

Fen Road Phase 2 Holbeach

Ashwood Homes Ltd

Flood Risk Assessment

MA11419/FRA/R01

June 2021



REVISION

Reference	Revision	Author	Date
MA11419-FRA-R01	Initial Issue	JMcK	25 June 2021

CONTENTS

1. INTRODUCTION	4
2 THE SITE.....	5
3 CONSULTATIONS	6
4 SEQUENTIAL AND EXCEPTION TESTS.....	10
5 PROPOSED DEVELOPMENT	12
6 FLOOD RISK	15
7 MITIGATION MEASURES	19
8 CONCLUSIONS.....	20

APPENDICIES

Appendix A – Drawings

MA11419/100: Site Location Plan

MA11419/200: Proposed Drainage Strategy

Appendix B – Consultations

Environment Agency Flood Map For Planning

Anglian Water Pre Development Enquiry Report

IDB discharge confirmation

Appendix C – South East Lincolnshire SFRA

Plan Extracts

Appendix D – Site Investigation

Relevant Extracts relating to infiltration.

Appendix E – Calculations

Preliminary hydraulic model

1. INTRODUCTION

- 1.1 Millward have been appointed to undertake a Flood Risk Assessment (FRA) for a proposed residential development for 38 dwellings at a site to the western side of Fen Road in Holbeach. This proposed development is due south of a new residential development currently under construction.
- 1.2 This FRA is undertaken in accordance with the National Planning Policy Framework and associated climate change allowances last updated 22 July 2020.
- 1.3 Environment Agency Data and the South East Lincolnshire SRFA have been reviewed to assist in the assessment of flood risk for the development site.
- 1.4 This FRA discusses and provides both a qualitative assessment and quantitative assessment for the development in terms of flood risk, future flood risk over the anticipated lifetime of the development and reference to the sequential and exception test using a precautionary and risk-based approach.

2 THE SITE

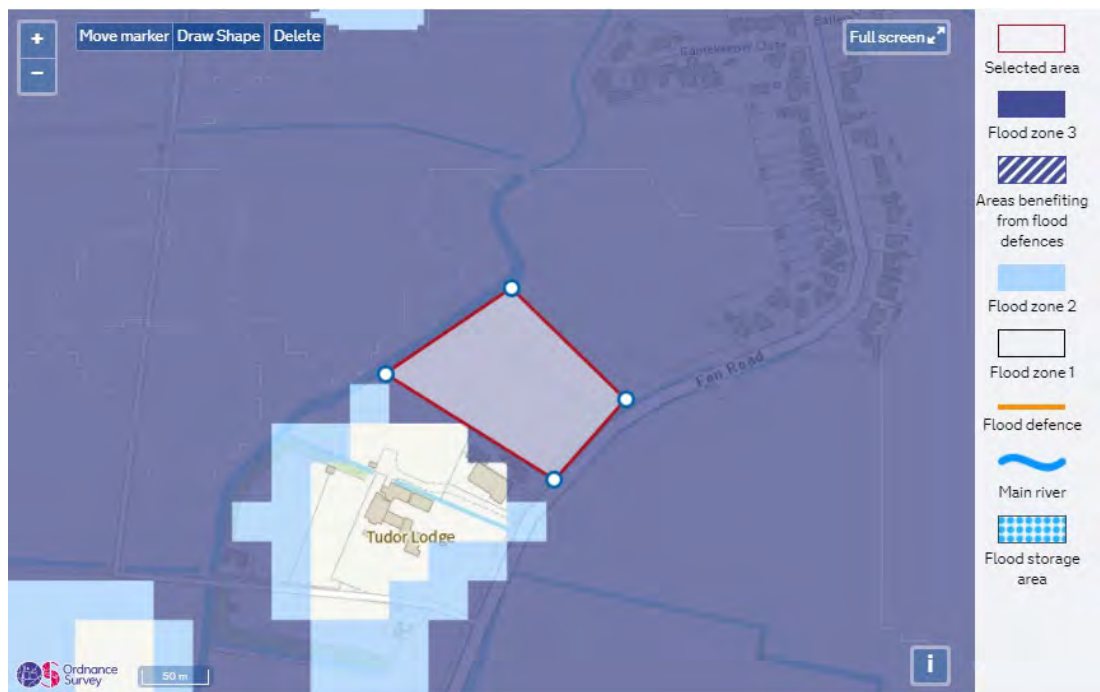
- 2.1 The site is located to the southern extents of Holbeach which is a fenland market town situated 8 miles east of Spalding.
- 2.2 The site is currently greenfield land and is 1.196Ha in plan area.
- 2.3 Vehicular access will be from the development to the north. An existing watercourse Maintained by the South Holland IDB abuts the western boundary of the site. An existing infiltration ditch abuts the eastern boundary of the site.
- 2.4 To the south of the site is an existing residential property and commercial business with an extensive hedge line along the southern boundary of the site.
- 2.5 Site levels vary between circa 3.3m AOD to 3.093m AOD. The site is generally flat.
- 2.6 The development layout is shown on drawing MA11419/200 contained within Appendix A.

