# PROPOSED DEVELOPMENT AT 36 BROADGATE, WESTON, SPALDING, PE12 6HY

# FLOOD RISK ASSESSMENT

View from Road

S M Hemmings B Sc C Eng MICE MIWEM,
40 Celta Road,
Peterborough,
PE2 9JD

This flood risk assessment has been prepared solely to support the planning application for a development alongside Pinfold Lane, Weston. 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.

## Introduction

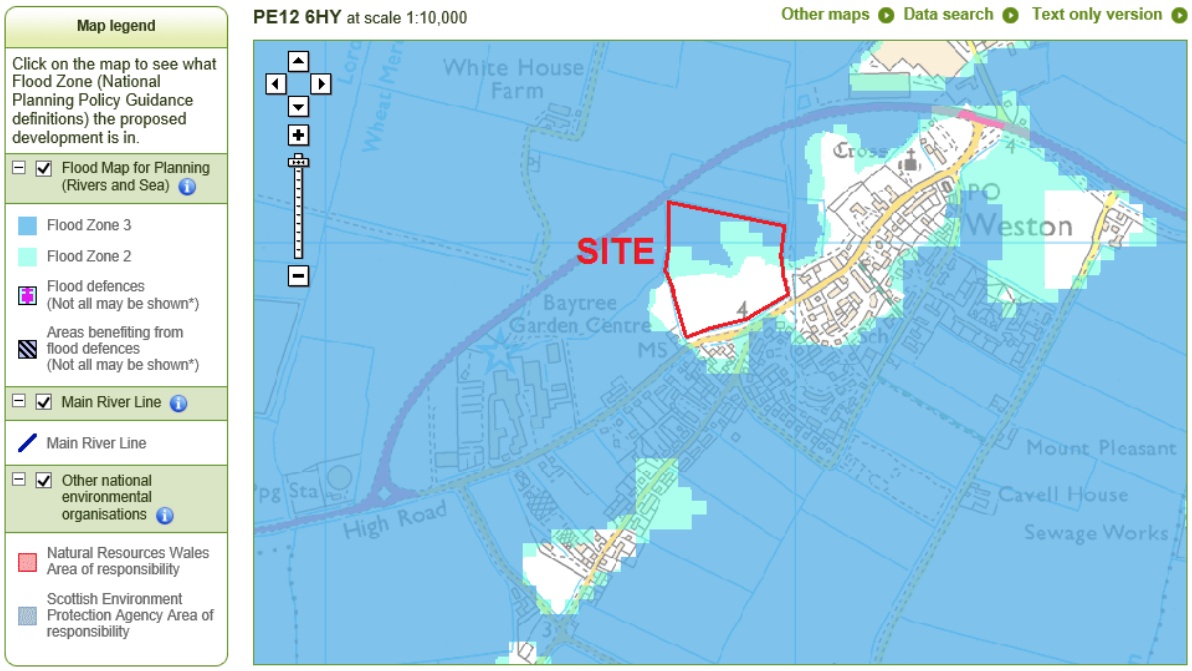
A development of 134 dwellings is proposed on a field north of the A151 and west of Pinfold lane at Weston, which is approximately 4km east of Spalding.

Half of the site is within Flood Zone 1, with parts of the other half in Flood Zones 2 and 3 as shown on the Environment Agency's Flood Zone map. The flood zone 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 Practice Guidance to the National Planning Policy Framework 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) map and is located in the South Holland 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 this area.




It can be seen that the southern part of the site is in Flood Zone 1, and the northern part is classed as Flood Zones 2 and 3.

## Application Site

The site is located 2.4 km from the tidal section of the River Welland. The National Grid Reference of the site is 528860 324960.

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

The proposed development is within Flood Zones 1,2 and 3(a) as detailed on the Environment Agency's flood zone maps without defences, as defined in Table 1 of the Technical Guidance.

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:

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

Therefore it can be seen that "More vulnerable" development is appropriate in Flood Zone 1 and 2, but the sequential and the exception test needs to be applied for the northern part of the development which is within Flood Zone 3.

