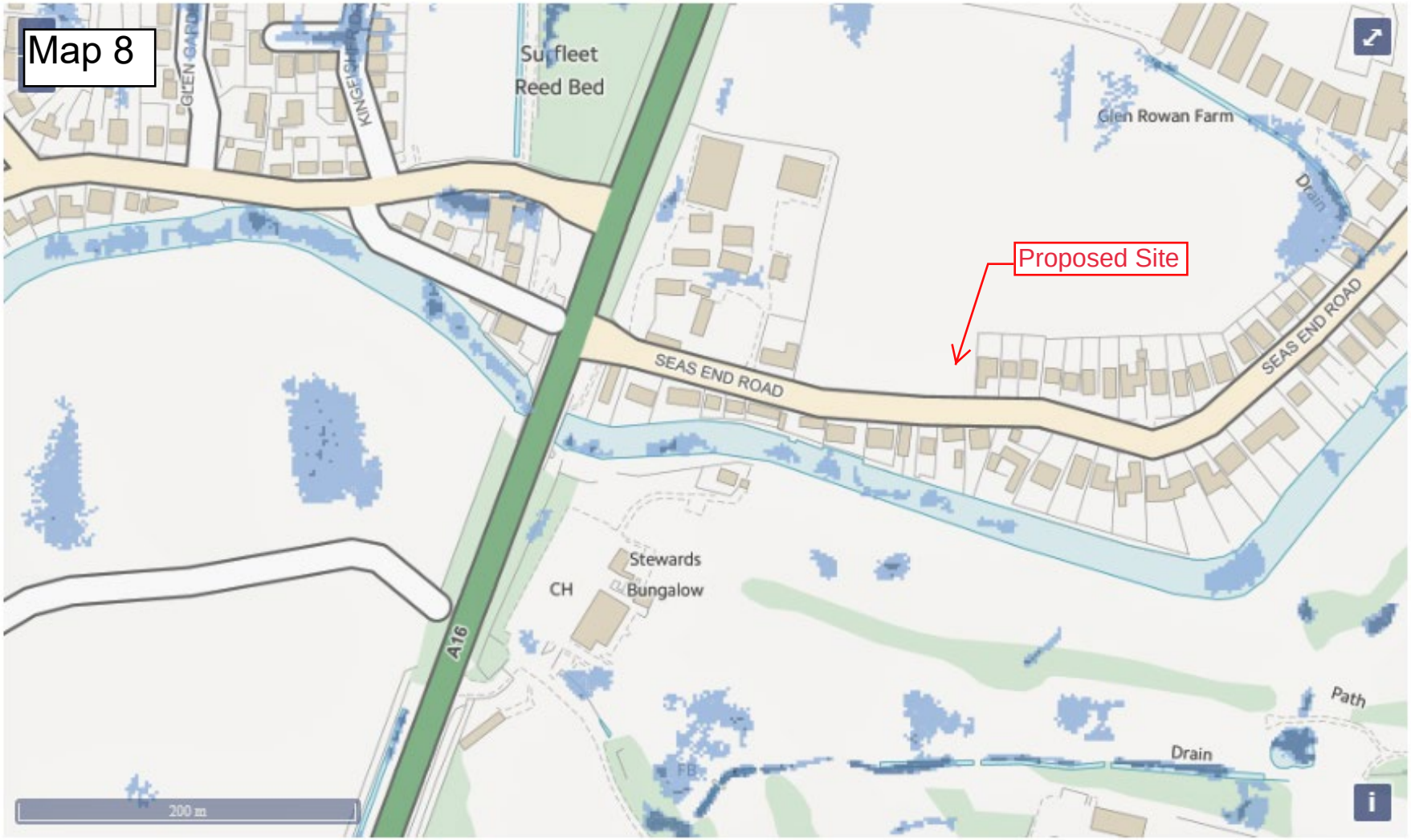

Map 7
Piggery
Surfleet
Seas End
Drain
Proposed Site
Glen House
Farm
SEAS END ROAD
River Glen
Map Legend
Peak Velocity (metres per second)
0 - 0.3
0.3 - 1
1 - 1.5
1.5 - 2.5
2.5 +
Functional Floodplain
South Holland District Boundary
UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Peak Velocity
Surfleet- Year 2115
1% Fluvial / 0.5% Tidal Event Probability
DATE OF ISSUE: Feb 2017
REV NO: 2

