PROPOSED REPLACEMENT DWELLING ON THE SITE OF BRIDGE HOUSE, NORTHGATE, PINCHBECK, SPALDING, PE11 3SE

FLOOD RISK ASSESSMENT

View looking south at existing house

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13 Lea Gardens

Peterborough

PE3 6BY

This flood risk assessment has been prepared solely to support the planning application for a development at Bridge House, Northgate, Pinchbeck, 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 purposes other than for which it was originally commissioned.

Introduction

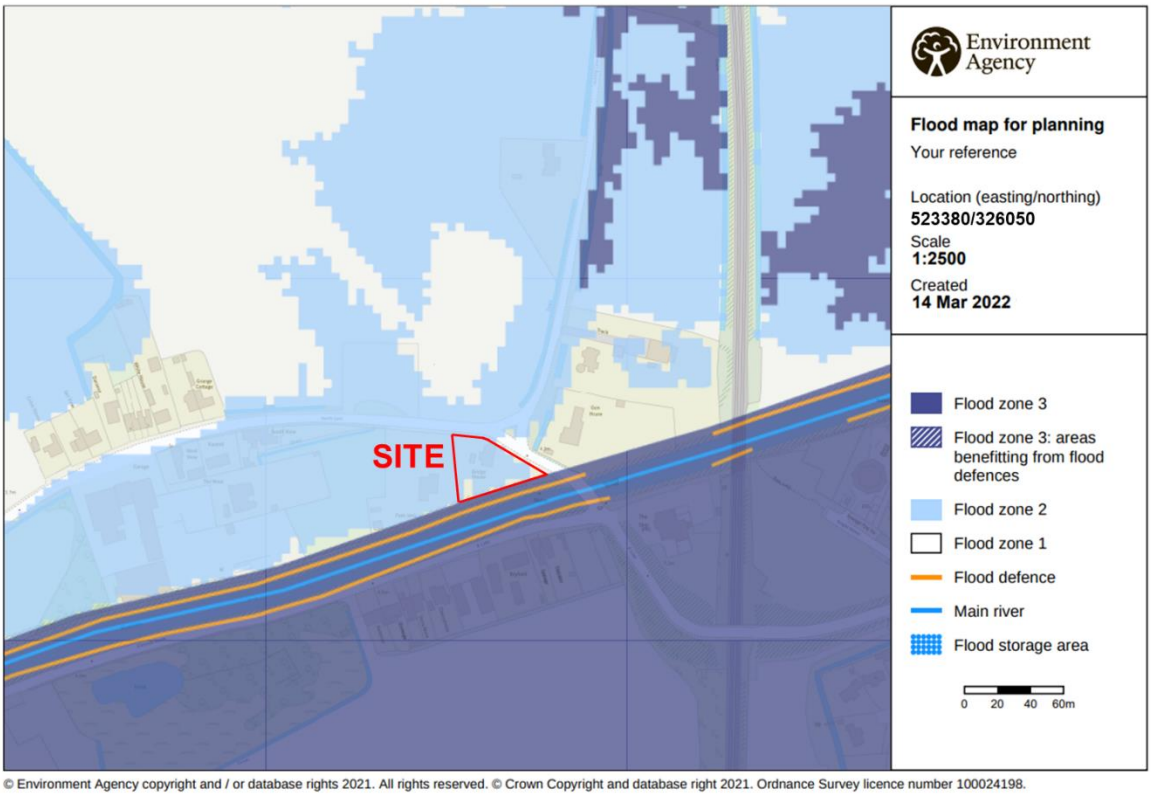
A planning application is due to be submitted to South Holland District Council to demolish the existing house called Bridge House at Northgate, Pinchbeck, Spalding, PE11 3SE and construct a new dwelling on the site. The site is situated on the western side of the village of Pinchbeck and is located directly north of the north bank of the River Glen.

The site is mostly within Flood Zone 2 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 specified 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 Black Sluice 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.



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It can be seen that approximately 95% of the site is in flood zone 2 and 5% in flood zone 1.

Application Site

The site is located directly north of the River Glen and the National Grid Reference of the site is 523380 326035.

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

Referring to the flood risk vulnerability classification in Table 2 of the Guidance, a residential development is categorised 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 †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

Therefore it can be seen that for “More Vulnerable” development in flood zone 2 the sequential test need to be applied to the development.

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.

As can be seen from the map on page 2 of this report most of this area immediately north of the River Glen is in Flood Zone 2.

Paragraph 5.14 of the South East Lincolnshire Local Plan 2011-36 entitled “Replacement Dwellings in the Countryside” states that replacement of original dwellings will only be acceptable in circumstances which are listed in Policy 22.

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

Therefore I consider that the sequential test has been passed.

Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment (SFRA) written for the South Holland District Council (SHDC) in 2010 provides details of the actual flood risk in the Council's area. This information has not been updated and reference to the maps in this document give the following information for the actual flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

For present day Depth of flooding … zero
Extent of flooding .. zero
Hazard …. Nil
Velocity … Nil

For year 2115 Depth of flooding … zero
Extent of flooding …zero
Hazard … Nil
Velocity .. Nil

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 present day Depth of flooding ... 0 – 500mm
Extent of flooding … High probability
Hazard ……. Less than 0.75 (low hazard)
Velocity ……. 0 – 0.3 m/sec

For year 2115 Depth of flooding..... 0 – 500mm
Extent of flooding .. High probability
Hazard …… 0.75 – 1.25 (danger for some)
Velocity …….. 0 – 0.3m/sec

The hazards are as follows for the 0.1% fluvial or tidal event probability:

For year 2115 Depth of flooding.... 0 – 500mm
Extent of flooding … High probability
Hazard …… 0.75 – 1.25 (danger for some)
Velocity …… 0 – 0.3m/sec

Tables in the SFRA show the following details of the defence bank on the west side of the tidal section of the River Welland north of Fulney Lock at chainage 22.0km.

	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	6.32m OD	6.65m OD	7.46m OD

The crest levels of the defences, which are earth banks along this length, vary between 6.97 and 7.30 m OD. With a minimum crest level of 7.00m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1020mm	690mm	-120mm
Peak 1 in 1,000 year freeboard	680mm	350mm	-460mm

Tables in the SFRA show the following details for the predicted flood levels in the River Glen at chainage 6.6 km.

	2007	2115
Peak 1 in 100 year flood level	4.40m OD	4.72m OD
Peak 1 in 1,000 year flood level	4.59m OD	4.80m OD

The table in the SFRA states that the crest level of the earth bank on this section of the northern side of the River Glen is 5.28m OD.

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 (2016). The reference of this information is CCN-2022-261149.

	2007	2115
Peak 1 in 100 year flood level	4.39m OD	4.47m OD
Peak 1 in 1,000 year flood level	4.86m OD	4.98m OD

The predicted fluvial levels supplied by the Environment Agency are reproduced on page 13 of this report.

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 immediately north of the bank on the north side of the River Glen which is maintained by the Environment Agency.

The site is located approximately 3.1 km from the tidal section of the River Welland, which is maintained by the Environment Agency.

There are additional smaller watercourses in the area that are maintained by Black Sluice IDB.

Existing Ground Levels

A topographical survey has been carried out and this plan will be included with the documents submitted for the planning application.

The approximate level of the site is 3.30m OD, and the level of the earth banks alongside the site are between 5.00m and 5.10m OD.

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. Failure or overtopping of the River Glen.
3. Flooding from the IDB drainage system.
4. Surface Water Flooding

1. Failure or overtopping of tidal defences

The nearest section of the tidal River Welland is approximately 3.1km east of the site. However if a breach were to occur in this section of the River Welland the site will not be affected as Vernatts Drain and the River Glen will prevent the flood water from reaching the site. However if a breach were to occur in the section north of the sluice at Surfleet Seas End then flood water could possibly affect the site. North of the sluice the bank levels are all higher than 7.50m OD. If a breach were to occur in this section of the west bank of the tidal Welland water would flow westwards then southwards towards the site. The railway line approximately 100 metres east of the site would check the flood flow and reduce the risk of flooding to the development site.

Therefore it is very unlikely that flood water from this source would flow as far as the development site and as this report will recommend that the floor level of the development should be significantly higher than the land around the site the risk of flooding from this source can be considered to be extremely low.

It is considered that the precaution of significantly raising floor level of the proposed dwelling will adequately mitigate the risk of flooding to the building from this source.

2. Failure or overtopping of the River Glen

The predicted maximum 1 in 100 year water level shown in the advice from the Environment Agency at the present time is 4.39m OD. This predicted level is lower than the defence levels on this section of the bank of the River Glen which are approximately 5.30m ODN.

The predicted maximum 1 in 100 year water level in 2115 in the River Glen with an allowance of 20% for climate change as advised by the EA is 4.47m ODN.

Although the actual risk is extremely low there is still a residual risk of flooding to the proposed dwelling if the bank were to fail directly south of the site. The possible maximum flood level that could occur on the site if a breach developed in the section of bank directly south of the site will be investigated later in this report.

The most common first stage of the formation of a breach is overtopping of a bank, which then leads to erosion of the back of the bank. This type of failure is more likely to happen at locations where the bank is lower and subject to overtopping. At this

location the predicted maximum 1 in 100 year flood level in 2115 is 4.47m ODN and the level of the bank is approximately 5.05m ODN.

Although the likelihood of a breach occurring at this location is extremely low, this source of flooding is the greatest risk to the site, and the hazards will be reviewed later in this report.

3. Flooding from the IDB Drainage System

Black Sluice IDB maintain the Graft Drain alongside Northgate and Connards Drain which flows north then westwards alongside Old Fen Lane.

Drainage channels maintained by the Black Sluice IDB generally have a 1 in 10 year standard with up to 1.0 metre of freeboard, which generally provides between 1 in 50 and 1 in 100 year standard against flooding.

As the proposed ground floor level of the development will be raised by a significant amount above the land levels on the site and the possibility of any flooding from the IDB system can be considered to be adequately mitigated.

4. Surface Water Flooding

As the proposed ground floor level of the building will be higher than the level of Northgate the risk of surface water flooding to the site can be considered to be adequately mitigated.

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 in the past fifty years.

Probabilities and Trends of Flooding

The probability of this development flooding from Environment Agency main river is very low.

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 River Glen.