## Sequential Test

As part of the proposed development is located in Flood Zone 3(a) the NPPF requires the sequential test to be applied to determine if there are any reasonably available and suitable alternative sites in a lower flood risk zone for this type of development.

The South Holland District Council Core Strategy states that there is a limited number of sites outside the town of Spalding available for residential development. Some greenfield land will need to be identified to enable the Council to meet the RSS and Structure Plan requirement for 2021. Therefore there is a requirement for further land to be brought forward and used for residential development.

With the above evidence it is considered that the proposed site passes the Sequential Test as there are no other sites in this area in Flood Zones 1 and 2 and with a lower flood risk.

## Exception Test

The Sequential Test has demonstrated that it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower

probability of flooding. Therefore the Exception Test must be applied and for this to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risks, informed by the Strategic Flood Risk Assessment; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking into account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible will reduce flood risk overall.

Both parts of this test must be satisfied in order for the development to be considered appropriate in terms of flood risk. There must be robust evidence in support of every part of the test.

The first section will be demonstrated by the Supporting Planning Statement and compliance with South Holland District Council's planning policies.

This flood risk assessment will demonstrate that the development will be safe for its lifetime and it will not increase flood risk elsewhere.

**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 .. zero |
| | Velocity … Nil |
| For year 2115 | Depth of flooding … 0 – 500mm over most of the site with lower areas 500mm – 1.0m |
| | Extent of flooding .. High for all of site |
| | Peak Velocity .. 0 – 0.1m/sec for all of site |

- The maps also illustrate the residual flood hazard which is as follows:-

| | |
|---|---|
| For the present day | Depth of flooding …zero over most of the site but 0 - 500mm for north west corner. |
| | Extent of flooding .. Low or medium flood probability |
| | Peak Velocity .. zero |
| For the year 2115 | Depth of flooding … 0 – 500mm in southern half of the site |

and northern areas 500mm – 1.0m

Extent of flooding .. High for all of site

Peak Velocity .. 0 – 0.1m/sec for all of site

Figure 16 of the general maps show that the site is not within the rapid inundation zone.

Tables in the SFRA show the following details of the defence bank on the east side of the tidal section of the River Welland north of the A16 road bridge, between chainage 19.8km and 20.8km.

| | 2007 | 2055 | 2115 |
|---|---|---|---|
| Peak 1 in 200 year extreme tide level | 5.98m OD | 6.31m OD | 7.12m OD |
| Peak 1 in 1,000 year extreme tide level | 6.27m OD | 6.60m OD | 7.41m OD |

With an average defence crest level between 7.80 and 7.90 m OD the freeboards are as follows:

| | 2007 | 2055 | 2115 |
|---|---|---|---|
| Peak 1 in 200 year freeboard | 1870mm | 1540mm | 730mm |
| Peak 1 in 1,000 year freeboard | 1580mm | 1250mm | 440mm |

Tables in the SFRA show the following details for the defence bank on the east side of the Coronation Channel between chainage 0 km and 2.0 km.

| | 2007 | 2115 |
|---|---|---|
| Peak 1 in 100 year extreme tide level | 4.32m OD | 4.69m OD |
| Peak 1 in 1,000 year extreme tide level | 4.34m OD | 4.69m OD |

The bank levels on this section vary between 5.35m OD and 6.0m OD. Therefore it can be seen there is a minimum freeboard of 650mm to the predicted design maximum levels in 2115.

**Existing Flood Alleviation Measures**

The site is within a defended flood plain, as defined in Appendix 1 of the Environment Agency's "Policy and Practice for the Protection of Flood Plains", which is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding occurring due to overtopping or failures of the defences is considered to be very low.

