PROPOSED DEVELOPMENT OF TWO DETACHED HOUSES BEHIND 156 BARRIER BANK, COWBIT, SPALDING PE12 6AL

FLOOD RISK ASSESSMENT



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This flood risk assessment and surface water plan has been prepared solely to support the planning application for the proposed development at Barrier Bank, Cowbit. 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

An application is due to be submitted to South Holland District Council for planning permission to construct two detached houses to the rear of the existing house at 156 Barrier Bank, Cowbit, Spalding PE12 6AL. The site is at present the rear garden of the existing house.

The site is within Flood Zone 3 as shown on the Environment Agency's 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.

The site is shown within the defended area of the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the South Holland Internal Drainage Board district.

Application Site

The development is located on the western edge of Cowbit alongside the Barrier Bank. The National Grid Reference of the site is 526240 317710.

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

The proposed development is within Flood Zone 3(a) "High Probability" 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, the development is classified as "more vulnerable" in Table 3 of the Guidance, which states that residential use is only permitted after the sequential and exception test is followed.

Sequential Test

As 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. This development can be classed as a windfall site within the village of Cowbit. All of the village of Cowbit and the surrounding area is within flood zone 3. The development complies with the South Holland District Council's policy on these types of sites.

There is a need for additional housing units in the Cowbit area and this location does not have a higher flood risk than other sites in the village. Therefore it can be concluded that the sequential test is passed.

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

The following information about the flood risk at the location of the proposed development has been gained from the maps produced for the South Holland District Council Strategic Flood Risk Assessment:

1. **Report Maps**

- Map 5 indicates the site to be low or medium risk and protected by flood defences.
- Map 6 indicates the peak depth is zero for the present day 1% / 0.5% tidal event probability.
- Map 7 indicates the peak velocity is zero for the present day 1% fluvial / 0.5% tidal event probability.
- Map 12 indicates the actual risk extent for the year 2055 for the 1% fluvial / 0.5% tidal event probability is low or medium, and protected by flood defences.
- Map 13 indicates the actual risk extent site for the year 2115 for the 1% fluvial / 0.5% tidal event probability is low or medium, and protected by flood defences.
- Map 16 indicates the site is not within the rapid inundation zone.

2. **Flood Maps Table D1**

- 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 … zero
	Extent of flooding …low or medium
	Velocity ... Nil

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

For the present day	Depth of flooding ...zero
	Extent of flooding .. low or medium
	Velocity .. Nil
For the year 2115	Depth of flooding ...0 – 500mm
	Extent of flooding .. high
	Velocity .. 0 – 0.1m/sec

(above figures on eastern edge of the site only, for most of site the figures are zero)

3. Maximum flood levels:

Maximum fluvial flood levels in the River Welland at Crowland at chainages between 3km and 4km are shown in the reports as follows:

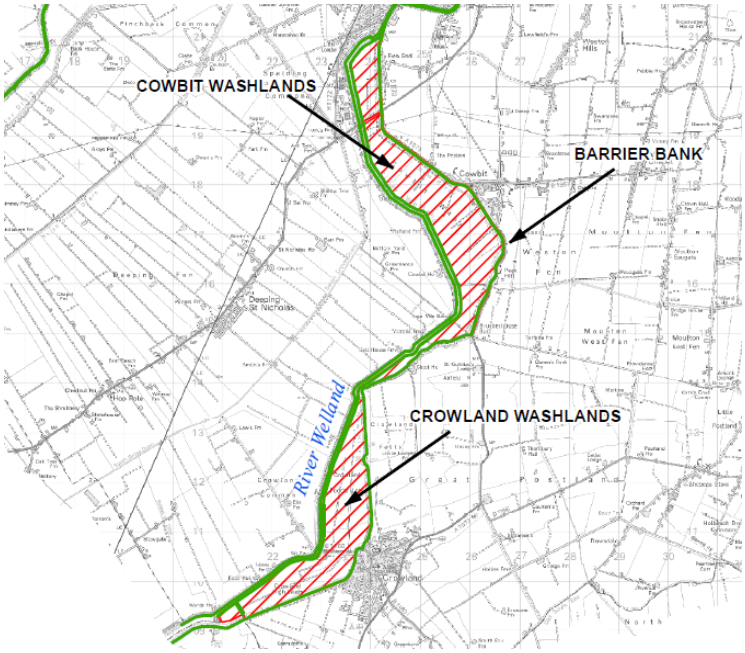
	Present	Present + Climate Change
1 in 100 year	4.53	4.67
1 in 1,000 year	4.54	4.67