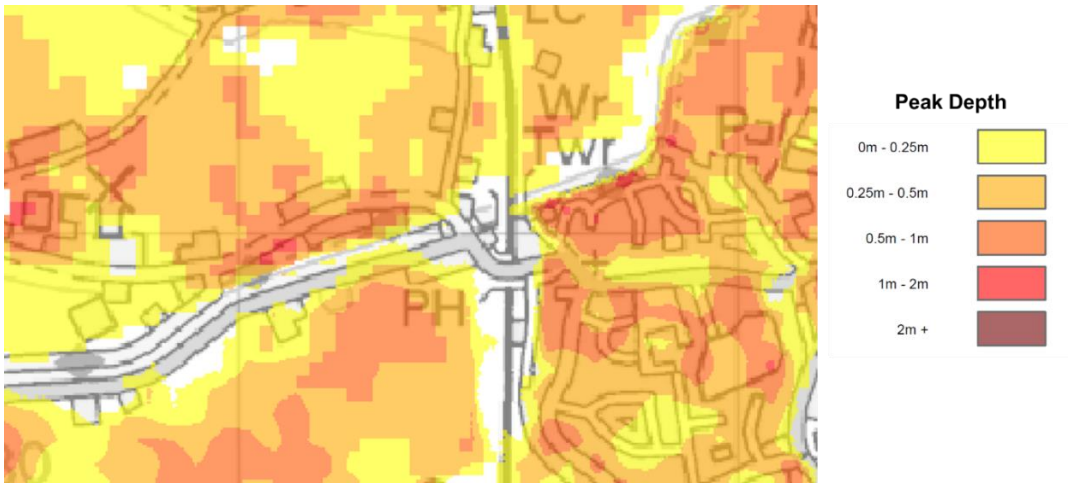
The risk of this happening in this case is low and the hazard from any flooding is also low.

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 19th February 2016 needs to be considered in this FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 23 to 26). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Conclusions and Proposed Mitigation

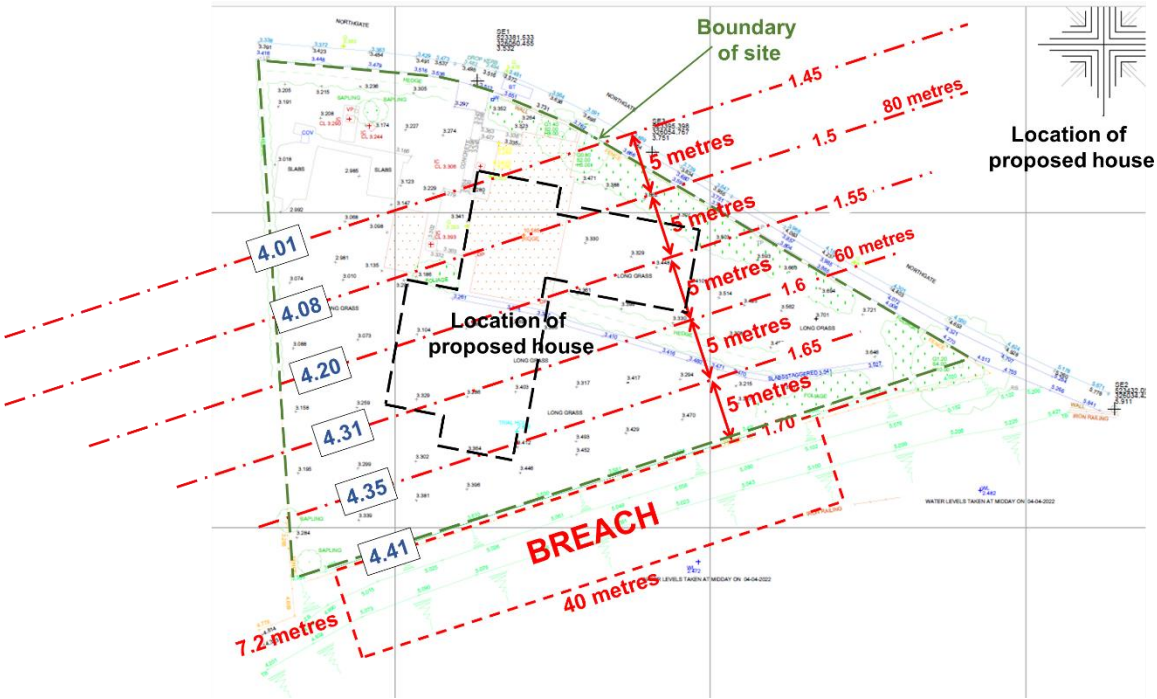
The map in the SFRA showing the residual flood depths in a 1 in 200 year coastal or a 1 in 100 year fluvial event in 2115 predicts that the maximum depth of flooding on the site would not exceed 250mm. This map is shown below:



It is assumed that this flooding will result from overtopping of the River Glen at a location west of the boundary to the site.

If in the future a breach occurs in the north bank of the River Glen immediately south of the proposed house this would result in greater flood depths on the site than shown on the map above. A calculation has been carried out to ascertain the approximate levels of flood water that could occur if a 40.0 metre wide breach developed in the bank of the river in a 1 in 100 year event in 2115. This calculation is detailed on pages 14 – 22 of this report.

The predicted water levels adjacent to the development are shown in blue on the plan below if a breach were to occur in the bank of the river during a 1 in 100 year in 2115.



The guidance on calculations such as these is that an allowance of 300mm should be made for model tolerances. It is considered that in this case this dimension is excessive due to the following reasons:

1) In the first minutes after the breach has formed the depth of the breach is unlikely to be the depth that has been estimated.
2) The flow of approximately 9.5 cumecs through the breach will have the effect of locally reducing the level of water in the River Glen. The predicted flow in the River Glen in a 1 in 100 year event in 2115 is 35.77cumecs. The reduction of water level is estimated to be 100mm to 200mm immediately and as the breach continues to empty water out of the river level will continue to fall. Therefore the actual water levels will be less than the predicted water levels in the breach analysis.
3) A breach in this river is more likely to occur further upstream than the breach modelled above, which will reduce the predicted water level affecting the proposed buildings.

Therefore it can be concluded that the proposed dwelling should have a minimum floor level of 4.40m ODN which will provide adequate mitigation against flooding to the proposed new building.

The risk of flood water from the tidal River Welland reaching the site if a breach occurred in these banks can be considered remote. Flood water would need to be at least 1.0 metres in depth across the whole fen before the proposed development would be affected.

The risk of any flood water from any IDB sources increasing above 4.30m OD can be considered remote.

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

Recommendations

In this area where there is a flood risk the proposed dwelling should be of two storey construction designed with all sleeping accommodation located on the first floor.

The ground floor level of the proposed two storey building should have a minimum level of 4.40m ODN.

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

In an extreme fluvial event water levels in the River Glen would rise slowly and would only reach their peak after a minimum of 24 hours. The Environment Agency would issue warnings hours before the event, and all occupiers would be aware of the situation.

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

The buildings should be designed incorporating flood resistant and resilient techniques to allow it to be refurbished after being flooding to a depth of approximately 300mm above the floor level of the new buildings. Consideration should be given to the electrics and heating pipes being distributed at ceiling level rather than at floor level. Materials used for the floor and walls should be able to withstand flooding for a period of a few days.

Further information for the Developer

The developer should be aware that the proposed building is 4.0 metres from the rear edge of the bank of the River Glen.

The Environmental Permitting Regulations (2016) require a permit or exemption should be obtained from the Environment Agency as the building is within 8 metres of a flood defence structure (the bank).

The Environment Agency state that an applicant should not assume that a permit will be forthcoming once planning permission has been granted.

S M HEMMINGS B Sc C Eng MICE MIWEM

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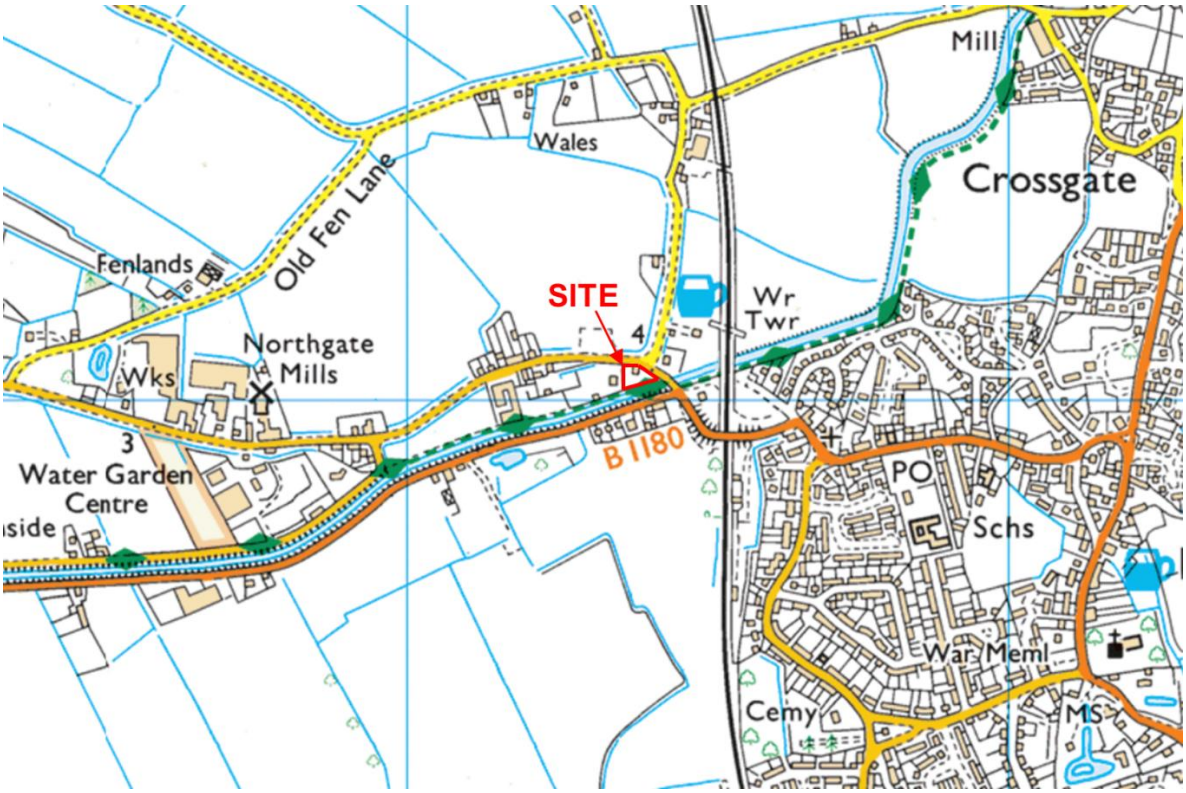
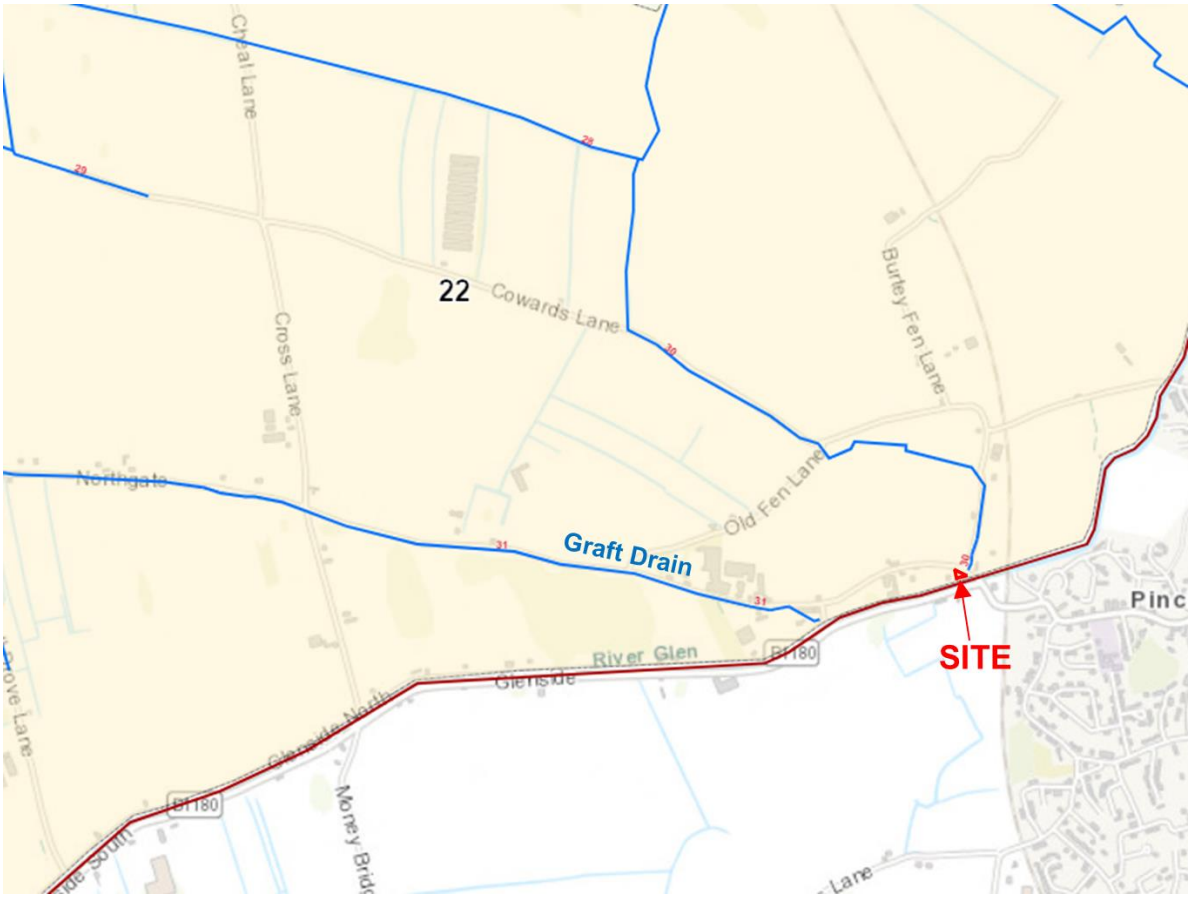
8th August 2023.

