

**PROPOSED DEVELOPMENT OF TWO PROPERTIES  
ADJACENT TO FLAXMILL HOUSE, RESERVOIR ROAD,  
SURFLEET, SPALDING, PE11 4DH  
FLOOD RISK ASSESSMENT**



Proposed site from Reservoir Road

S M Hemmings B Sc C Eng MICE MIWEM,  
13 Lea Gardens,  
Peterborough,  
PE3 6BY.

**Revision A 12<sup>th</sup> February 2024 Maps updated as required**

This flood risk assessment has been prepared solely to support the planning application for the proposed new dwellings at Reservoir Road, Surfleet, Spalding. The author has made every effort to provide an accurate assessment of the flood risk but accepts no liability should the information be found to be incorrect or incomplete, or if it is used for any other purposes other than for which it was originally commissioned.

## **Introduction**

An application is due to be submitted for planning permission to construct two new properties on a site east of Flaxmill House, 12 Reservoir Road, Surfleet, Spalding. Reservoir Road is located on the top of the north bank of the River Glen and the development site is 750 metres west of the main outfall sluice from the River Glen in to the tidal River Welland.

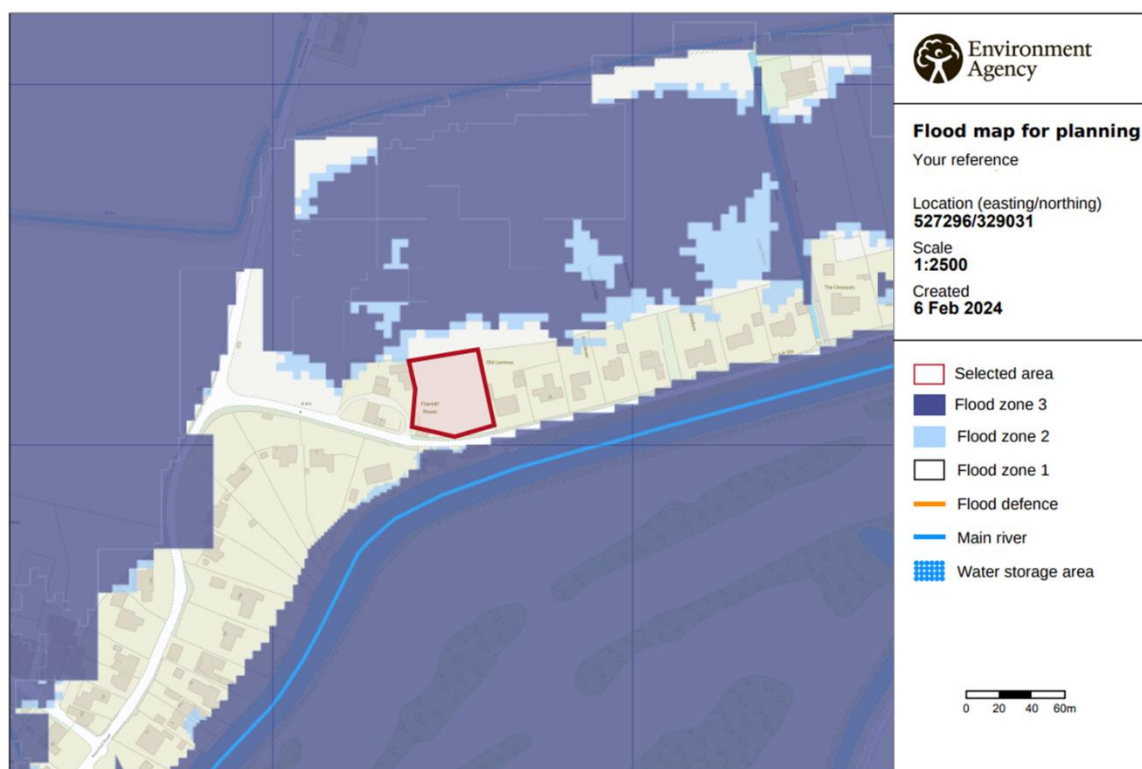
The site is within Flood Zone 1, indicating a low risk, as shown on the Environment Agency's (EA) Flood Zone map. These maps do not take into account existing flood defences.

The Planning Application requires a flood risk assessment to be carried out as required in the Technical Guidance to the National Planning Policy Framework (NPPF) Development and Flood Risk.

The site is within a defended area as specified on the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) and is located in the Welland and Deepings Internal Drainage Board district.

## **Environment Agency (EA) Flood Zones**

The map below is taken from the Environment Agency website and shows the flood zones in the area.