Flood risk

Low risk: depth

Location

Surfleet Seas End

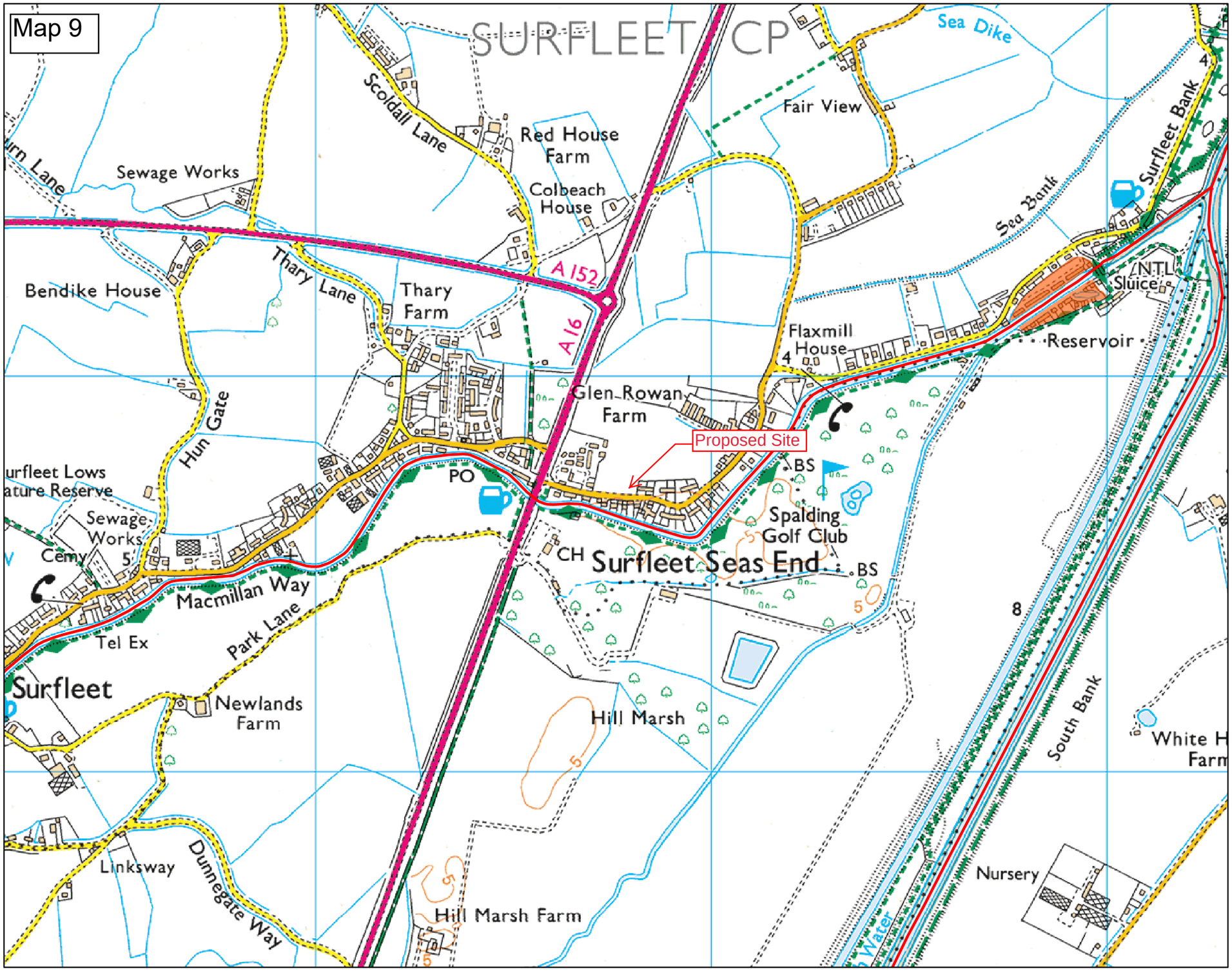


Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm | 300 to 900mm | Below 300mm

Historic Flood Map centred on TF 26760 28722 - created August 2020 [Ref: CCN-2020-178535]