3 CONSULTATIONS

3.1 Environment Agency

3.1.1 The Environment Agency national flood risk maps available on their web site have been interrogated firstly to define in terms of planning what flood zone the site is contained within.

3.1.2 The development site is shown to be contained within Flood Zone 3 which is defined as High Probability having greater than a 1 in 100 chance (1%) of flooding from rivers in any one year (excluding the presence of flood defences). The flood map for planning is contained within Appendix B.



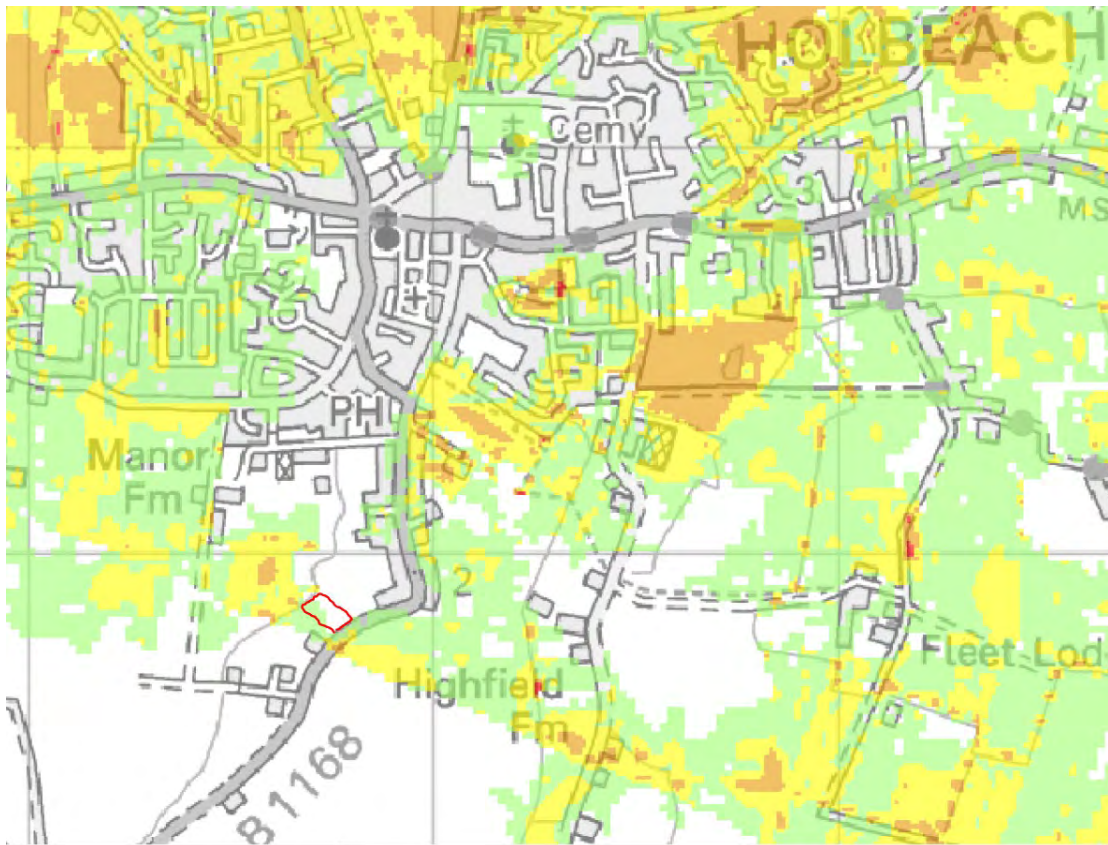
3.1.3 The site and surrounding areas benefit from significant tidal and fluvial flood defences.