It can be seen that the site, which is immediately north of the river bank, is within flood zone 1. The fields to the north are lower and are mostly within flood zone 3.

## **Application Site**

The development is located approximately 600 metres east of the new A16 road at Surfleet and three miles north of Spalding city centre. The National Grid Reference of the site is 527295 329025.

The position and extent of the site is shown on the plan at the end of this document.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a development consisting of dwelling houses is classified as “more vulnerable”.

Table 3 of the Guidance is shown below:

| <u>Flood Zones</u> | <u>Flood Risk Vulnerability Classification</u> |                         |                         |                 |                  |
|--------------------|------------------------------------------------|-------------------------|-------------------------|-----------------|------------------|
|                    | Essential infrastructure                       | Highly vulnerable       | More vulnerable         | Less vulnerable | Water compatible |
| Zone 1             | ✓                                              | ✓                       | ✓                       | ✓               | ✓                |
| Zone 2             | ✓                                              | Exception Test required | ✓                       | ✓               | ✓                |
| Zone 3a †          | Exception Test required †                      | X                       | Exception Test required | ✓               | ✓                |
| Zone 3b *          | Exception Test required *                      | X                       | X                       | X               | ✓*               |

It can be seen that “More vulnerable” development is appropriate in flood zone 1.

## **Sequential Test**

The aim of the Sequential Test, as set out in the Planning Practice Guidance, is to ensure that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The flood zones as defined in the Strategic Flood Risk Assessment for the area provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

The area north of the River Glen is in flood zone 3, but the immediate area on the north bank of the river is in flood zone 1 as it almost as high as the road on the top of the bank. Therefore it would be difficult to find a similar site for the development within the Surfleet Seas End village boundary that has a lower flood risk..

The safety of the development will be delivered by ensuring the floor level of the proposed new properties are above predicted residual flood levels for this area.

The principal of development on this site has been established with the outline approval (reference no H17-0346-19 granted on 13<sup>th</sup> May 2019) of planning permission and the approval of reserved matters (reference no H17-1284-21 granted on 1<sup>st</sup> February 2022).

Therefore I consider that the sequential test has been passed.

### **Strategic Flood Risk Assessment**

Consultants have produced a Strategic Flood Risk Assessment (SFRA) for the South Holland District Council (SHDC). This document provides details of the flood risk in the Council's area. Reference to the maps in this document give the following information for the flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

The maps illustrate the actual flood hazard which is as follows:

|                     |                                            |
|---------------------|--------------------------------------------|
| For the present day | Depth of flooding ... zero                 |
|                     | Extent of flooding .. Low or medium        |
|                     | Velocity ..... Nil                         |
| For year 2115       | Depth of flooding ... 0 – 500mm            |
|                     | Extent of flooding .. High                 |
|                     | Peak Velocity ..... Greater than 0.25m/sec |

The maps showing the residual flood hazard were revised in the 2016 update of the South Holland District Council Strategic Flood Risk Assessment which can be found on the website of the South East Lincolnshire Joint Planning Committee. The hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

|                     |                                                                                             |
|---------------------|---------------------------------------------------------------------------------------------|
| For the present day | Depth of flooding.... zero                                                                  |
|                     | Extent of flooding ...low or medium                                                         |
|                     | Hazard ..... zero                                                                           |
|                     | Velocity ..... zero                                                                         |
| For the year 2115   | Depth of flooding ....0 – 250mm                                                             |
|                     | Extent of flooding ...High                                                                  |
|                     | Hazard ..... Low hazard (0 – 0.75) (south part)<br>Danger for some (0.75 – 1.25) north part |
|                     | Velocity ..... 0 – 0.3m/sec                                                                 |

Figure 16 of the general maps shows that the site is not within the rapid inundation zone for the present day or in 2115.

- 1. The maximum flood levels in the fluvial section of the River Glen shown in the SFRA are as follows:**

|                 |      |      |
|-----------------|------|------|
| Year            | 2007 | 2115 |
| 1 in 100 year   | 4.13 | 4.65 |
| 1 in 1,000 year | 4.18 | 4.68 |

The bank level on this side of the river at chainage 0.7km is shown to be 4.67m OD and at 0.8km it is 4.40m OD.