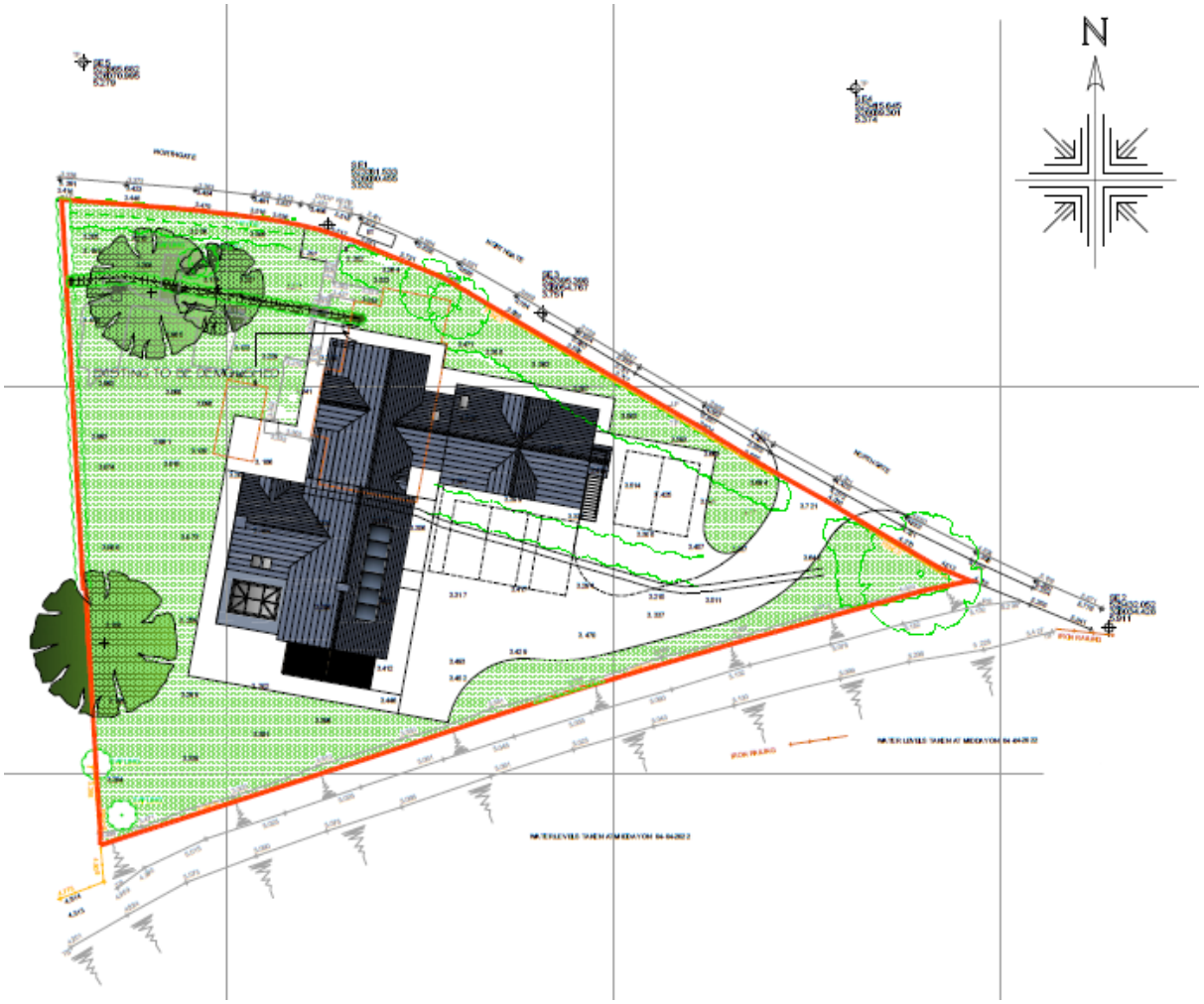
LOCATION PLAN



PLAN OF IDB DRAINS



BLOCK PLAN OF PROPOSED DEVELOPMENT



Environment Agency

Datasheet [Ref: CCN-2022-261149] **Model Name: Welland Catchment Strategic Model** **Model Date: 2016**

Fluvial Flood Levels (mODN)

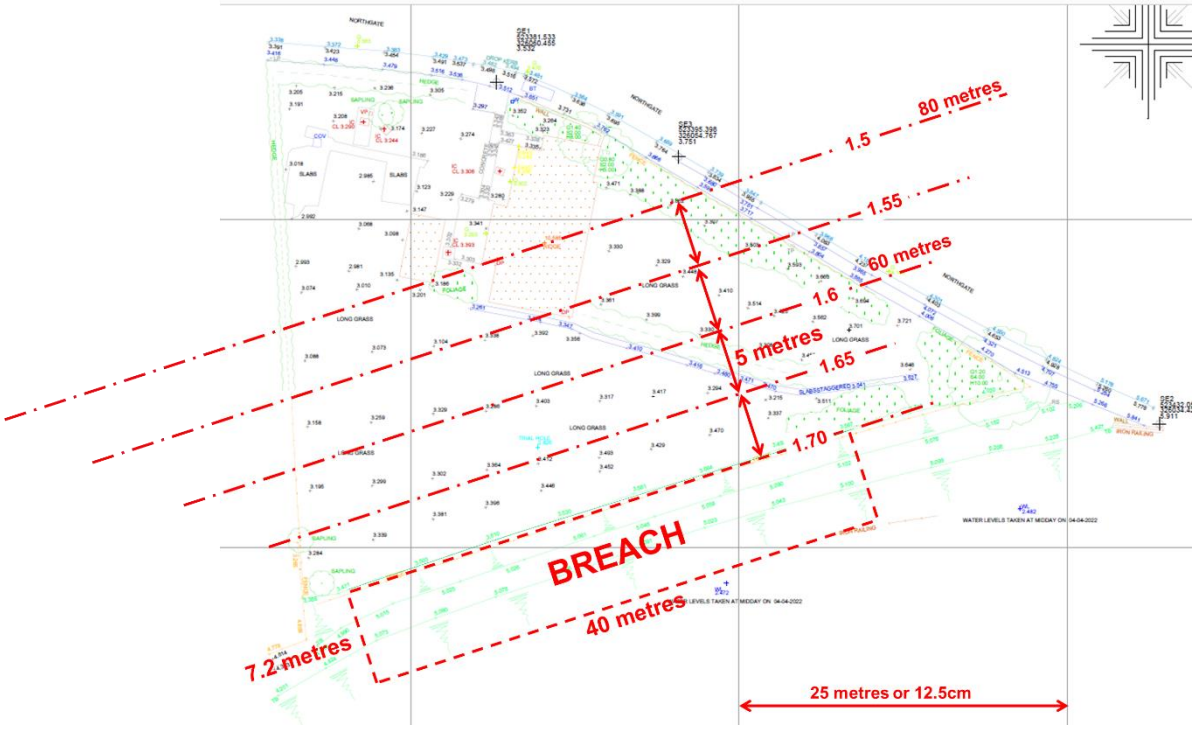
The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

			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)	4% (1 in 25)	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 6685	523603	326081	4.01	4.16	4.23	4.31	4.32	4.34	4.35	4.38	4.44	4.60	4.84	4.94
GLEN 6837	523459	326033	4.02	4.16	4.24	4.31	4.32	4.34	4.36	4.38	4.45	4.63	4.85	4.95
GLEN 6884	523414	326020	4.03	4.17	4.25	4.32	4.33	4.35	4.37	4.39	4.47	4.66	4.86	4.98
GLEN 7082	523224	325963	4.04	4.17	4.25	4.32	4.34	4.36	4.39	4.41	4.49	4.70	4.87	5.01
GLEN 7280	523035	325904	4.04	4.18	4.26	4.33	4.35	4.38	4.40	4.41	4.51	4.72	4.88	5.03

Fluvial Flood Flows (m^3/s)