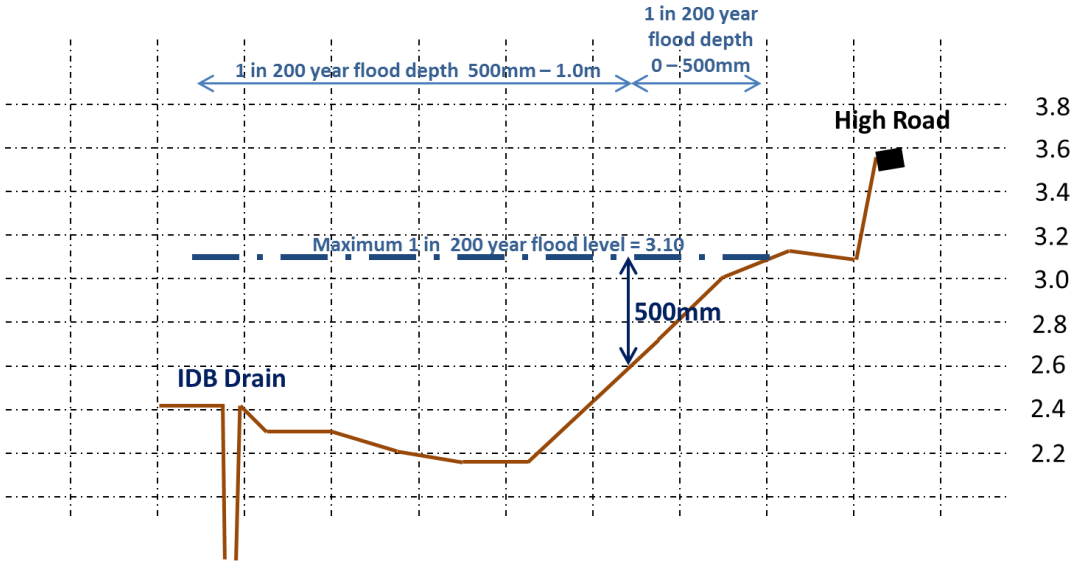
The site is located approximately 2.4 km from the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located approximately 2.8 km from the Coronation Channel which is maintained by the Environment Agency.

There are watercourses in the area that are maintained by South Holland IDB. The watercourse on the northern boundary of the site is a Board's drain.

## Existing Ground Levels

The existing ground levels on the site are shown on page 11 of this report. A width of approximately 60 metres on the southern side of the field adjacent to High Road is at a level of between 3.00 and 3.10m OD. Further north the levels fall gradually and the lowest part of the field, approximately 100 metres south of the IDB drain on the northern boundary is at a level of 2.16m OD. The level of the water in the IDB drain on 12th January was approximately 0.8m OD. A cross section north to south across the field is shown below. Interpolating these levels with the plan in the SFRA showing predicted residual flood depths in 2115 a maximum flood level of 3.10m OD can be worked out.




## Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Welland
2. Overtopping or breach in the Coronation Channel
3. Failure of Lords Pumping Station and Sluice (IDB)
4. Blockages in IDB drains or culverts
5. Blockages or problems in local surface water systems
6. Surface Water Flooding

1. **Failure or overtopping of tidal defences**

As shown above, the east bank of the River Welland, which is approximately 2.4 km from the site, has at least a 1 in 200 year standard of protection. If the eastern bank of the tidal section of the River Welland breached then the maps in the SFRA indicate flood depths of up to 1.0 metre could occur at this site in a 1 in 200 year return period event in 2115.

2. **Overtopping of Breach in the Coronation Channel**

The SFRA states that the maximum design water level in the Coronation Channel is 4.69m OD. The minimum crest level of the east bank of the Channel is 5.14m OD, which gives a minimum freeboard of 450mm. However, generally there is a freeboard of 600 mm along this bank of the Channel.

If the Channel were to breach water would flow eastwards towards the site. However, it would be retained for a short time by the A16 which is higher than the surrounding land. The SFRA indicates that with a serious breach water would not reach the site in a 1 in 100 year event.

With the site being at least 2.8 km from the Coronation Channel the maximum level of flood water from this source will be lower than the flood level if the tidal Welland breached.

3. **Failure of Lords Pumping Station or Sluice**

The water level in the internal dykes and drains in this area is controlled by Lords Pumping Station which is 6 km north of the development site. This is operated and maintained in excellent condition by South Holland IDB and there the likelihood of flooding due to this source is low. 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.