**2. The extreme tide levels in the section of the River Welland at chainage 16.1km is shown in the report as follows:**

|                 |      |      |      |
|-----------------|------|------|------|
|                 | 2007 | 2055 | 2115 |
| 1 in 100 year   | 5.99 | 6.32 | 7.13 |
| 1 in 1,000 year | 6.32 | 6.65 | 7.46 |

The bank levels of the west bank of the tidal River Welland north and south of the River Glen outfall are at a level of approximately 7.50m OD and above, but the bank level at 16.1km, the River Glen outfall is shown to be 7.05m OD.

**3. Rapid Inundation Zone:**

The maps in the SFRA show that the site is not within the rapid inundation zone.



**Information from the Environment Agency**

The Environment Agency has provided predicted flood levels for the River Glen which are taken from the Welland Catchment Model produced in 2016. The levels quoted below are maximum predicted water levels in the River Glen directly south of the development site.

|                                  |          |                                             |
|----------------------------------|----------|---------------------------------------------|
|                                  | 2007     | 2007 including 20% climate change allowance |
| Peak 1 in 100 year flood level   | 4.19m OD | 4.78mOD                                     |
| Peak 1 in 1,000 year flood level | 4.32m OD | 4.83m OD                                    |

## **Site Levels**

Existing ground levels have been taken on the site and a plan showing these is shown on page 10 of this report.

The level of Reservoir Road south of the site is between 4.47m and 4.52m OD.

The site is lower than the road with levels between 3.99m and 4.32m OD.

## **Existing Flood Alleviation Measures**

The site is 750 metres from the tidal sluice at Surfleet Seas End where the River Glen discharges into the tidal section of the River Welland. Both watercourses are main river and maintained by the Environment Agency.

## **Potential Sources of Flooding**

The following sources of flooding have been identified:

1. Flooding from the River Glen.
2. Overtopping of the tidal River Welland.
3. Flooding from failure of IDB systems.

### **1. Flooding from the River Glen**

Flooding could occur on the development site if the bank, which incorporates the road, were to overtop or breach when levels in the River Glen are high. The level of the bank shown in the SFRA is between 4.40m and 4.67m OD, and the level measured was approximately 4.50m OD. The maximum predicted level in the River Glen at this location is 4.13m OD for a 1 in 100 year event at the present time. Therefore at the present time there is adequate freeboard and a robust bank with a 7.0 metre top on which there is a tarmaced road. Therefore there is no risk of overtopping and the risk of a breach occurring at this location at the present time can be considered extremely low.

The SFRA indicates that the 1 in 100 year level for the year 2115 will be 4.65m OD. The EA have carried further modelling and the 2016 Welland Catchment model predicts the 1 in 100 year level in 2115 will be 4.78m OD. As the level of the road at this location is 4.50m OD there will be a risk of the River overtopping the banks at this location in a 1 in 100 year event in 2115. As the top of the bank is more than 6.0 metres wide with tarmac surfacing and a very shallow gradient on the back of the bank it extremely unlikely that a breach will be formed.

Adequate mitigation will be provided by raising the ground floor level of the proposed properties above the predicted flood level.

### **2. Flooding from the tidal River Welland**

The River Welland is tidal in the section adjacent to the River Glen outfall sluice. The SFRA states that the defences are adequate to withstand a 1 in 200 year (0.5%) probability event for present day. In the future in 2115 some of the banks would be overtopped with a 0.5% probability event.

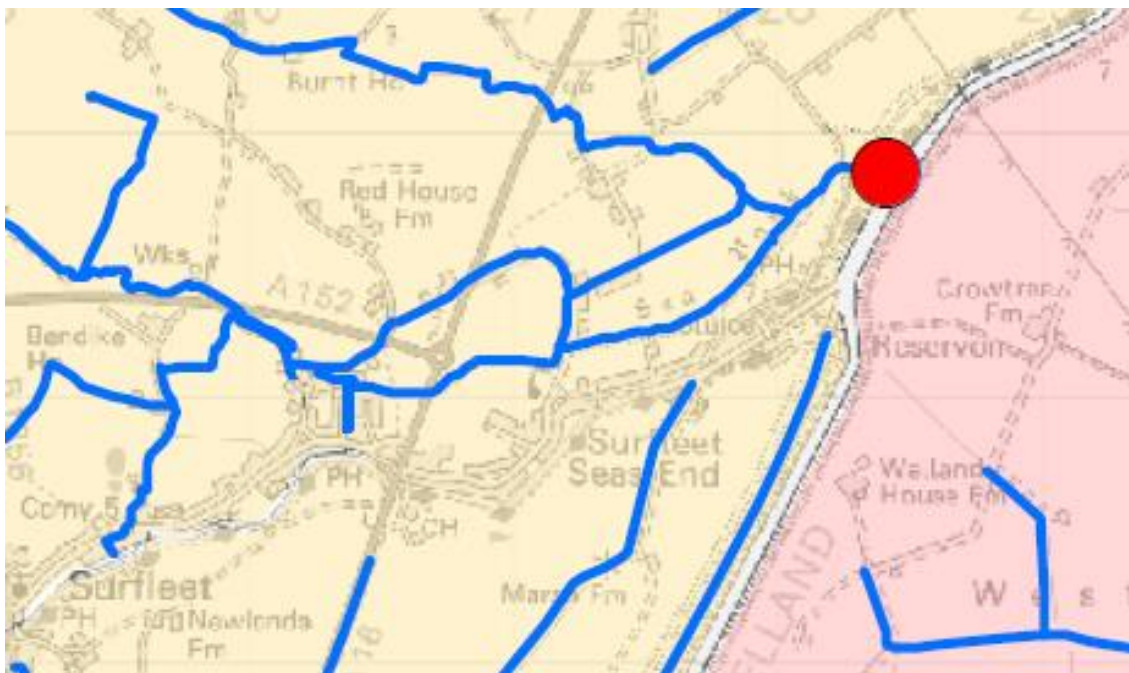
It is reasonable to assume that within the next 100 years the tidal defences will be raised to continue to provide a 1 in 200 year level of protection to this area.