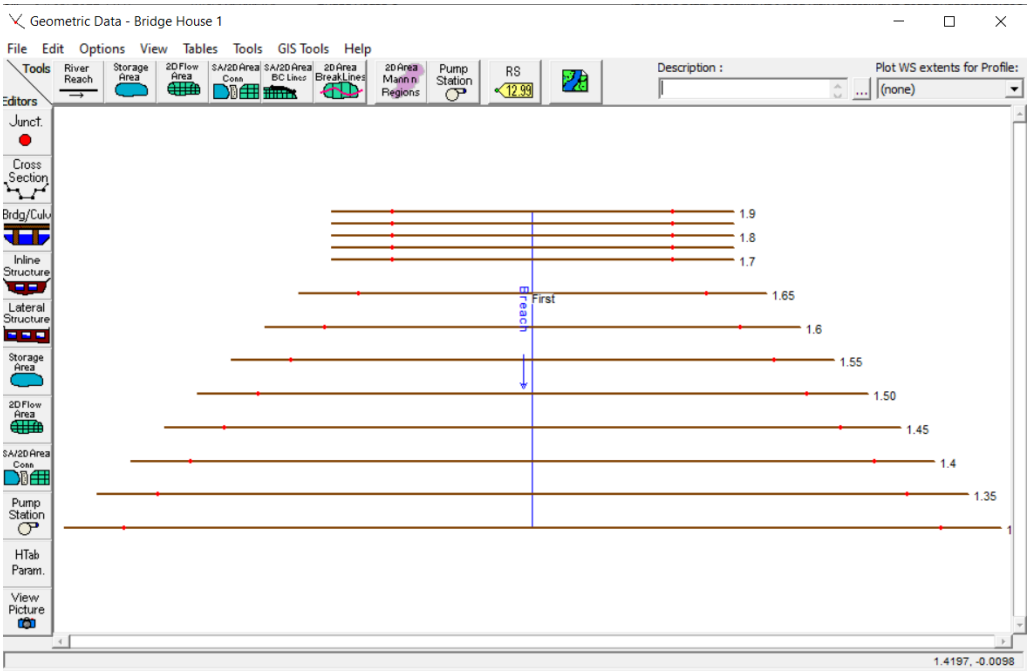
APPENDIX A BREACH ANALYSIS

A breach 40 metres wide in the north bank of the Glen has been simulated immediately in front of the proposed replacement dwelling.

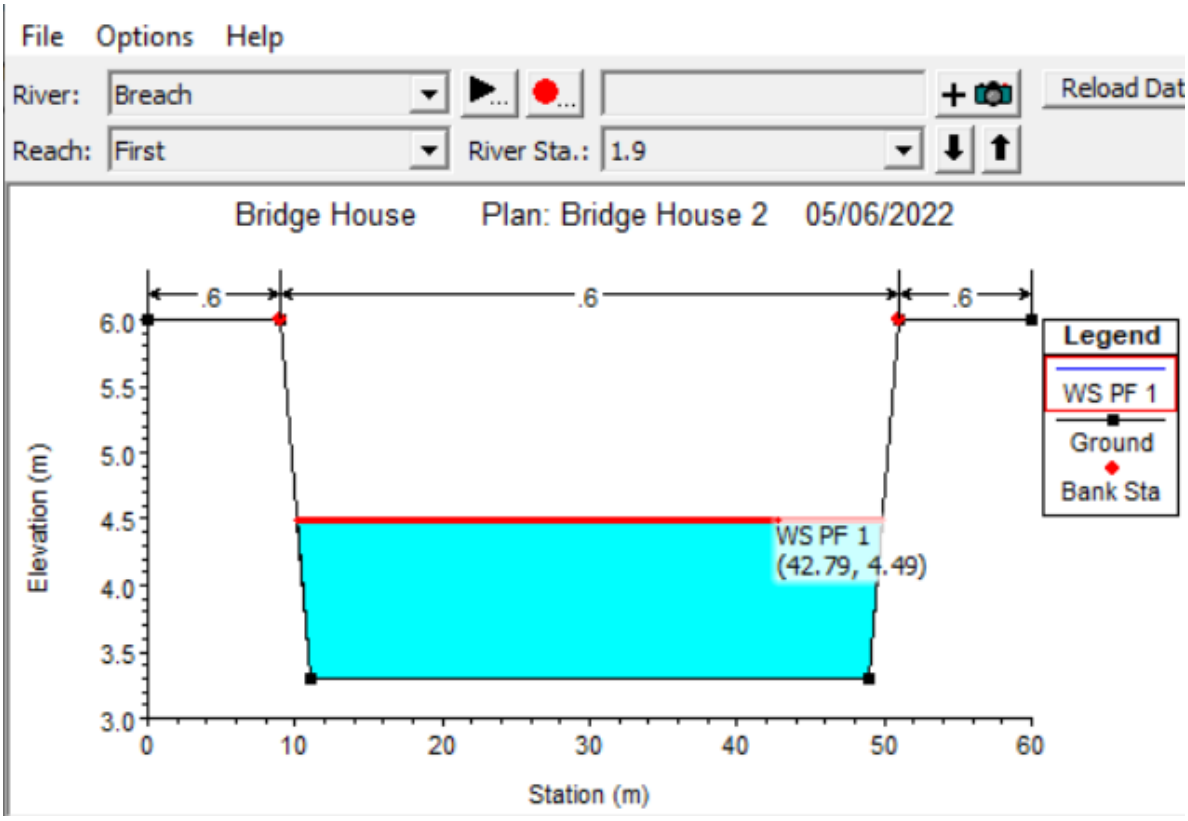


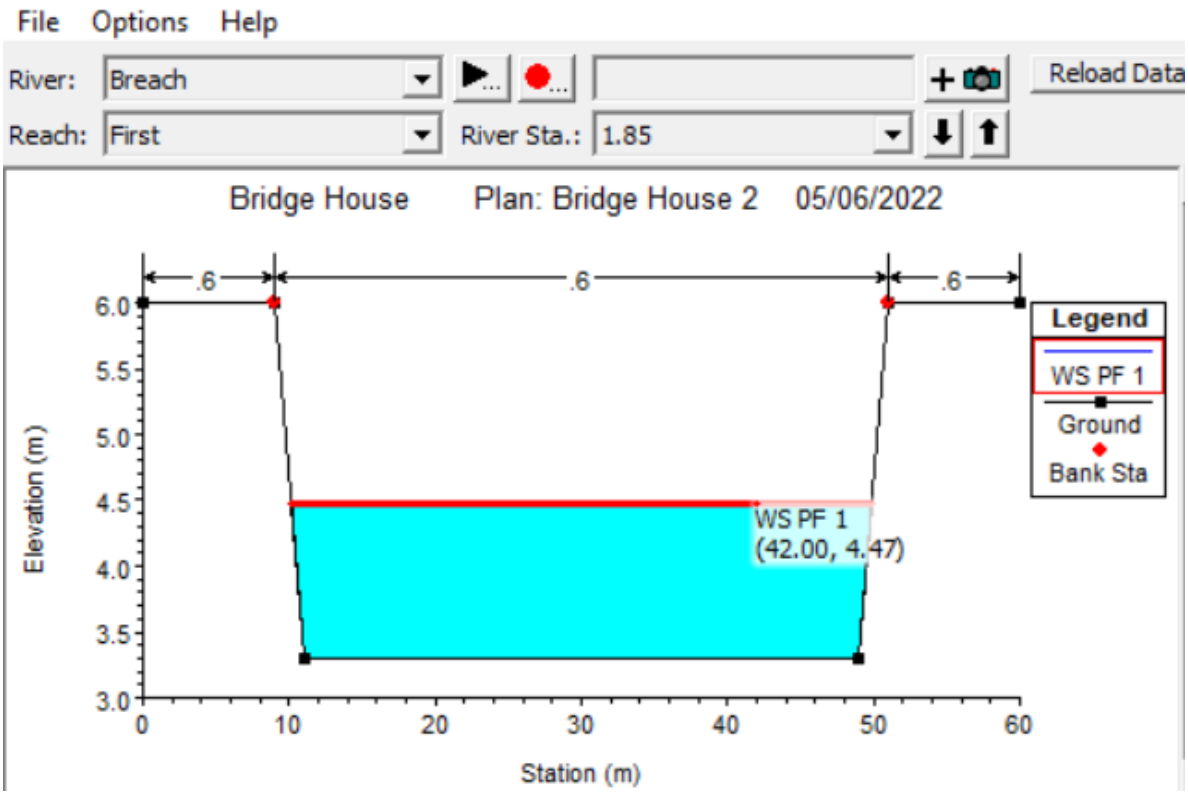
It is assumed that the flow will be 40 metres wide and the breach will immediately reduce the bottom level of this section of bank to a level of 3.30m ODN.

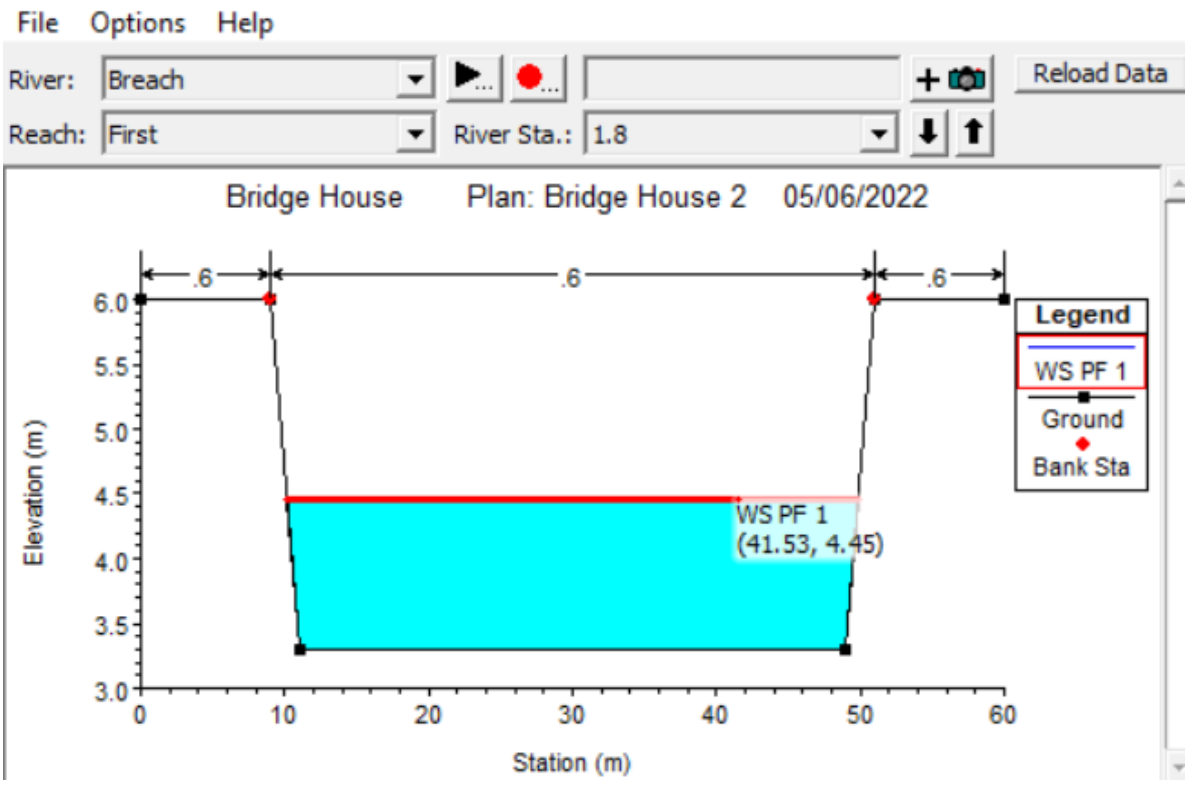
A calculation of the flow from the river to the south has been carried out using HECRAS. The plan from HECRAS showing the cross sections is below.