4. **Blockages in IDB drains and culverts**

The watercourse on the northern boundary of the site is a watercourse maintained by South Holland IDB. All drains maintained by the South Holland IDB have a regular maintenance programme. The normal water level in the drain is 0.8m OD, 1.4 metres below the lowest level of the site. South Holland IDB have advised that water levels in this drain can be much higher in a period of heavy rainfall. The Board have carried out computer modelling in this catchment and advise that the maximum predicted level in a 1 in 10 year event would be 1.75m OD and in a 1 in 100 year event this would be 2.10m OD. If climate change were taken into account by increasing flows by 30% then it is likely that water levels would be higher and water would flood onto the field. However even in this scenario or if a large blockage occurred in some part of the

drainage system the water level is unlikely to reach the proposed ground floor level of the houses which are recommended to be raised to 3.2m OD. Therefore the risk of flooding to the houses from this source is extremely low, and can be almost discounted.

South Holland IDB have advised that the Bye laws apply to the IDB drain on the northern boundary of the site. Byelaw No 10 states that no buildings or any other structures such as hedges, trees or fences shall be placed within 9.0 metres of the brink of the drain. However the Board may consider the relaxation of Byelaw 10 on the proviso that a dedicated fenced off 6 metre wide access strip is transferred over to the Board at the cost of the developer. This would be subject to a formal application being submitted to the Board and the transfer being completed before construction works begin.

5. **Blockages or problems in local surface water systems.**

There is a possibility that the surface water systems that drain High Road could cease to work satisfactorily and the road could become flooded. However it is extremely unlikely that the depth of flooding from this source would approach 300mm in depth and affect the proposed buildings in the developemnt and therefore the risk of flooding from this source can be considered extremely low.

6. **Surface Water Flooding**

There is a risk of surface water that has been discharged from roofs, roads or hardstandings on the site accumulating and flooding some of the dwellings on the site.

The risk from this source will be mitigated by carrying out the following measures:

a) Buildings will be raised at least 300mm above the level of the site roads.

b) A suitable surface water and foul water system will be implemented.

A substantial part of the site will need to be raised above the existing ground level to comply with the flood risk to the site. It is assumed the houses will be constructed with normal strip foundations and ground floors will be elevated by using precast concrete beam and block type floors.

The principle of SuD's design which are set out in the SuD's manual (CIRIA report C753) will be followed in the design of the surface water disposal system for the site.

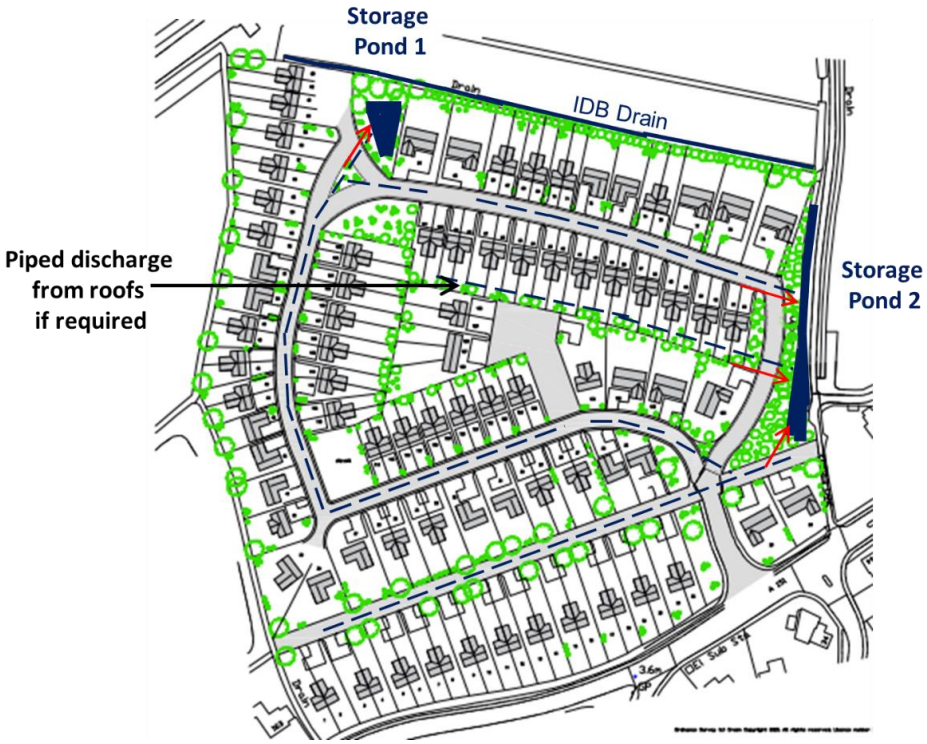
Surface Water Disposal.