The development site could be affected if the west bank of the tidal Welland north of Surfleet Seas End were to breach. Flood water would flow into Surfleet Marsh and could flow south westwards and reach the Development site. The hazard maps in the updated SFRA state that the predicted flood depth in a 1 in 200 year tidal event in 2115 could be up to 250mm in depth.

Adequate mitigation will be provided by raising the ground floor level of the proposed properties above the predicted flood level.

### **3. Flooding due to failure of IDB Systems.**

There is a system of IDB drainage channels which drain the fenland area north of the site. These lead to Surfleet Marsh Pumping Station where the water is pumped into the tidal River Welland. This pumping station provides an overall standard of protection to the area of between 1 in 50 and 1 in 100 years. There is an IDB drain, called Old Beach East Drain, immediately north of the site which runs eastwards to the pumping station. Welland and Deepings IDB have stated that the 1 in 100 year predicted maximum level at Surfleet Marsh Pumping Station is 1.75m OD, which is 2.25m lower than the lowest ground levels on the site.



It is expected that Welland and Deepings IDB will continue to review predicted 1 in 100 year levels over the next 100 years to ensure that freeboards are retained in the future.

As the proposed ground floor level of the property will be approximately 2.9 metres above the predicted maximum flood level in the IDB drain flooding from this source can be considered to be remote.

### **Extent of known Flooding**

There is no history of flooding having occurred over this section of the north bank of the River Glen for the last thirty years.

### **Probabilities and Trends of Flooding**

The probability of this development flooding from Environment Agency tidal River Welland is very low. In an extreme event water levels in the River Glen could rise and flood the property but any effect on this location would not be sudden and there would be time for residents to take precautionary measures to limit the impact of any flooding that may occur.

### **Residual Risk – Extreme Events**

The residual risk from extreme events is very low on this site. The major risk to the site is from high levels in the River Glen. The present levels of the banks of the River Glen along the stretch from Surfleet Seas End to West Pinchbeck are as low as 4.28m OD and overtopping of the river will begin to occur at these locations prior to overtopping occurring at a location which will affect the proposed development site.

### **Climate Change**

The recommendations for flood depths for this flood risk assessment use information mostly taken from the South Holland DC SFRA which was last updated in 2010. The EA have issued new guidance on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which from 19<sup>th</sup> February 2016 needs to be considered in this FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 12 to 15). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