The cross section details are shown below with water levels



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Ground
Bank Sta
WS PF 1
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Elevation (m)
Station (m)
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5.0
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4.0
3.5
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10
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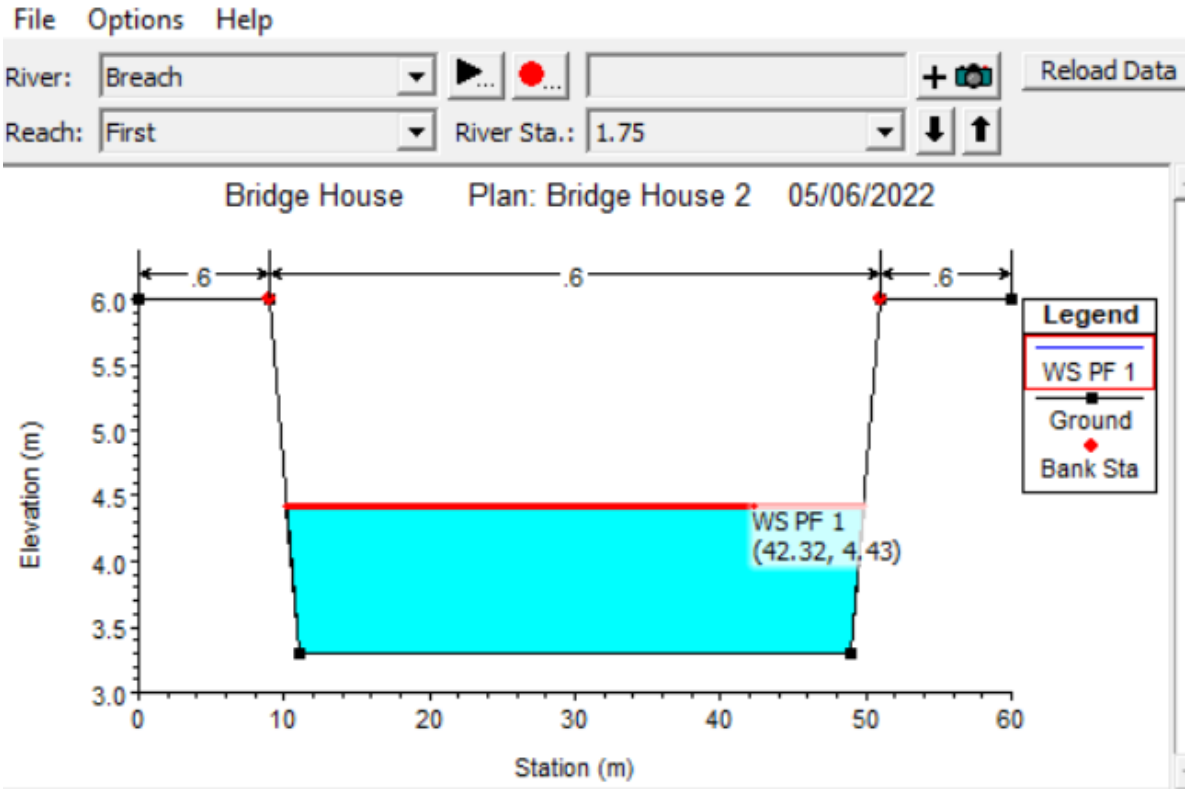
30
40
50
60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Legend
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Ground
Bank Sta
WS PF 1
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Elevation (m)
Station (m)
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4.5
4.0
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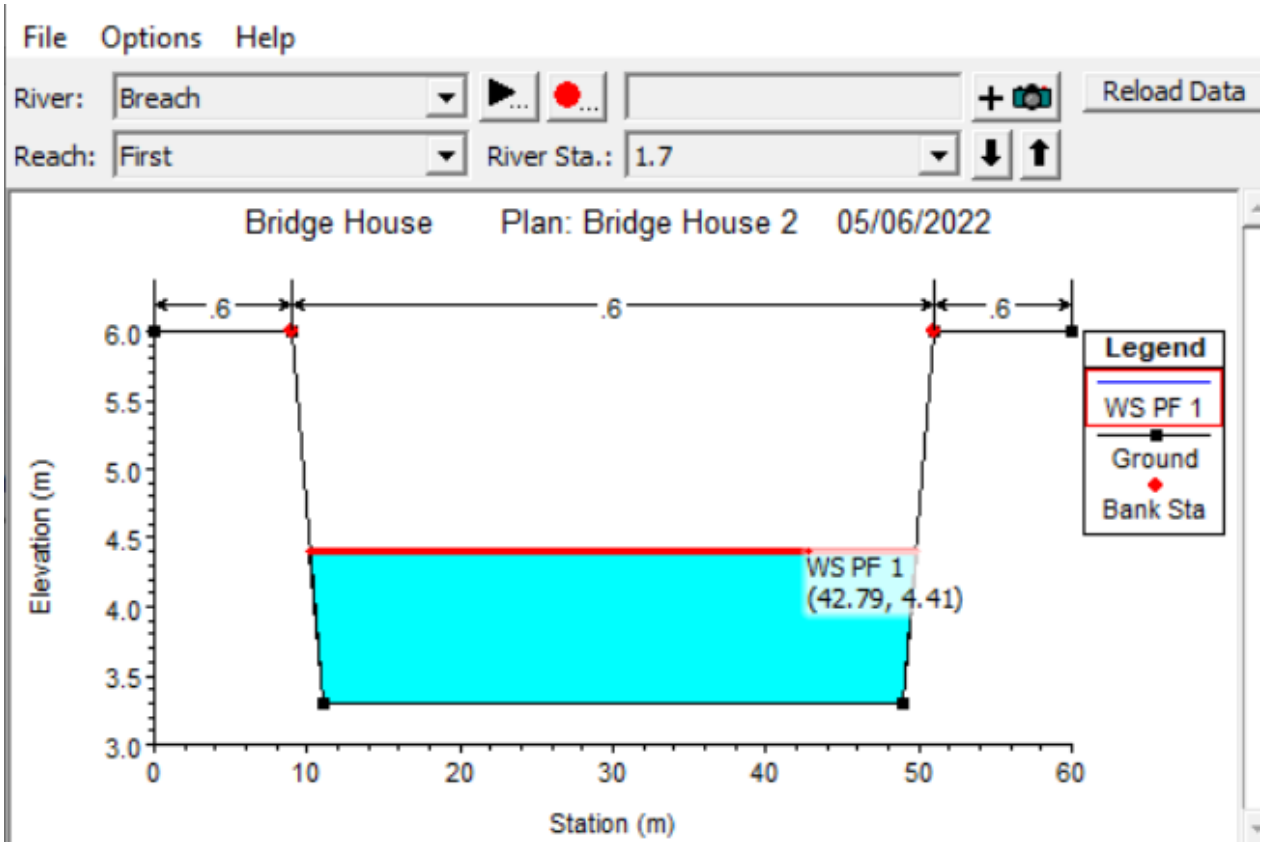