The lowest level of the Barrier Bank of the River Welland stated in the SFRA is between 5.77m OD and 6.05m OD between chainages 3.0km and 4.0km.

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" and is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding due to overtopping or failures of the defences is considered to be very low.

The section of the River Welland from south of Crowland to the southern outskirts of Spalding has two washlands located on the east side of the River, called Crowland Washlands and Cowbit Washlands. These areas are designed to alleviate very high flows in the River Welland. When the water level in the River Welland reaches a level of approximately 5.10m OD large syphons are activated which discharge excess water onto the Washes. The Barrier Bank is located on the east side of the Washes to contain the water in the Washlands and is the main flood defence bank on the east side of the river.

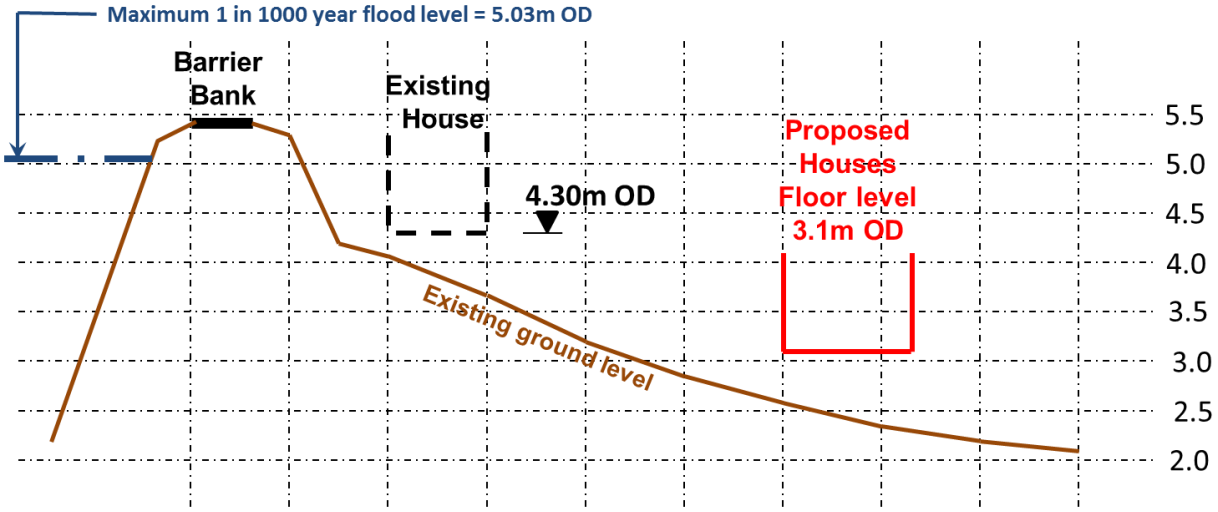


The site of the proposed houses is adjacent to Barrier Bank, approximately 60 metres from the top of the bank.

Existing Ground Levels

The site is located east of the Barrier Bank and slopes from a level of 4.20m OD in the driveway in front of the existing house to a level of 2.09m OD on the eastern boundary of the site, which is approximately 90 metres from the centre of the road (Barrier Bank). The existing house has a ground floor level of approximately 4.30m OD and the proposed ground floor level of the new houses is 3.10m OD.