At present the field has no underdrains and therefore ground water levels are controlled by sub terrain movement of water into the IDB drain on the northern boundary of the site and dykes on either side of the site. The ground conditions of the site are generally silty, which should provide acceptable percolation rates for soakaways to work satisfactorily. However the northern half of the site does have more of a clay content on the surface than the south side of the site.

It is recommended the rainwater from the roofs of the buildings should be discharged into individual soakaways in each plot. These will be designed to accommodate a 1 in 100 year rainfall with a 30% allowance above this for climate change. Percolation tests should be carried out at a number of locations to establish the percolation rate to be used. The soakaways will either be constructed with traditional gravel infill or modular plastic units (Polystorm plastic crates). There may be difficulties in constructing suitable soakaways where the ground levels are low and the site has to be built up. In the lowest area the rainwater from the roofs may need to be discharged into a drainage system which would discharge into a storage lagoon or a storage facility constructed with modular plastic units (eg Polystorm crates) which could be located either on the east or the north side of the development.

The site access roads should be constructed using permeable materials, which would be either blockwork laid on a gravel base, or a suitable permeable tarmac, both of which should have a gravel base which would store excess rainwater. This could be either a full infiltration system or a partial infiltration system. With a full infiltration system the rainwater that falls on the road would be stored in the gravel base of the road and would gradually soak away. The volume of voids in the base would need to be sufficient to store the rainwater which would then soakaway into the subsoil. A partial infiltration system would again store the rainwater in the sub base and some would soakaway into the subsoil. However a piped system would be placed in the base of the road to convey excess rainwater to a storage facility. Both systems would be designed to accommodate a 1 in 100 rainfall event with a 30% allowance for climate change.

The plan shown below gives an example of how a system with a partial infiltration system for roads could be planned.



There are two suggested storage ponds which take the flows from the road. There is also the possibility of discharging roof water from the houses in the lowest area if this is required. Both pond would discharge at a low rate through a flow limiter into the IDB drain if necessary. If open ponds were not acceptable storage could be provided with modular plastic units (eg Polystorm crates).

Hardstandings on the plots should be designed to be a full infiltration system overflowing if necessary onto gardens alongside.

Foul Water Disposal.

It is recommended that a foul water drainage system should be constructed under the new roadways on the development so that the foul water from the dwellings can be discharged into the foul water sewer under High Road, subject to the agreement of Anglian Water.

## Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties being flooded.

## Probabilities and Trends of Flooding

The probability of this development flooding from Environment Agency main river is very low. In an extreme event 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 a breach or overtopping of the tidal defences

The risk of this happening in this case is low and the hazard from any flooding is also low.

## Conclusions

It is assumed that the predicted depths of residual flooding would be the consequence of a breach in the tidal defences either of the River Welland or the Wash. The maps predict that flood depths across the south part of the site would be 0 – 500mm and the northern part 500mm to 1.0 metre. The graph on page 6 has been used to calculate the predicted maximum flood level of 3.10m OD on the site. Therefore it is recommended that floor levels on the site should be raised to a level of 3.20m OD to prevent any flooding in the scenario where a bank breached during a 1 in 200 year tidal event in 2115.

The risk of flood water reaching the site if a breach occurred in the east bank of the Coronation Channel is extremely low, and the residual flood depth maps for 2115 in

the SFRA show that there is no predicted flooding to the site in a 1 in 100 year fluvial event.

The risk of flooding from IDB drains can be considered low. If the pumping stations were to fail then the IDB have adequate arrangements to operate pumps with alternative motive power, or to bring in mobile pumps. South Holland IDB have advised that the 1 in 100 year predicted level in the drain on the northern boundary would be 2.10m OD. It can be assumed that the IDB will continue to monitor predicted water levels in the drain and carry out improvements to the system over the next 100 years to retain the present standard.