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4.5
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Elevation (m)
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30
40
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Station (m)
Legend
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Ground
Bank Sta
WS PF 1
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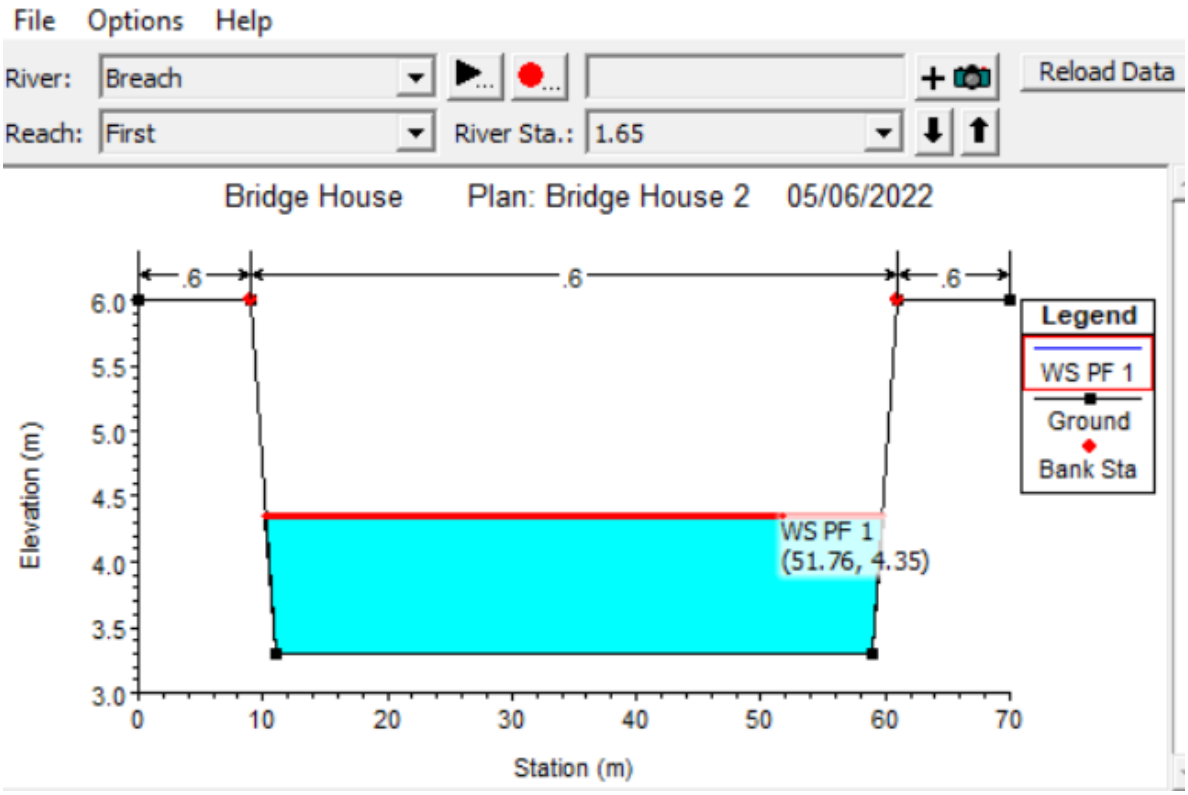
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3.5
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Elevation (m)
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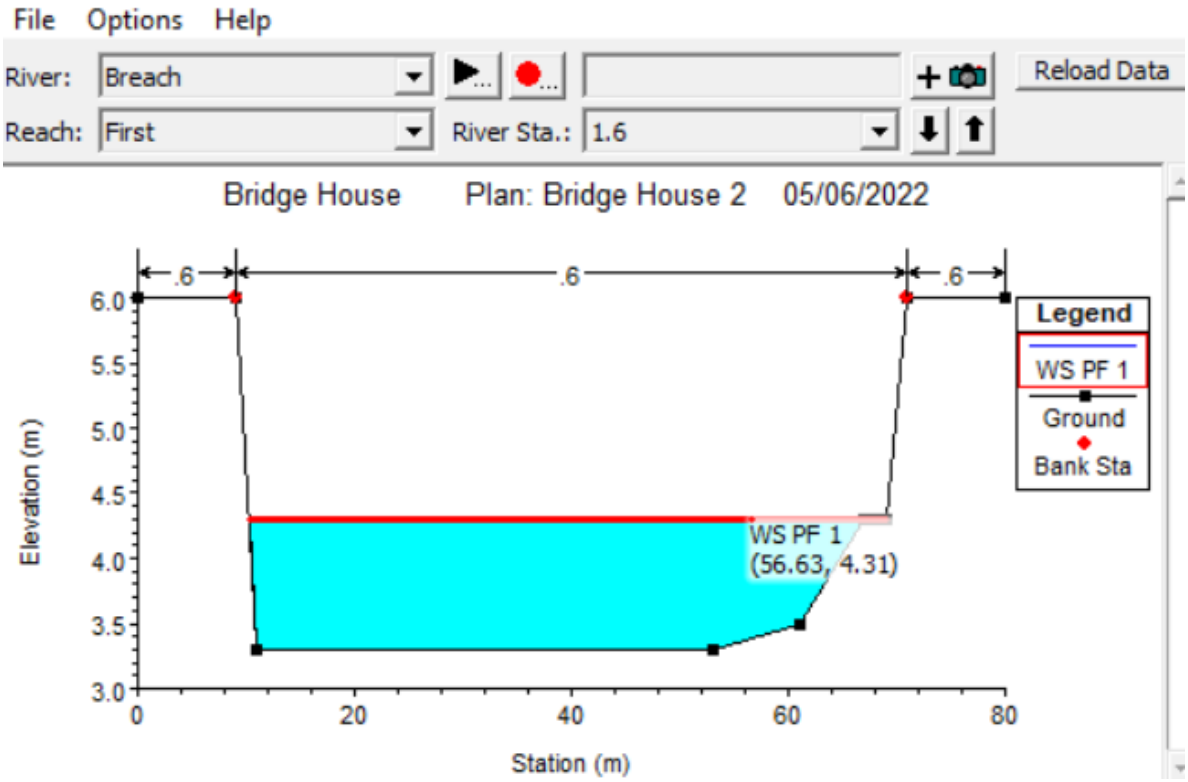
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Reload Data
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Legend
WS PF 1
Ground
Bank Sta
WS PF 1
(56.63, 4.31)
Elevation (m)
Station (m)
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5.0
4.5
4.0
3.5