A section west to east across the site is shown below.



Potential Sources of Flooding

The following sources of flooding have been identified:

1. Failure or overtopping of the Barrier Bank (River Welland)
2. Failure or overtopping of Coronation Channel
3. Failure or overtopping of tidal section of the River Welland
4. Flooding from IDB Drain

1. Failure or Overtopping of the Barrier Bank.

The Barrier bank is the eastern bank of the Cowbit Washes. The Washes are only flooded in extreme conditions (around 1 in 50 years) and are used the rest of the time as agricultural land. There are two syphons which operate automatically to allow water to flood on to the Washes and alleviate high water levels in the River Welland. When this occurs the level of water in the washes will quickly rise to around 5.00m OD.

As the road level is 5.42m OD at this location any possibility of overtopping at this location can be discounted. There is a remote possibility that a breach could develop in the bank alongside the village, but a breach is more likely to occur north or south of the village where the back slope of the bank has a much steeper gradient and therefore the bank is more not as stable as the bank alongside the village.

At the development site the land levels fall slowly eastwards, as shown on the section on page 5. If a breach were to occur it would probably form with a base level of 4.20m OD. Therefore in Appendix 1 (pages 12 and 13) there are predictions of the hazard and water depths that could occur at the development site if a breach as described above occurred. These indicate the hazard is mainly in the “Danger for Some” category with flood depths probably between 400mm and 500mm. However these predictions can be considered to be in excess of the true hazard because a breach would result in a rapid reduction in the levels in the River Welland which would reduce the computed flow through the breach.

Therefore taking a precautionary approach it is recommended that the ground floor level of the proposed houses should be a minimum of 500mm above the average ground level in the area.

2. Flooding from Coronation Channel

The SFRA states that the maximum design level in the Coronation Channel is 4.69m OD. The minimum crest level of the south bank of the Channel on is 5.70m OD, which gives a minimum freeboard of 1.0 m. The Coronation Channel is 3.8 km north of the development site.

If the Channel were to breach water would flow southward towards the site. However, it would be retained for a short time by the A16 which is higher than the surrounding land. The extent of the residual flooding of 0 – 500mm predicted in the

SFRA at the eastern boundary of the site in a 1 in 200 year event could be from this source. However the flooding would be less severe than the predictions from a breach of the Barrier Bank and therefore as the proposed level of the ground floor of the building is 1000mm above the ground level on the eastern boundary of the site the risk of flooding to the house in a 1 in 100 year event from this source can be discounted.

3. Flooding from Tidal Section of River Welland

The tidal section of the River Welland starts north of the sluices near the confluence of the Coronation Channel and the River Welland on the northern side of Spalding, which is approximately 7.5km north of the development site. Flood water would tend to flow eastwards towards Weston rather than southwards towards Cowbit.

The SFRA states that flooding in a 1 in 200 year residual event could extend to the eastern boundary of the site and this could be the result of a failure of the tidal banks.

The raising of the floor levels by approximately 1000mm above ground level at the eastern boundary of the site should mean that the risk of flooding in a 1 in 200 year event in 2115 from this source can be discounted.

4. Flooding from IDB Drain

South Holland IDB maintain drainage channels in this area. There are two watercourses, Mill Dyke (B21) and Backgate Dyke (B37) which flow eastwards from the central area of Cowbit. These flow into Wheatmere Drain (B35) which flows southwards into the South Holland Main Drain (B30). The water level in the South Holland Main Drain is controlled by Wisemans Pumping Station.

IDB drains were designed to provide at least a 1 in 10 year standard of service with a freeboard of at least 900mm. This normally provides at least a 1 in 50 year standard of service against overtopping and in many cases a 1 in 100 year standard at the present time.

South Holland IDB have a policy of monitoring standards of protection in all their catchments and will carry out improvements to pumping stations, sluices and drainage channels to ensure they do not fall due to higher run-offs predicted with climate change.