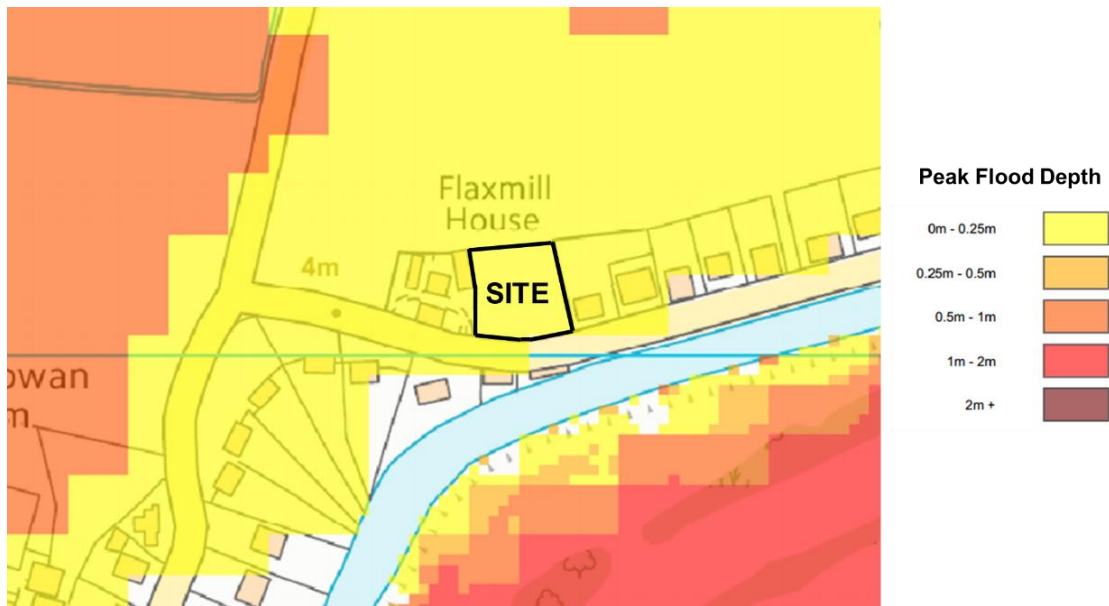
### **South East Lincs Advice Matrix**

Advice can be found on the recommended mitigation required by referring to a spreadsheet on the South East Lincolnshire website. There is no designated advice in the Matrix for this type of development in flood zones 1 and 2.

If the development were to be considered as in flood zone 3 and as the flood hazard is “danger for Some” (0.75 to 1.25) reference would be made to Category E8 which states for a predicted flood depth of between 0 and 250mm the finished ground floor level should be 300mm above ground level.

### **Summary of Risk of Flooding to the Site**

The updated SFRA indicates that the predicted depth of flood water would be 0 – 250mm depth at the development site in a 1 in 100 year event occurred in 2115. The map showing predicted flood depths in 2115 is shown on the next page.



The highest ground level on the site is 4.32m OD and it is recommended that the finished ground floor level of the proposed properties should be set at a level of 4.65m OD. This will raise the ground floor levels at least 330mm above ground levels and 150mm above the level of Reservoir Road. This will raise the finished ground floor levels above the predicted level of a 1 in 100 year event in 2115.

### **Conclusions**

The site is in flood zone 1.

The maps in the updated SFRA indicate a predicted flood depth of between 0 and 250mm in a 1 in 100 year fluvial or a 1 in 200 year tidal event in 2115.

There is adequate mitigation for the hazard from any possible overtopping or breaching of the north bank of the River Glen. The predicted level in a 1 in 100 year event in 2115 is unlikely to be reached as there are lengths of banks where the risk of breaching is considerably higher than the bank south of the development site.

There is adequate mitigation for the hazard from any possible high levels in the IDB drainage system.

Any flooding that does occur will happen very slowly and residents of the building will have adequate time to monitor the water levels in the River Glen and take appropriate action.

In a flood risk area there is always a risk of an event occurring of greater magnitude than has been considered in this flood risk assessment.

### **Recommendations**

In any area at risk of flooding, even though in this case the risk is extremely low, it is preferable that a proposed new buildings should be of two story construction with all bedrooms at first floor level. This will provide a refuge for residents if the building

becomes flooded after a major breach of the tidal bank, and ensure there is no danger to residents when they are asleep.

The ground floor level of the proposed buildings should be at least 4.65m OD, which is 150mm above Reservoir Road in front of the site.

Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service.

On site surface water drainage should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