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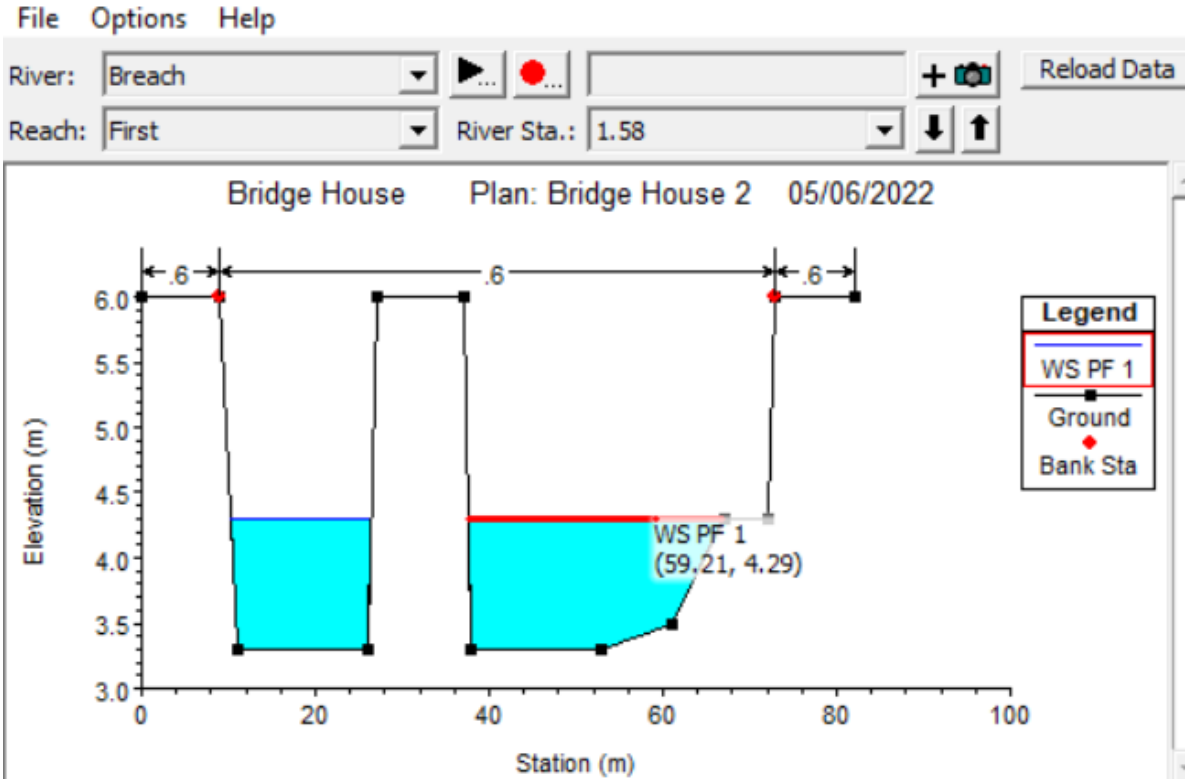
0
20
40
60
80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.6
Legend
WS PF 1
Ground
Bank Sta
WS PF 1
(59.21, 4.29)
Elevation (m)
Station (m)
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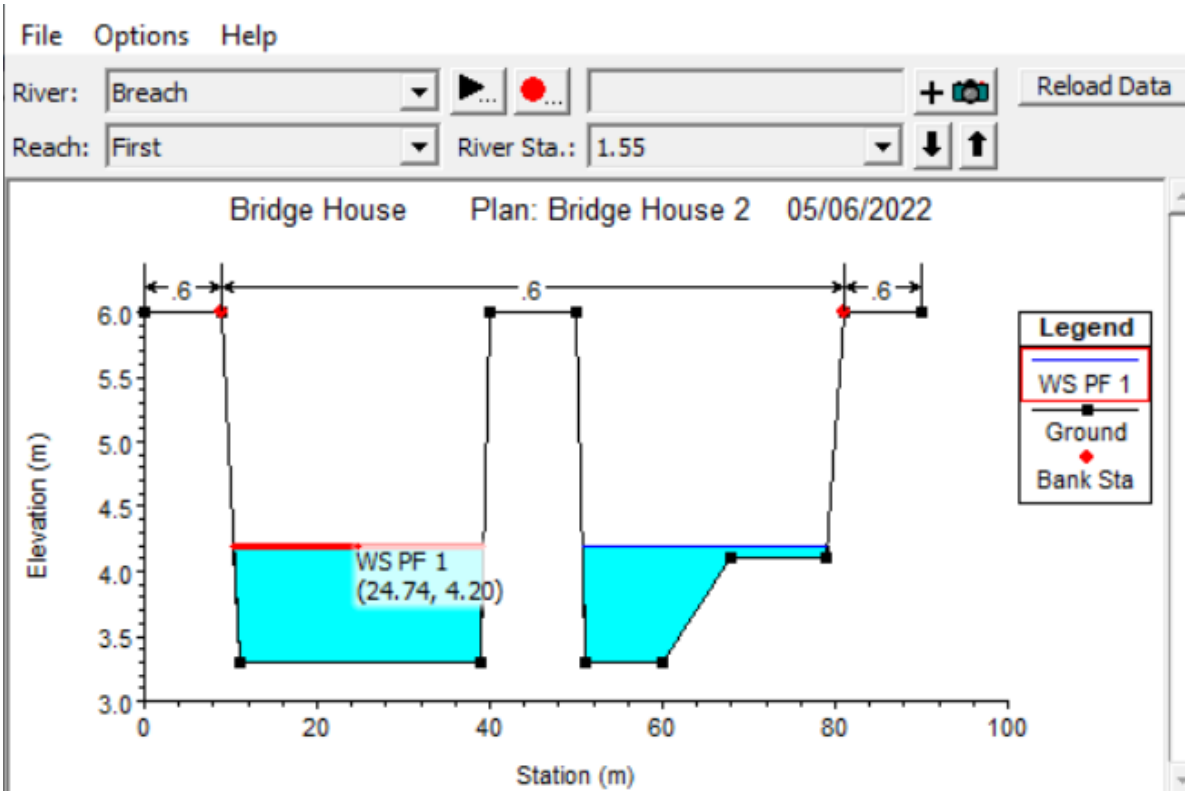
4.5
4.0
3.5
3.0
0
20
40
60
80
100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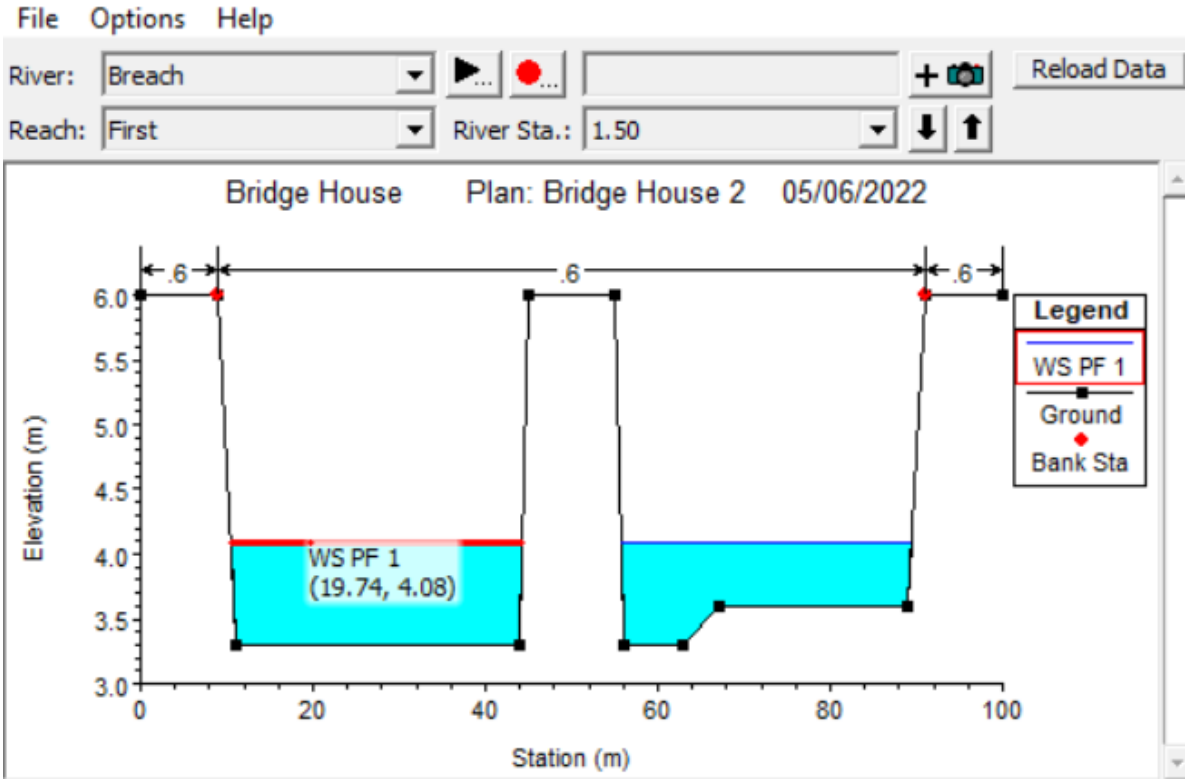
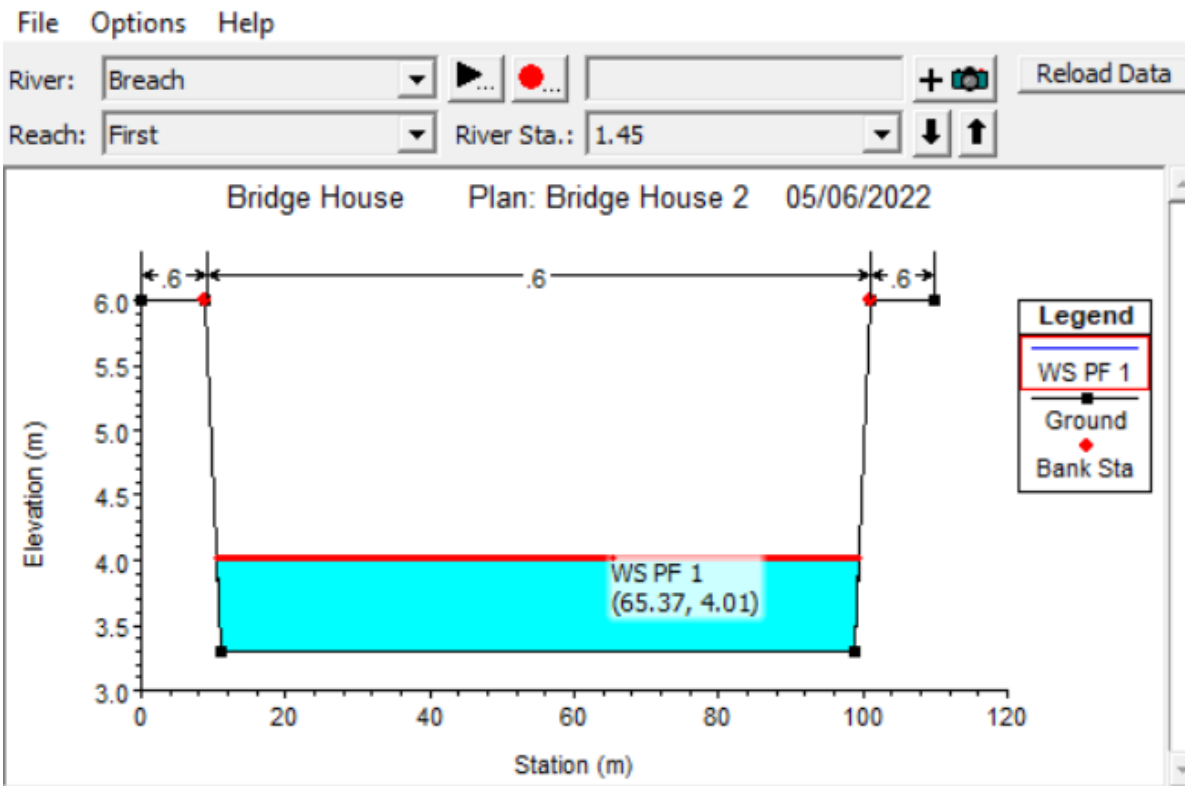
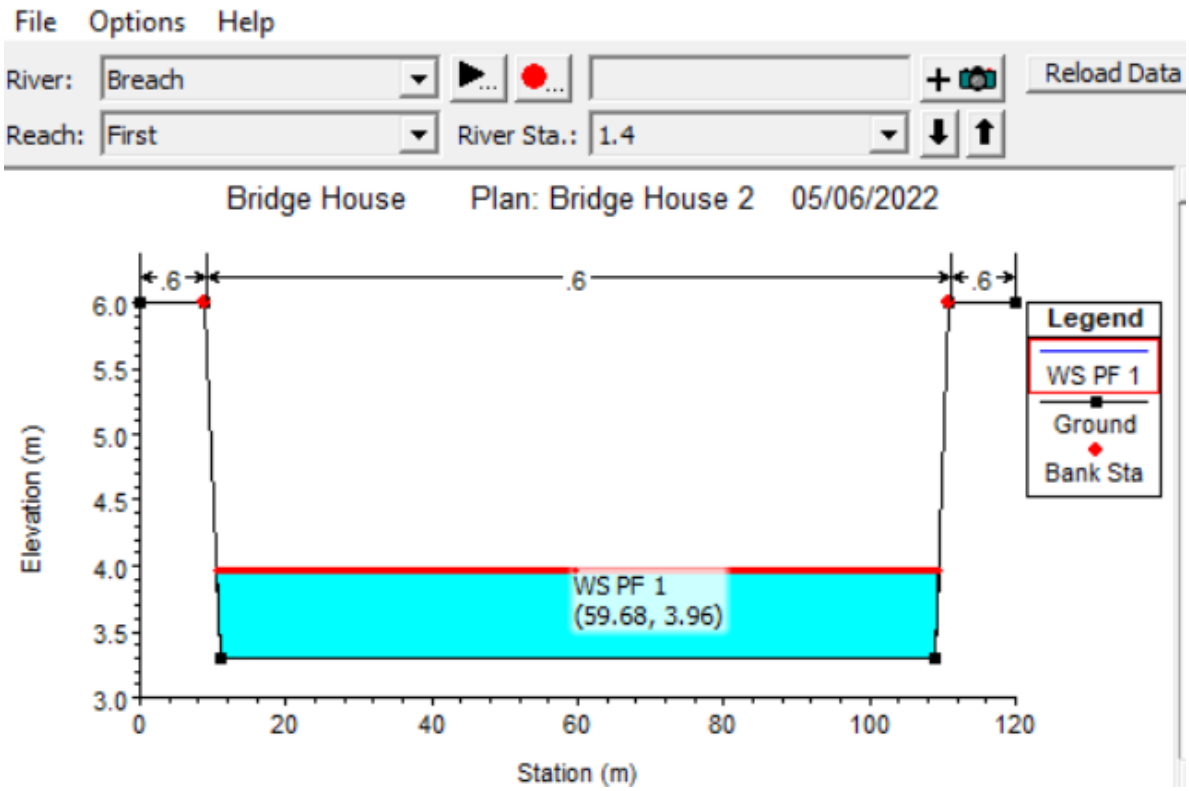
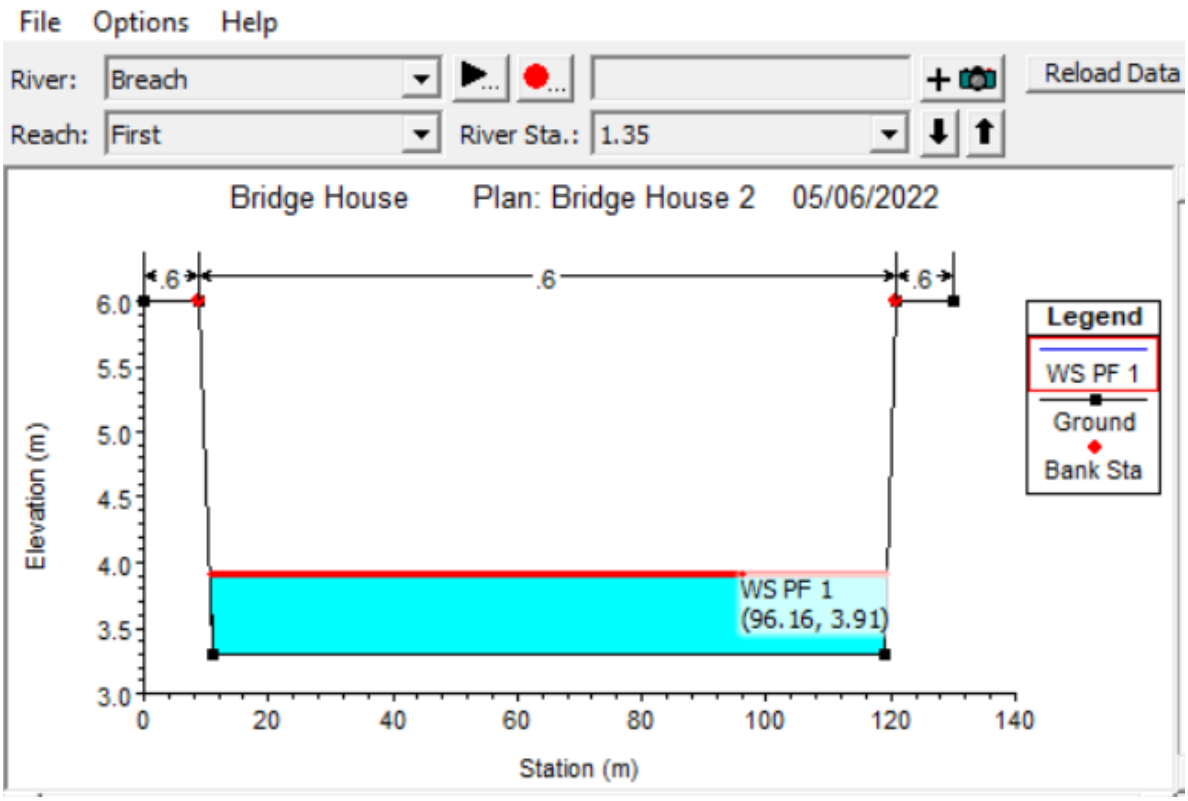
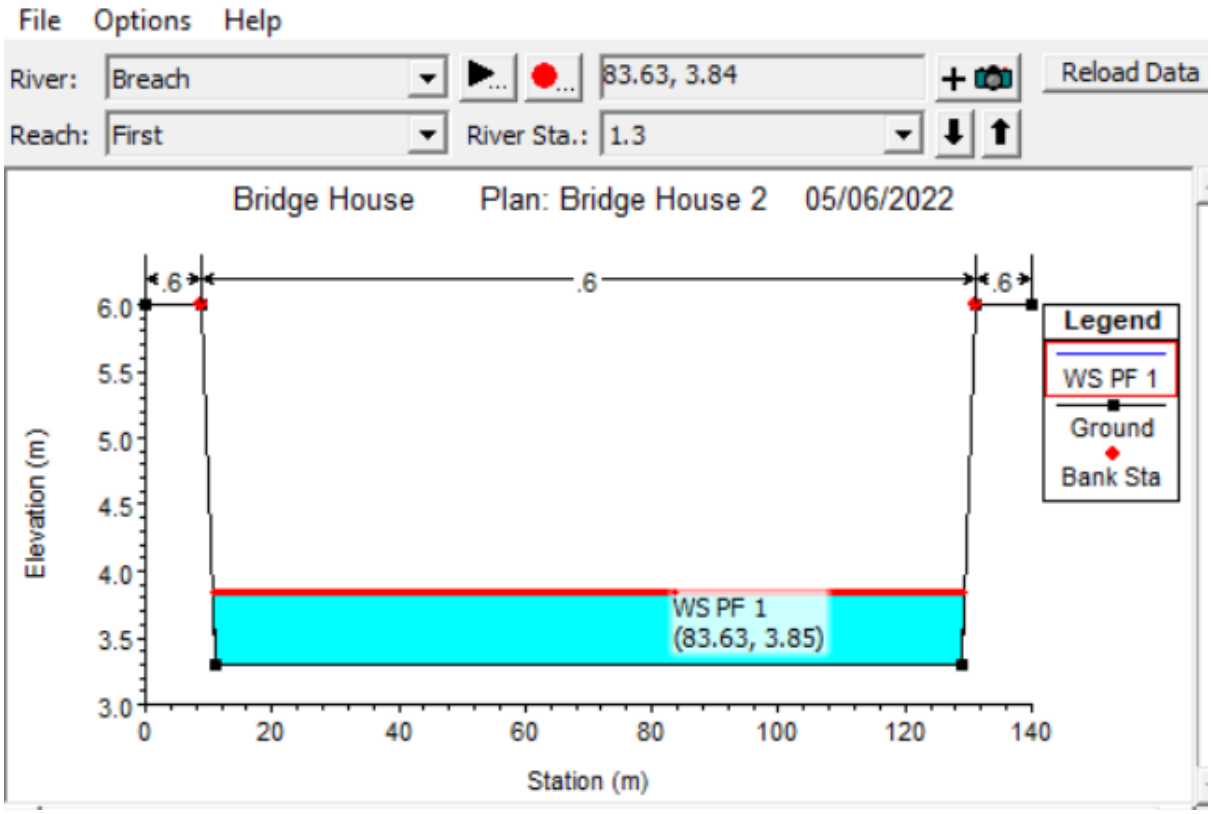
River: Breach
Reach: First
River Sta.: 1.55
Reload Data
Bridge House Plan: Bridge House 2 05/06/2022
.6
.6
.6
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Elevation (m)
WS PF 1
(24.74, 4.20)
0
20
40
60
80
100
Station (m)
Legend
WS PF 1
Ground
Bank Sta