Environment Agency

Scale 1:10,000

N

Legend

- Main River
- Easter 1998 on the River Glen at Surfleet

Created by the Partnership & Strategic Overview Team, Kettering

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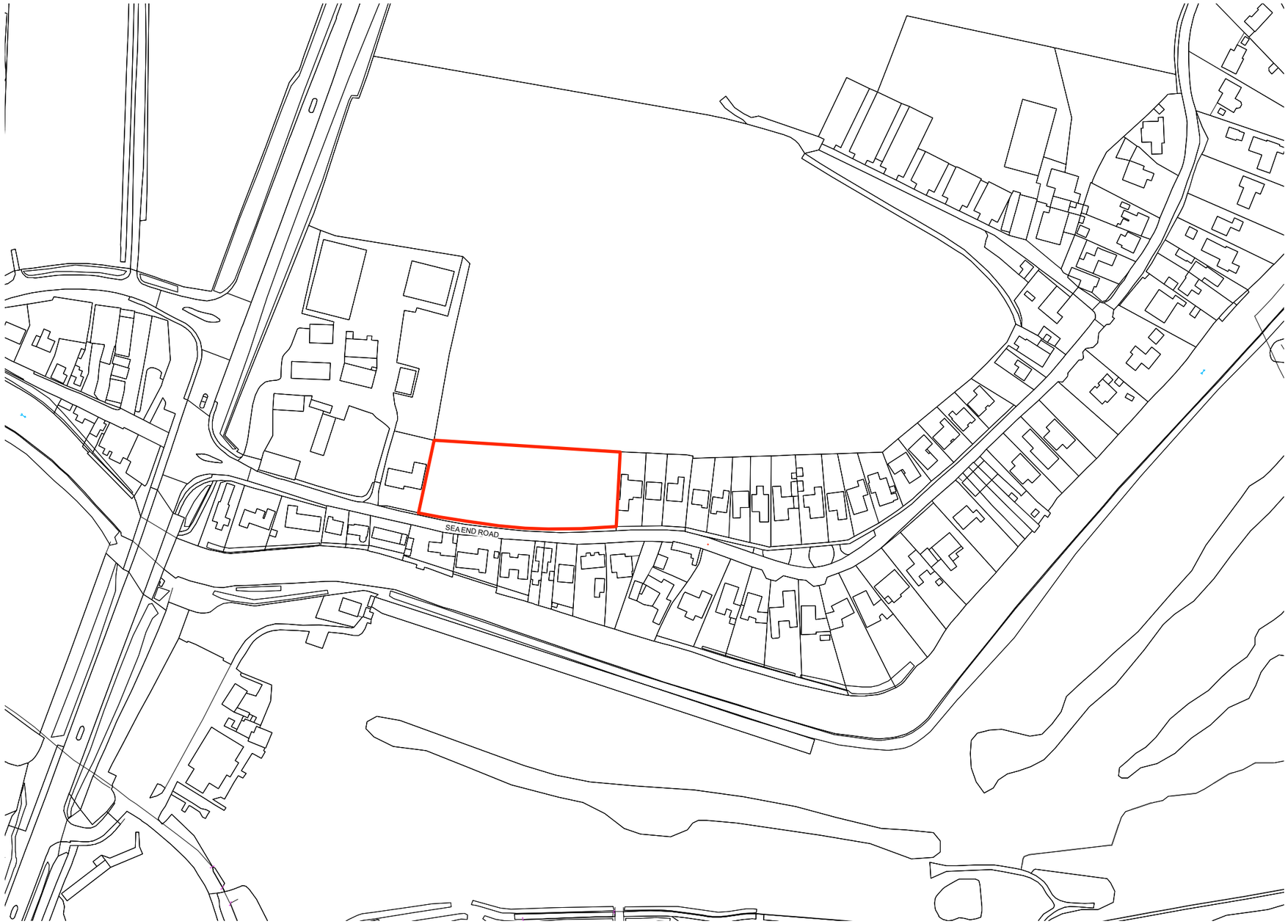
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Plan 1

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GENERAL NOTES: **All dimensions to be checked on site.** | Use figured dimensions only. | All queries to be directed to the Architect. | Refer to Structural Engineer's drawings for all details relating to structure. | Any discrepancies between the Architect's drawings and those by any other party to be reported immediately. | All drawings are not for construction unless explicitly marked for this purpose.

GENERAL NOTES ON MATERIALS: Materials to comply with appropriate British Standards or Agrément Certificate stamped and independently certified or otherwise to show their suitability. | Materials should be in accordance with BS8000 series of documents and other accepted good practice (e.g. Quality assured to ISO9000).



SITE LOCATION PLAN
1:2500

SITE LOCATION PLAN
1

Do not scale from this drawing. Figured dimensions are taken to structure unless indicated otherwise. All dimensions to be checked on site prior to commencement of work . Drawing to be read in conjunction with all other Architect's drawings, Consultant's and Specialist's drawings, construction notes and specifications.