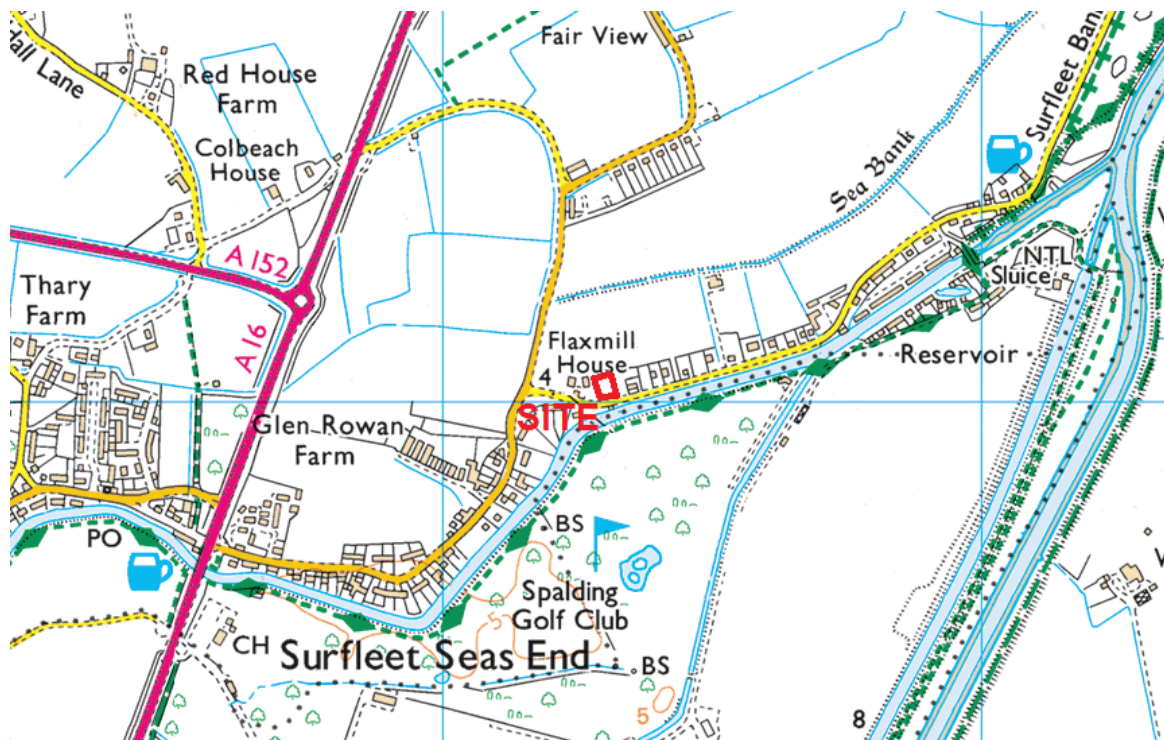
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[stuart.hemmings@btinternet.com](mailto:stuart.hemmings@btinternet.com)