File Options Help
River: Breach
Reach: First
River Sta.: 1.50
Reload Data
Bridge House Plan: Bridge House 2 05/06/2022
.6
.6
.6
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Elevation (m)
WS PF 1
(19.74, 4.08)
0
20
40
60
80
100
Station (m)
Legend
WS PF 1
Ground
Bank Sta

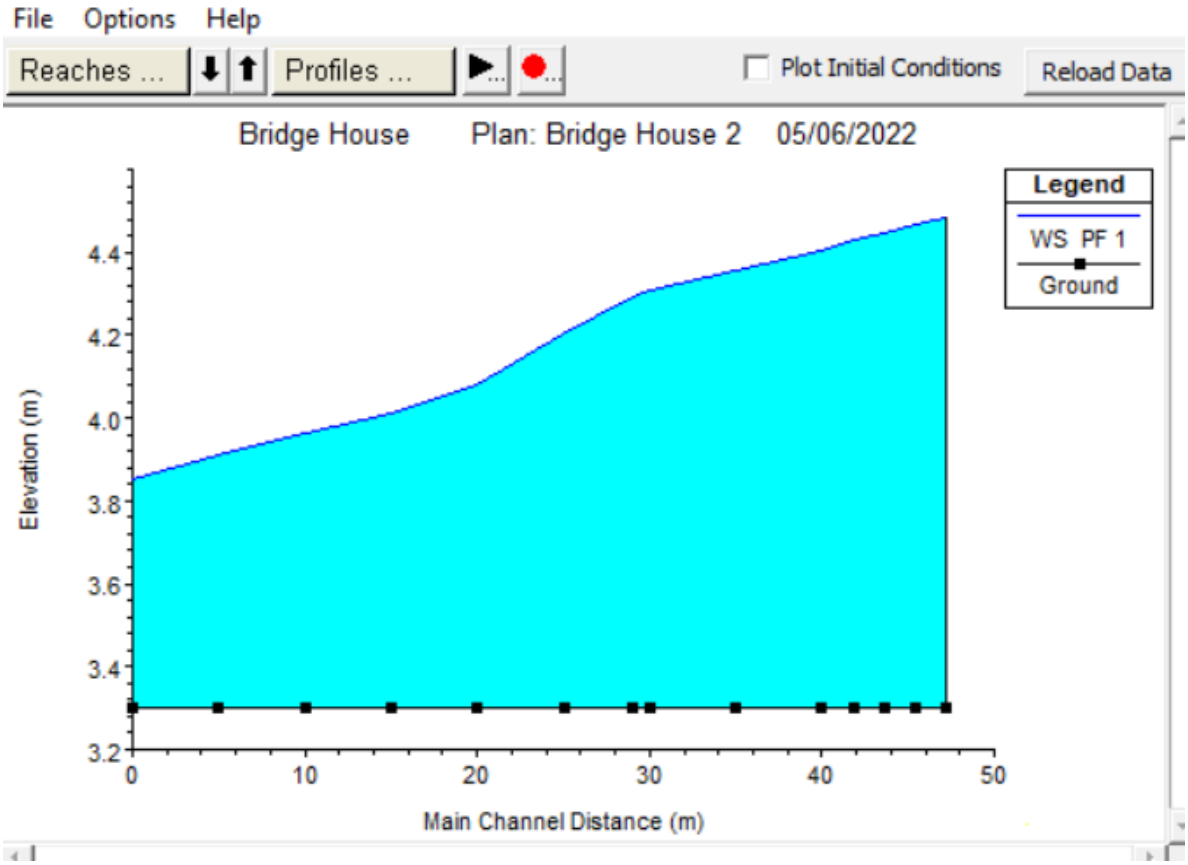

File Options Help
River: Breach
Reach: First
River Sta.: 1.45
Reload Data
Bridge House Plan: Bridge House 2 05/06/2022
.6
.6
.6
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Elevation (m)
WS PF 1
(65.37, 4.01)
0
20
40
60
80
100
120
Station (m)
Legend
WS PF 1
Ground
Bank Sta


File Options Help
River: Breach
Reach: First
River Sta.: 1.4
Reload Data
Bridge House Plan: Bridge House 2 05/06/2022
.6
.6
.6
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Elevation (m)
WS PF 1
(59.68, 3.96)
0
20
40
60
80
100
120
Station (m)
Legend
WS PF 1
Ground
Bank Sta


File Options Help
River: Breach
Reach: First
River Sta.: 1.35
Reload Data
Bridge House Plan: Bridge House 2 05/06/2022
.6
.6
.6
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Elevation (m)
0
20
40
60
80
100
120
140
Station (m)
WS PF 1
(96.16, 3.91)
Legend
WS PF 1
Ground
Bank Sta


File Options Help
River: Breach
Reach: First
83.63, 3.84
River Sta.: 1.3
Reload Data
Bridge House Plan: Bridge House 2 05/06/2022
.6
.6
.6
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Elevation (m)
0
20
40
60
80
100
120
140
Station (m)
WS PF 1
(83.63, 3.85)
Legend
WS PF 1
Ground
Bank Sta

The long section is shown below.



The predicted water levels in the breach with a flow of 9.5 cumecs and a river level of 4.49m ODN are shown below.

Section	1.3	1.35	1.40	1.45	1.50	1.55	1.58	1.60	1.65	1.70	1.75	1.80	1.85	1.90
Level	3.85	3.91	3.96	4.01	4.08	4.20	4.29	4.31	4.35	4.41	4.43	4.45	4.47	4.49

APPENDIX B 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 19th 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[1]. 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

document is out of date

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%	

s been withdrawn (19

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 2 the central and higher central figure 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)

Area of England	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 SFRA predicts that there will be flooding to the proposed development site up to a depth of 500mm in a 1 in 100 year fluvial or 1 in 200 year tidal event in 2115. It has been concluded that the major flood risk to the site is most likely to be fluvial flooding from the River Glen to the north of the site.

The FRA has identified three sources of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site:

1) Flooding from the tidal River Welland
2) Flooding from the River Glen
3) Flooding from the Vernatts Drain and other IDB drains

1) 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

It can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. This will only have the effect of increasing flood levels by between 10mm and 20mm at the most. This may slightly increase the risk of a breach occurring in the tidal bank north of the site.

Therefore the small increase in the maximum level of tidal flooding will not change the conclusion of this flood risk assessment.

2) Fluvial Flooding from the River Glen.

Fluvial flooding from the River Glen is considered to be the major flood risk to the site. As the development is in flood zone 2 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 between 25% and 35% in this river systems it will have the effect of flooding over the long sections of bank between Bourne and Surfleet Reservoir and the maximum levels will not increase significantly.

3) Flooding from IDB drains

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 ground floor levels should be raised to the levels shown on page 9 of this report is considered satisfactory.