Project	Location	Drawing name	Drawing number	Paper	Scale	Date	Rev
NEW DWELLING	SEAS END ROAD	SITE LOCATION PLAN	146 -001	A3	1:2500	08/20	

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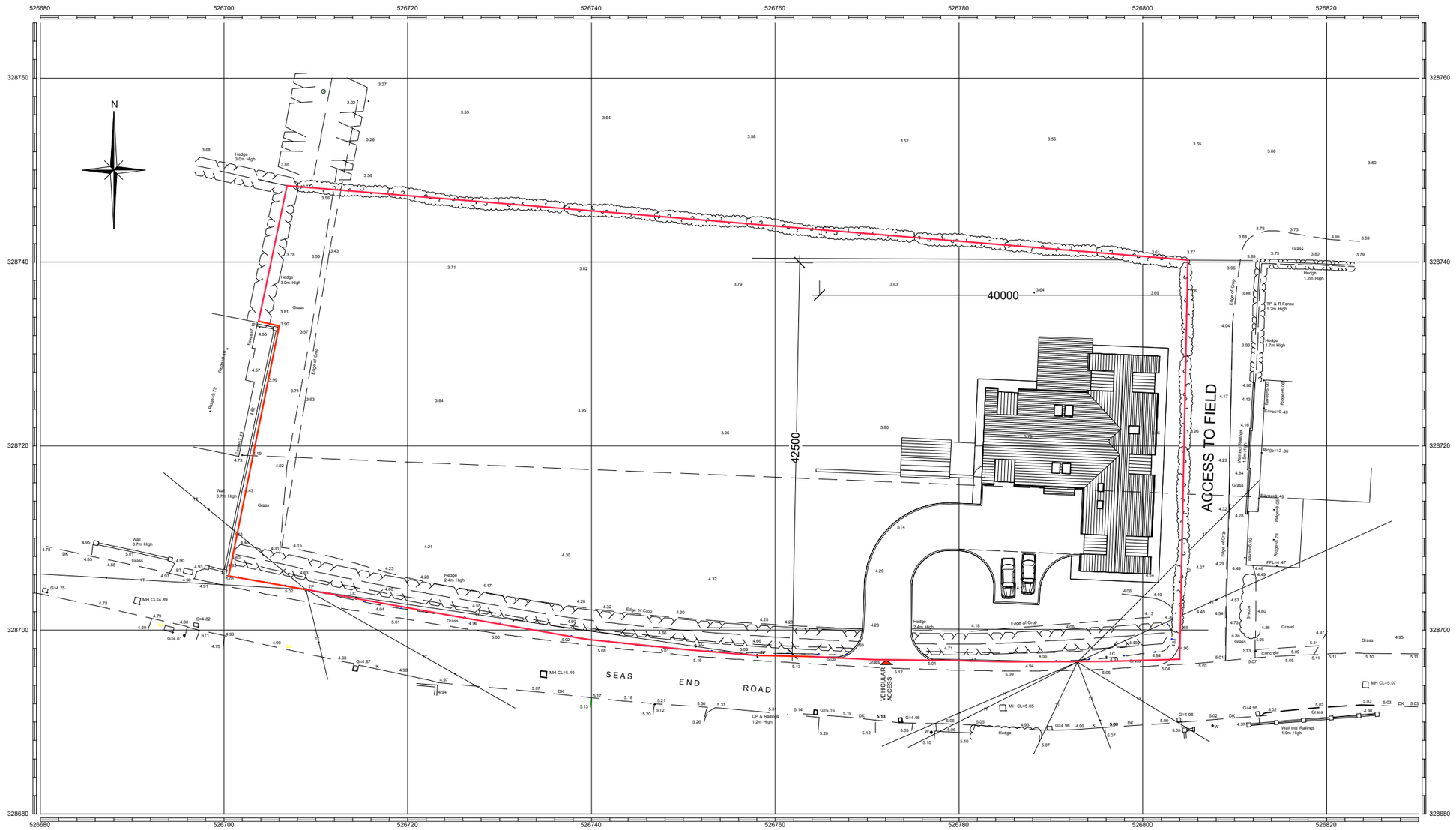
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Plan 2

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PROPOSED SITE PLAN
SCALE:1:500

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Project	Location	Drawing name	Drawing number	Paper	Scale	Date	Rev
NEW DWELLING	SEAS END ROAD	SITE LOCATION PLAN	146 -100	A3	1:500	09/20	