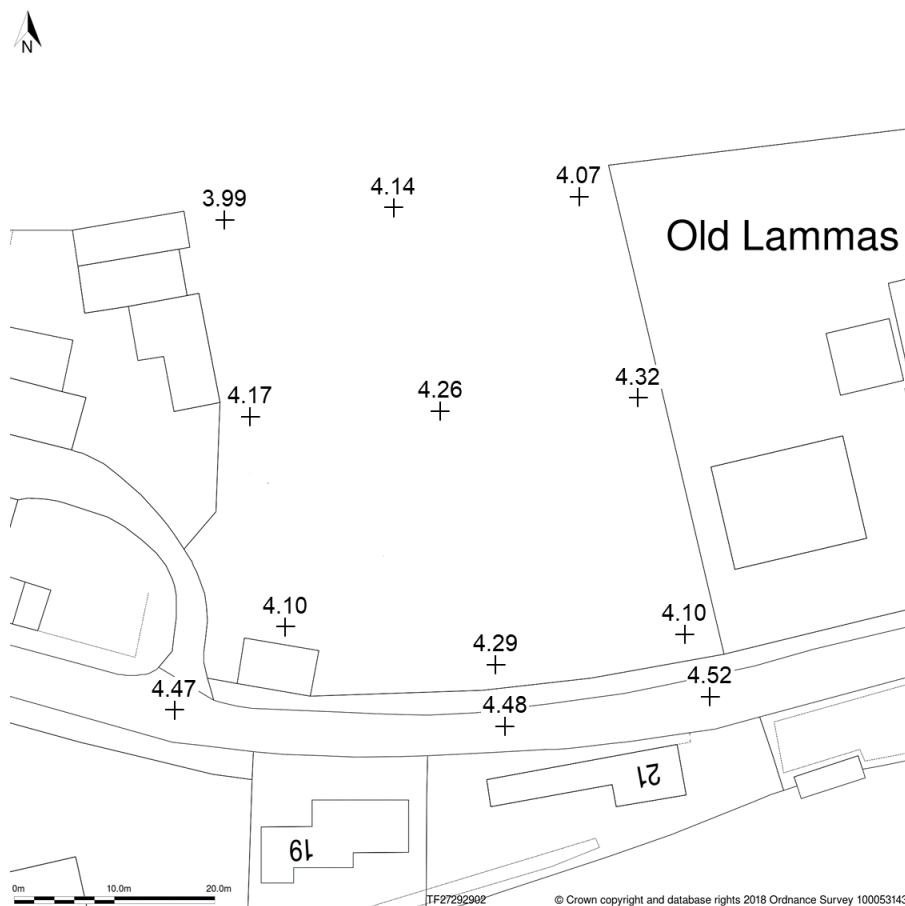
18<sup>th</sup> April 2019

**Revision A 12<sup>th</sup> February 2024 Maps updated as required**

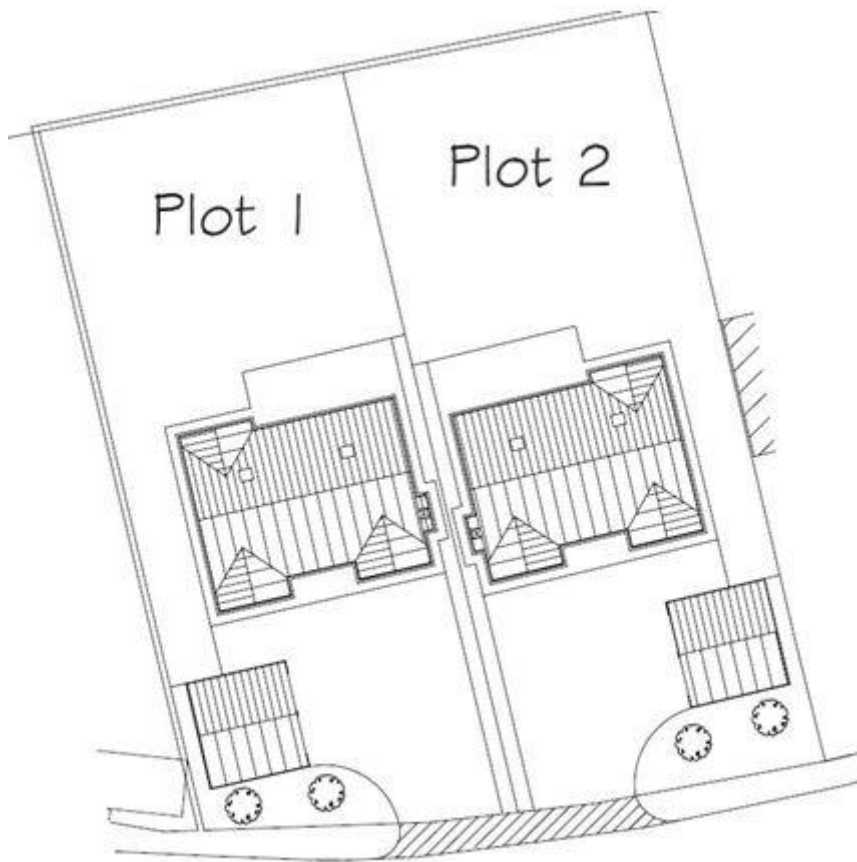
## LOCATION PLAN



## SITE PLAN AND LEVELS



**PLAN OF PROPOSED DEVELOPMENT**



Site Layout ( Not to scale )

## **APPENDIX A CLIMATE CHANGE**

The Environment Agency has issued revised guidance on climate change and have now stated that the new predictions should be considered and incorporated into all flood risk assessments produced after 19<sup>th</sup> February 2016.

Listed below are the climate change allowances in three documents:

- South Holland SFRA
- EA guidance (2013)
- Revised EA guidance

The recommendations in each document are shown below.

### **2010 South Holland DC SFRA**

The SHDC SFRA states that the the following allowances have been made for climate change:

#### **4.4 Climate Change**

Scenarios for the years 2055 and 2115 include for climate change contingency allowances to the amount suggested by PPS25<sup>1</sup>. These allowances are expressed in Table 2. Percentage increases are relative to the present-day.

Table 2 – Adopted Climate change contingency allowances

| Parameter                  | Year 2055 | Year 2115 |
|----------------------------|-----------|-----------|
| Sea level rise (m)         | + 0.33    | + 1.14    |
| Extreme wave height        | + 10%     | + 10%     |
| Peak river flow and volume | + 20%     | + 20%     |
| Peak rainfall intensity    | + 20%     | +30%      |

Where flows arise from pumping rather than natural run-off, notably in the Vernatt's Drain and for the Fenland subcatchments of the South Forty Foot Drain, peak flow rates for future eras have been taken as equal to current rates since this SFRA assumes all flood risk management measures will remain in their current state.