It is unlikely that any failure of assets such as pumping stations, sluices or drainage channels would lead to overtopping of the watercourse because South Holland IDB have an excellent maintenance regime and monitor all assets with a modern telemetry system.

As the floor level of the proposed house is at least 1000mm above the average ground levels in Cowbit east of the site the risk of flooding from this source can be discounted.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties having been flooded in the last 50 years. The last time that a breach occurred in the River Welland was 1947, and since that date considerable investment has been made to raise banks and provide a banks which are above the 1 in 100 year flood level.

Probabilities and Trends of Flooding

The probability of this site 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

There is a residual flood risk to the site if the Barrier Bank immediately west of the site breached when the Cowbit Washland is full. If the bank breached more than 100 metres north or south of the site then the proposed development would not be affected.

Conclusions

The following conclusions can be made:

- The proposed development is not in a functional flood plain as defined by the Guidance.
- Although the site is in flood zone 3, the actual risk of the site flooding from any Environment Agency water course is very low.
- The SFRA states for the 1.0% fluvial and 0.5% tidal event there is no actual risk of flooding at the present time or in 2115.
- The SFRA states for the 1.0% fluvial and 0.5% tidal event there is no residual risk of flooding at the present time. In 2115 the maps indicate that some flooding could occur on the eastern boundary, and it is assumed that the maximum level of flooding would be 2.25m OD, below the proposed ground floor level of both of the new properties.
- The possible depths of flood water if a breach occurs in the Barrier Bank immediately west of the site after the Cowbit Washes have been flooded has been considered. The risk of a breach developing at this location are extremely low, and must be less than 1 in 5000 years. The section of the site on page 5 shows only the top section is likely to breach.
- The possible outcome if a breach occurs in this bank immediately west of the site is considered in Appendix 1, and a precautionary approach of raising the

ground floor levels of both houses by 500mm above ground level is recommended.

- If a breach occurred in any part of the Barrier Bank more than 100 metres from the site then there would be no flooding to the proposed houses because the ground floor levels are at least 1000mm above ground levels in Cowbit east of the site.
- 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.