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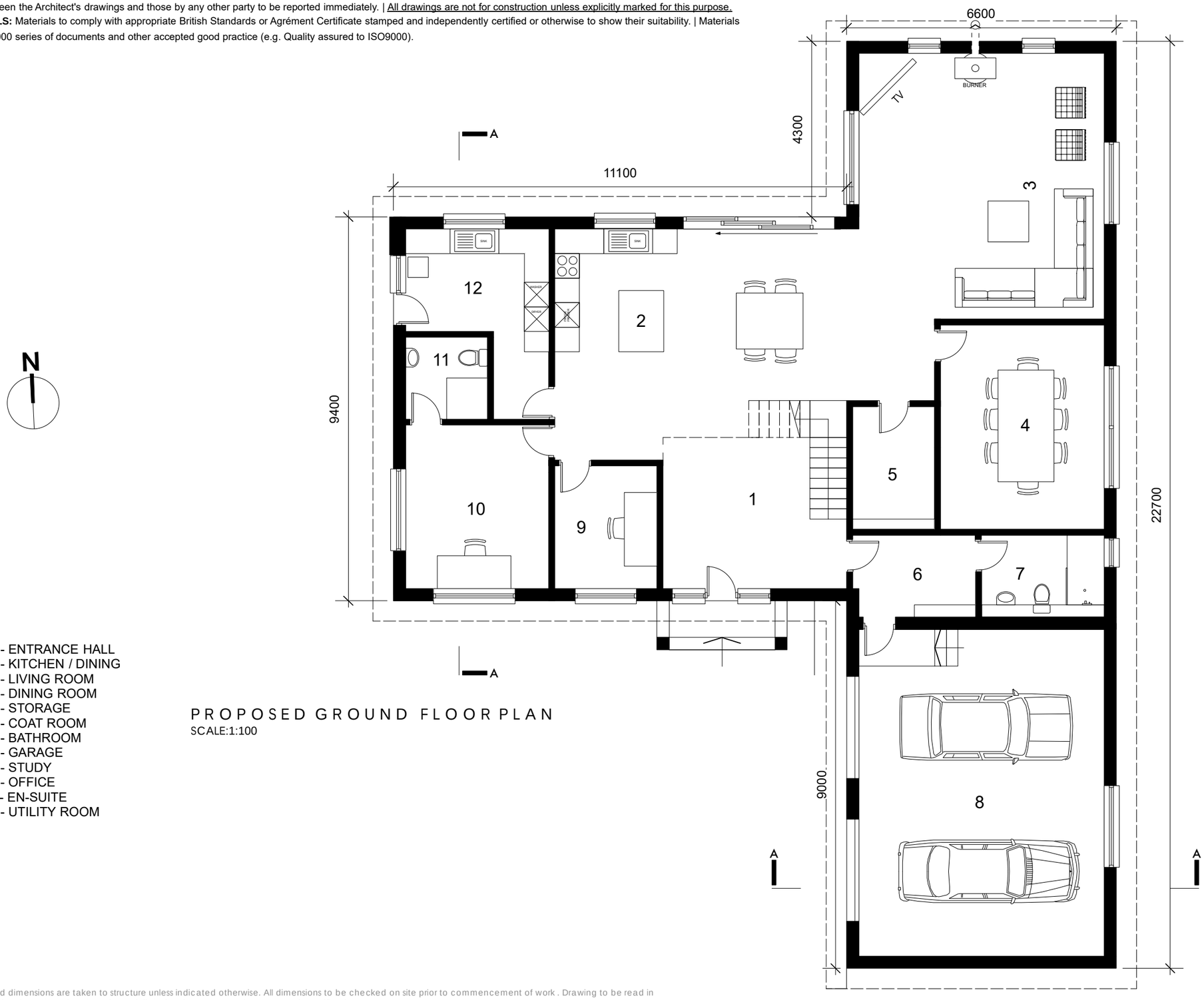
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Plan 3

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1 - ENTRANCE HALL
2 - KITCHEN / DINING
3 - LIVING ROOM
4 - DINING ROOM
5 - STORAGE
6 - COAT ROOM
7 - BATHROOM
8. - GARAGE
9 - STUDY
10 - OFFICE
11 - EN-SUITE
12 - UTILITY ROOM

PROPOSED GROUND FLOOR PLAN
SCALE:1:100

REV B: Raised roof level option
REV C: Changes in accordance with notes from meeting 23/09/20

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Project	Location	Drawing name	Drawing number	Paper	Scale	Date	Rev
NEW DWELLING	SEAS END ROAD	PROPOSED GROUND FLOOR PLAN	146 -101	A3	1:100	09/20	C