### **2013 Guidance to Planners**

Guidance to planners was issued by EA in September 2013

Table 1: Recommended contingency allowances for net sea level rises (Net sea level rise (mm per year) relative to 1990)

|                                                                                        | 1990 to 2025 | 2025 to 2055 | 2055 to 2085 | 2085 to 2115 |
|----------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|
| East of England, east midlands, London, south-east England (south of Flamborough Head) | 4.0          | 8.5          | 12.0         | 15.0         |
| South-west England                                                                     | 3.5          | 8.0          | 11.5         | 14.5         |
| North-west England, north-east England (north of Flamborough Head)                     | 2.5          | 7.0          | 10.0         | 13.0         |

**Table 2: Recommended national precautionary sensitivity ranges for peak rainfall intensity, peak river flow, offshore wind speed and wave height**

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

## **Revised 2016 EA Guidance**

**Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)**

| River basin district | Allowance category | Total potential change anticipated for '2020s' (2015 to 39) | Total potential change anticipated for '2050s' (2040 to 2069) | Total potential change anticipated for '2080s' (2070 to 2115) |
|----------------------|--------------------|-------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| Anglian              | Upper end          | 25%                                                         | 35%                                                           | 65%                                                           |
|                      | Higher central     | 15%                                                         | 20%                                                           | 35%                                                           |
|                      | Central            | 10%                                                         | 15%                                                           | 25%                                                           |

For more vulnerable development in flood zone 1 the central and higher central category should be used to assess the range of allowances.

**Table 2 peak rainfall intensity allowance in small and urban catchments (use 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%                                                 |

**Table 3 sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)**

| <a href="#">Area of England</a>         | 1990 to 2025 | 2026 to 2050   | 2051 to 2080 | 2081 to 2115 | Cumulative rise 1990 to 2115 / metres (m) |
|-----------------------------------------|--------------|----------------|--------------|--------------|-------------------------------------------|
| East, east midlands, London, south east | 4 (140 mm)   | 8.5 (212.5 mm) | 12 (360 mm)  | 15 (525 mm)  | 1.24 m                                    |

**Table 4 offshore wind speed and extreme wave height allowance (use 1990 baseline)**

| Applies around all the English coast | 1990 to 2050 | 2051 to 2115 |
|--------------------------------------|--------------|--------------|
| Offshore wind speed allowance        | +5%          | +10%         |
| Offshore wind speed sensitivity test | +10%         | +10%         |
| Extreme wave height allowance        | +5%          | +10%         |
| Extreme wave height sensitivity test | +10%         | +10%         |

### **Effects on Predictions of Flood Risk in FRA**

The FRA has identified the main source of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site is flooding from the tidal River Welland.

The contingency allowance in metres for the years 2055 and 2115 using 1990 as a baseline in the SFRA compared with the guidelines is as follows

| Year | SFRA | 2013 guidance | Revised 2016 guidance |
|------|------|---------------|-----------------------|
| 2055 | 0.33 | 0.395         | 0.412                 |
| 2115 | 1.14 | 1.205         | 1.24                  |

Therefore it can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. This will not have the effect of increasing the predicted flood level at the site in a 1 in 200 year breach event in 2115 by the maximum of 100mm, but it will probably be only between 10mm and 50mm. It is unlikely that this increase will significantly change the maps of flood risk at present issued by the Environment Agency.

### Fluvial River Flooding.

As the development is in flood zone 1 and is classed as more vulnerable, the advice from the Environment Agency is that the central climate change allowance, which is 25%, should be considered. After considering the effects of this increase the higher central allowance, which is 35%, should be considered to assess the effect of this.

Maximum flood levels in the River Glen will not be increased by the increase in flows projected in the new climate change allowances. If flows increase by 35% in these systems it will have the effect of flooding over the long sections of bank between Surfleet and Bourne and the maximum levels will not increase significantly.

### Flooding from IDB drainage system

As the development is in flood zone 1 and is classed as more vulnerable, the advice from the Environment Agency is that the central climate change allowance, which is 25%, should be considered. After considering the effects of this increase the higher central allowance, which is 35%, should be considered to assess the effect of this.

IDB's have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. Generally IDB's are happy that their systems provide a 1 in 100 year standard to most urban areas at the present time.

Welland and Deepings IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations, sluices and drainage channels. Pumping stations and sluices only have a 30 year life and will need to be refurbished or rebuilt within this timespan. It is assumed that Welland and Deepings IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that the Board continues to provide the same standard of service as the present day.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the floor levels should be a minimum level of 4.65m OD, is satisfactory.