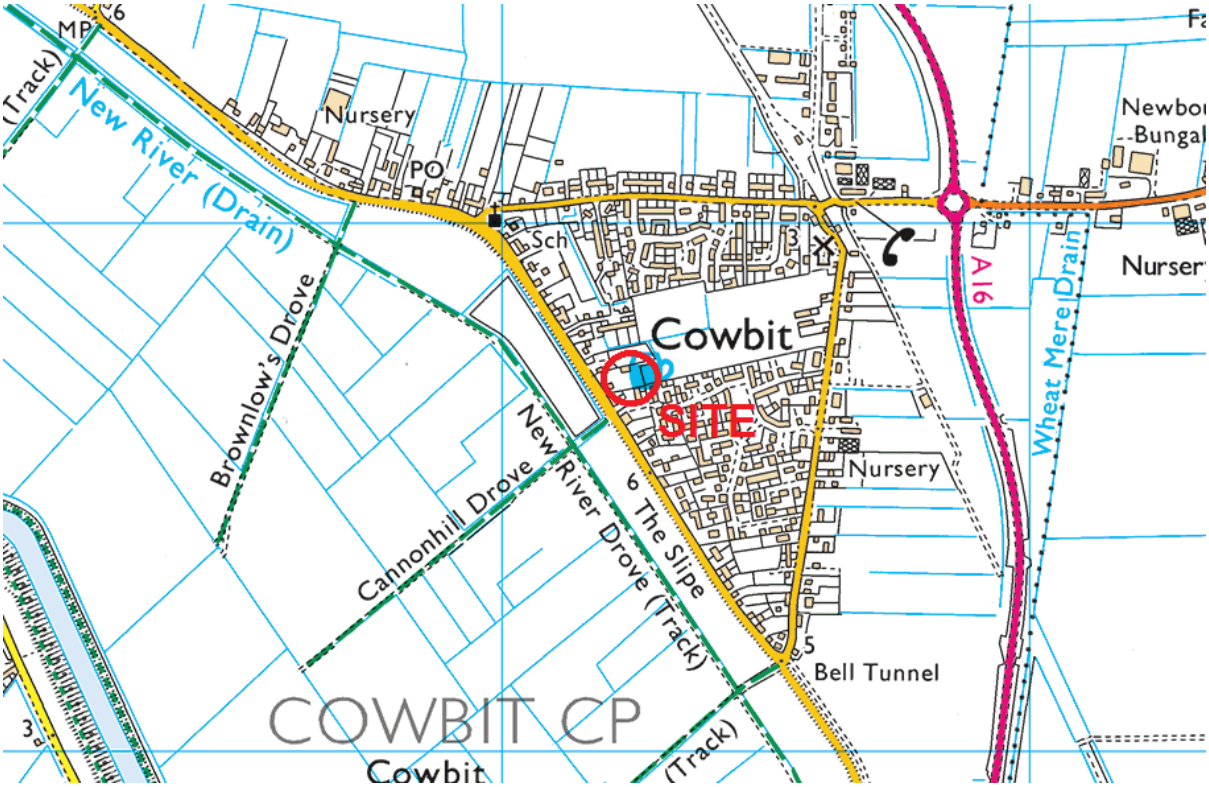
Recommendations

- In any area at risk of flooding it is preferable that any new dwelling should be of two story construction with all bedrooms at first floor level. This is to provide a refuge for residents if the building becomes flooded after a major breach of the tidal or fluvial bank, and ensure there is no danger to residents when they are asleep
- The ground floor level of the proposed houses should be approximately 500mm above existing ground level at a level of 3.10m OD and all bedrooms should be at first floor level.
- Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service.
- If occupiers of the building are warned of possible very high levels in the fluvial River Welland they should monitor the situation and if necessary be prepared to evacuate the area during the period when the Washes are at the maximum level.
- On site surface water drainage should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.
- All future owners and occupiers of the building should be given a copy of the Flood Risk Assessment so that they are fully aware of the risk of flooding in this area.