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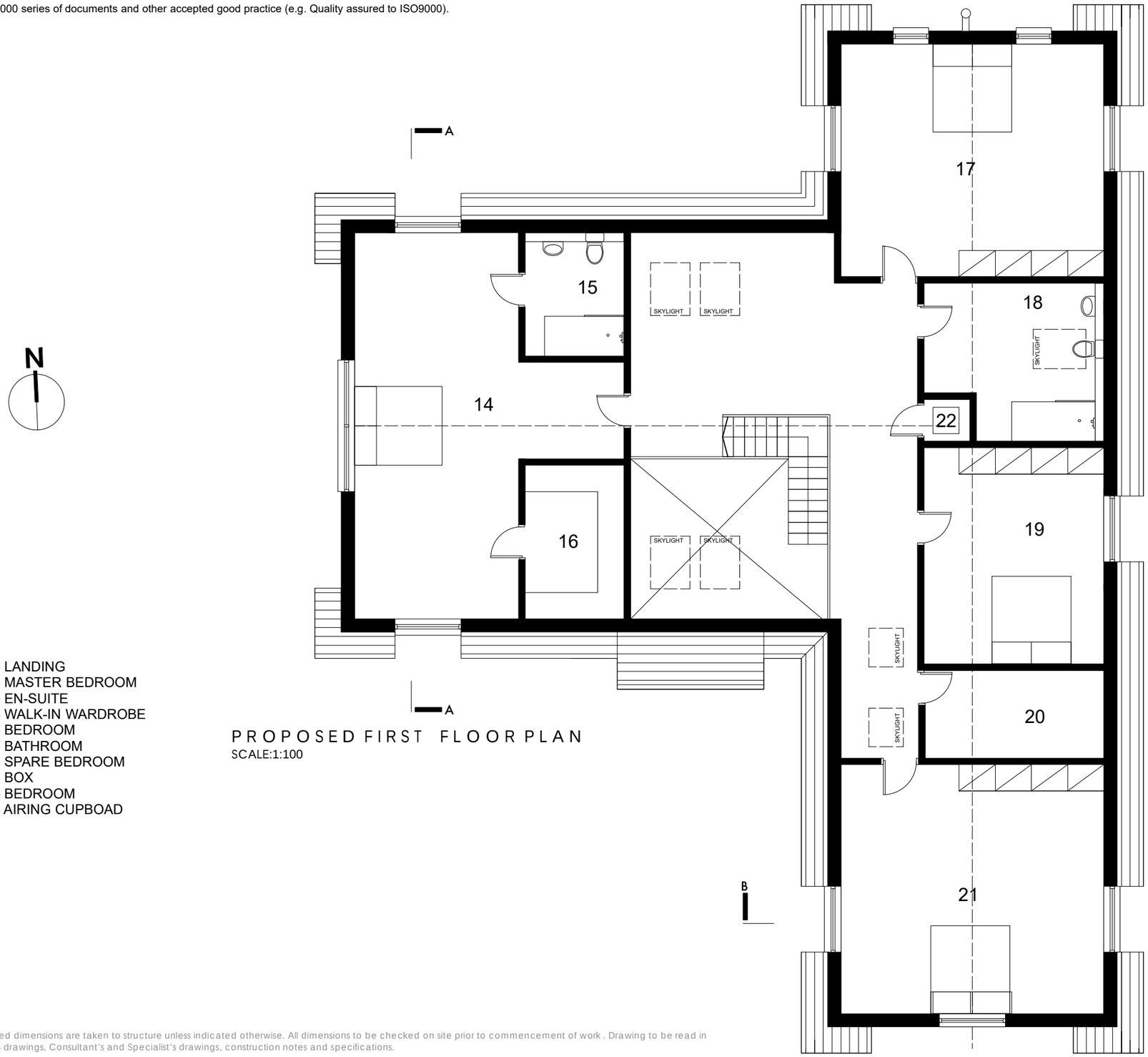
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Plan 4

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13 - LANDING
14 - MASTER BEDROOM
15 - EN-SUITE
16 - WALK-IN WARDROBE
17 - BEDROOM
18 - BATHROOM
19 - SPARE BEDROOM
20 - BOX
21 - BEDROOM
22 - AIRING CUPBOAD

PROPOSED FIRST FLOOR PLAN
SCALE:1:100

REV B: Raised roof level option
REV C: Changes in accordance with notes from meeting 23/09/20

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Project	Location	Drawing name	Drawing number	Paper	Scale	Date	Rev
NEW DWELLING	SEAS END ROAD	PROPOSED FIRST FLOOR PLAN	146 -102	A3	1:100	09/20	C