The proposed development is not in a functional flood plain as defined by PPS 25.

Although the site is in flood zone 3, the actual risk of the site flooding from any Environment Agency or IDB watercourse is very low.

If any flooding that did occur it would happen very slowly and residents would have adequate time to prepare themselves for the event.

**Recommendations**

In an area where there is a flood risk, however small, it would be preferable that all the new dwellings should be two story houses designed with all sleeping accommodation located on the first floor.

The ground floor level of the proposed buildings should be at a minimum level of 3.20m OD.

All future occupiers of the properties should register with the Environment Agency's Floodline Warnings Direct Service.

A suitable surface water disposal system using SuD's should be designed for the site. Percolation tests should be carried out as set out in BRE Digest 365 to enable the soakaways for the roads and houses to be designed.

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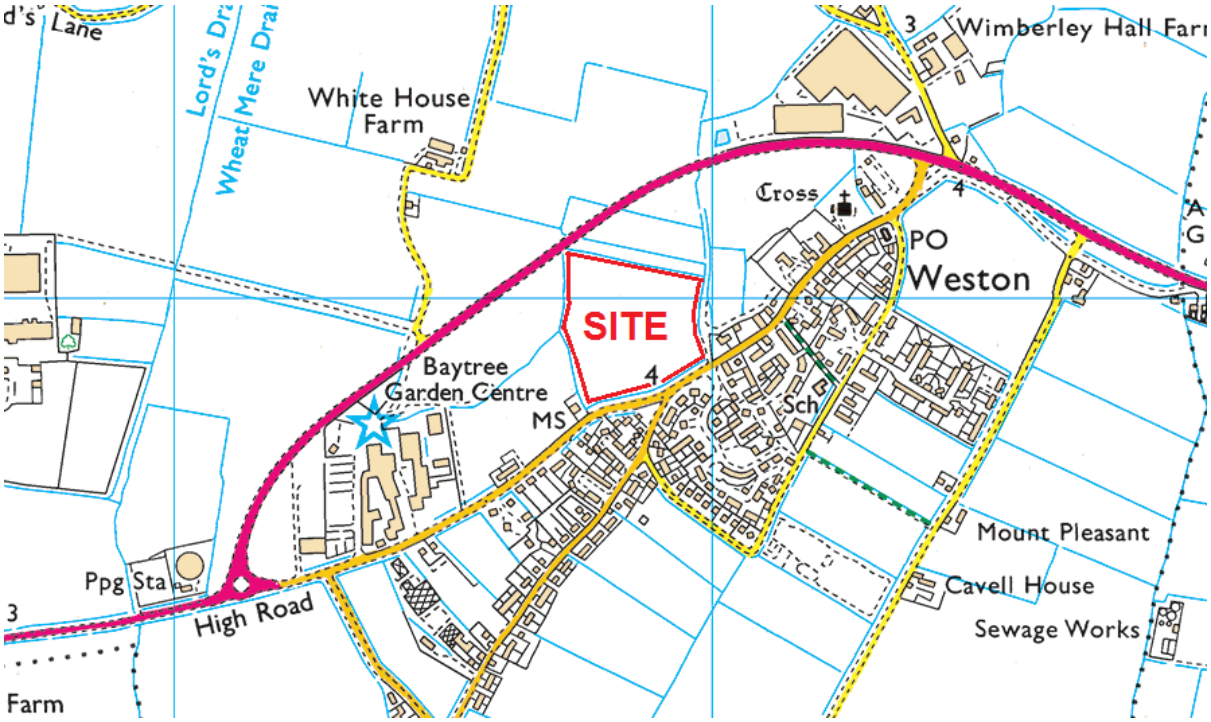
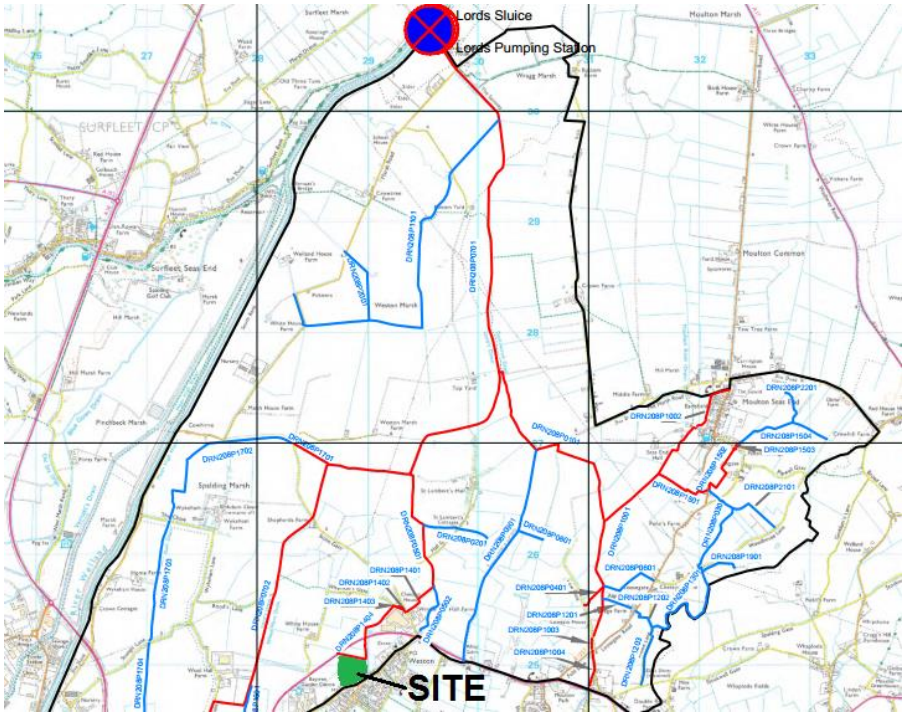
26th January 2016