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26th October 2015

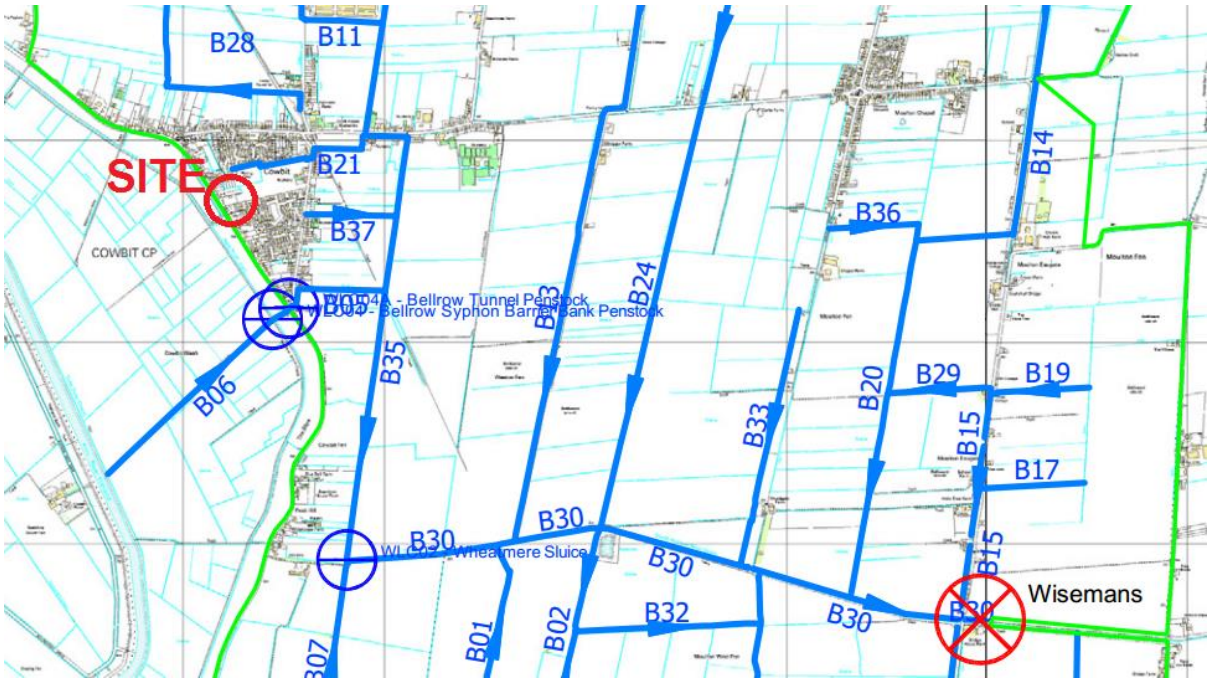
LOCATION PLAN



PLAN OF PROPOSED SITE



PLAN OF SOUTH HOLLAND IDB WATERCOURSES



APPENDIX 1

BREACH CALCULATIONS FOR BARRIER BANK

This calculation will work out an assumed volume that will flow through a 20 metre wide breach of the Barrier Bank when the water level in the flood storage area is the maximum 1 in 100 year level in 2115.

A calculation of this volume will then be carried out 60 metres from the bank to work out probable water depths, velocities and hazard rating for the proposed houses.

Maximum level of the River Welland = 5.03m OD

Assume breach willonly develop down to a level of 4.20m OD.

Width of breach = 20 metres

Assume the breach is a broad crested Weir

Maximum Volume through Breach = $1.7 \times b \times H^{3/2}$

$= 1.7 \times 20 \times 0.83^{3/2}$

= 25.7 cumecs

Velocity of water through breach = 25.7/(20 x 0.83) = 1.55m/sec

Assume that water will flow away from the breach and spread at a 45 degree angle.

Width of flow at first house = 140 metres

Therefore if we assume the same volume (25.7 cumecs) is flowing through line 60 metres from the breach the we can work out flood depths for different chosen velocities.

For example choose velocity of 0.2 m/sec, therefore area of flow = 128.5 sm

Therefore flood depth = 128.5/140 = 0.918 metres

This can be repeated for different velocities and the hazard rating worked out for each case, using the formula

Hazard Rating = (depth of flooding x (velocity + 0.5)) + Debris factor

The debris factor will be taken as 0.5.

Velocity	Area	Flood depth	Hazard Rating	Hazard
0.2	128.5	918mm	(0.918 x 0.7) + 0.5 = 1.11	Danger for some
0.3	85.7	612mm	(0.612 x 0.8) + 0.5 = 0.97	Danger for some
0.4	64.25	459mm	(0.459 x 0.9) + 0.5 = 0.89	Danger for some

0.5	51.4	367mm	(0.367 x 1.0) + 0.5 = 0.851	Danger for some
0.6	42.8	306mm	(0.306 x 1.1) + 0.5 = 0.89	Danger for some
0.7	36.7	262mm	(0.262 x 1.2) + 0.5 = 0.81	Danger for some

The hazard has been worked out following the guidance shown in the Supplementary Note to FD2320 and FD2321 on Flood Hazard Ratings and Thresholds for Development Planning.

There is some discussion in the supplementary note about what value should be taken for the debris factor. One table suggests that for arable land the factor should be zero. However the final table suggests the use of a factor of 0.5. If a factor of zero were to be used it would reduce the hazard rating to below 0.75 in every case and the hazard to “Very low hazard - Caution”.

Therefore it is estimated that the deepest flooding that would occur on the site would be between 400mm and 500mm in depth.