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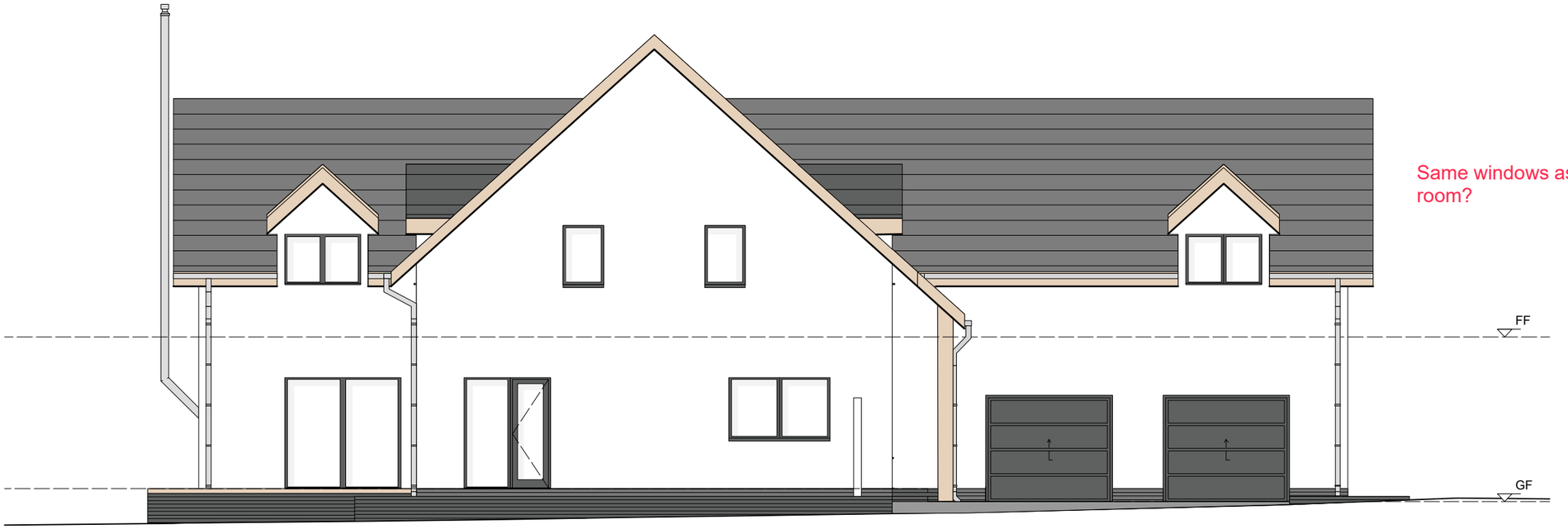
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Plan 5

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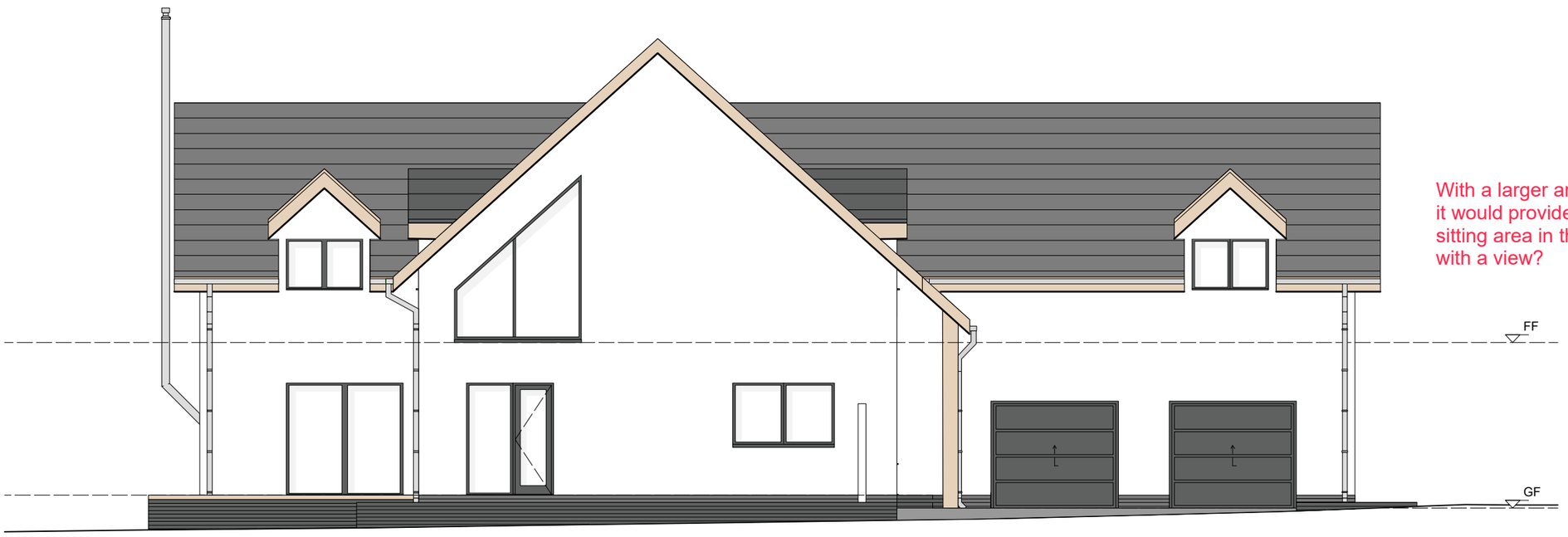
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Same windows as in Abbies room?