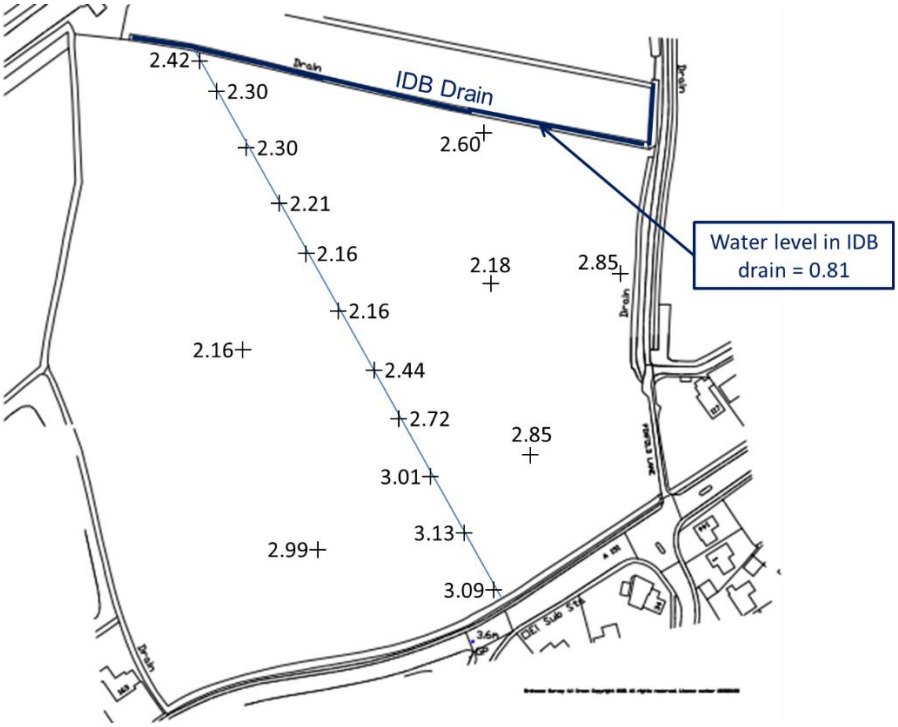
## LOCATION PLAN




## PLAN OF IDB DRAINS



## PLAN SHOWING SITE LEVELS




## PROPOSED PLAN OF DEVELOPMENT