PROPOSED WEST ELEVATION (DORMER OPTION 2)

SCALE:1:100



With a larger area of glazing it would provide a small sitting area in the bedroom with a view?

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Site Name	**Surfleet**
Date	**Oct-20**
Comments:	**FRA**
Environment Agency CCN Number	**CCN-2020-178535**

INPUT DATA TO BLUE CELLS ONLY

Model Information

Model Name	**Welland Catchment Strategic**
Date of Model	**2016**
Model Node	**Glen 1889**

OUTPUTS IN YELLOW CELLS

Modelled Results

Re-order based on Flow	FLOW	LEVEL
2	44.6	3.92
5	46.68	4.04
10	48.84	4.12
20	51.68	4.20
50	52.61	4.21
75	53.24	4.21
100	53.88	4.22
200	56.94	4.23
100+20	63.47	4.78
1000	64.61	4.34
1000+20	73.18	4.83

Attenuation Factor

1.87 % FOR 1:100

5.95 % FOR 1:1000

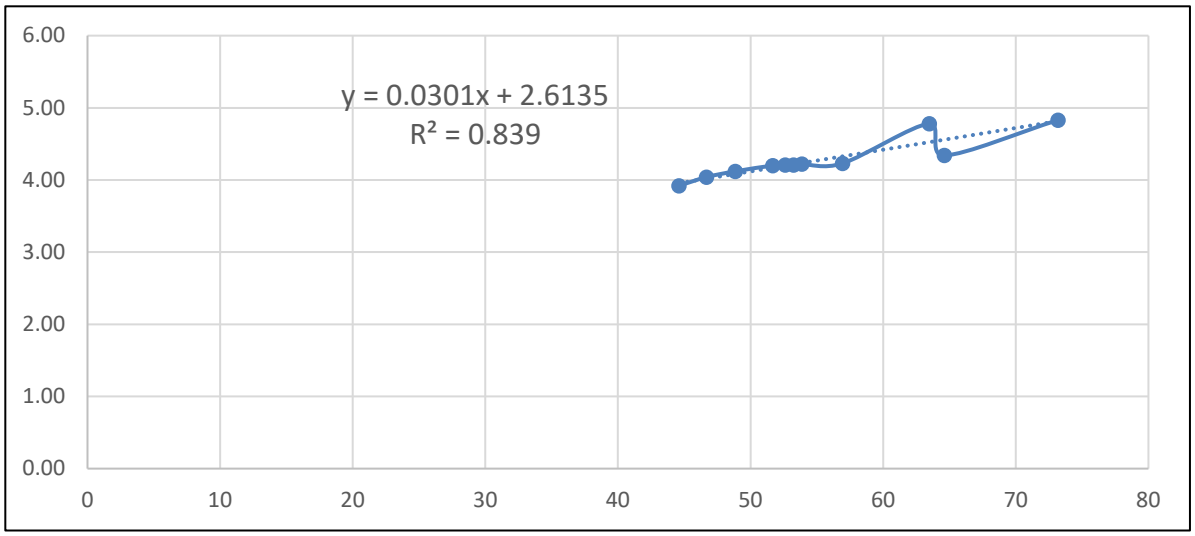
Note: Higher attenuation factors mean results through extrapolation will be Overestimated

River Basin	Anglian	
Time Horizon	Upto 2115	
AEP Scenario	100	AEP

MAKE SURE YOU COPY THE FORMULA VARIABLES AND R^2 ON THE GRAPHS TAB !

EXTRAPOLATED WATER LEVEL OUTPUTS AT NODE		
Upper End Scenario	**5.29**	mODN
Higher Central Scenario	**4.80**	mODN
Central Scenario	**4.64**	mODN

Linear Interpolation				EQUATION >	0.0301	2.6135
		1 in 100			1 in 1000	
		FLOW	LEVEL		FLOW	LEVEL
65	65%	88.90	5.29		106.61	5.82
35	35%	72.74	4.80		87.22	5.24
25	25%	67.35	4.64		80.76	5.04



R2 value 0.839