3.1.4 Therefore, the SFRA has been reviewed to assist in the further assessment of flood risk to this area.

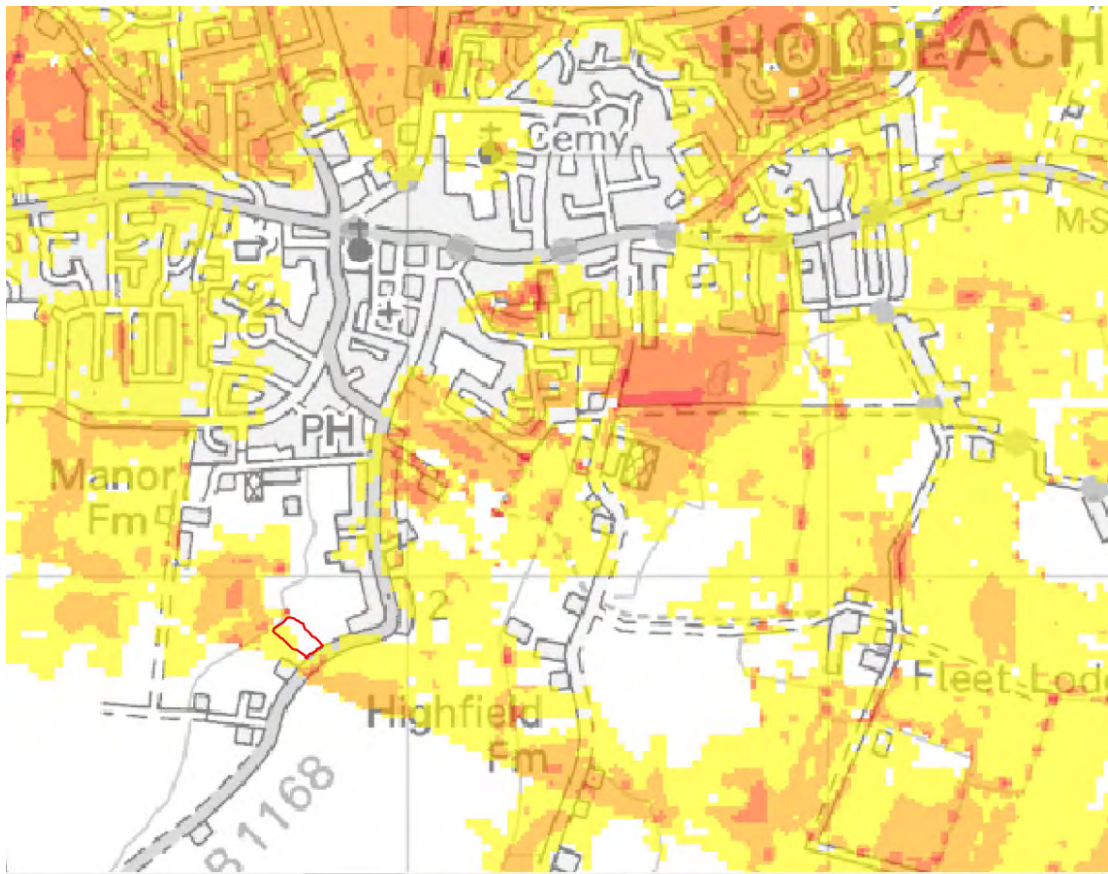
3.2 South East Lincolnshire SFRA

3.2.1 In summary, the site lies within an area of flood zone 3. In terms of assessing residual flood risk to this development site, the SFRA hazard mapping has been reviewed to establish what hazard rating the site is contained within.

3.2.2 The SFRA has hazard mapping for the area as shown below;



3.2.3 The above hazard mapping extract shows the development site to be within 'Low Hazard' Rating area. (Extract from plan Residual Flood Hazard Year 2115 1% Fluvial / 0.5% Tidal Event Probability) February 2017.



- 3.2.4 Residual peak depths of flooding are shown on the plan extract above which is from the Residual Peak Depth District – Year 2115 1% Fluvial / 0.5% Tidal Event Probability February 2017 Rev number 2.
- 3.2.5 The SFRA Appendix C has a matrix for Standing Advice and the development site is classed as 'Low Hazard' and is a Major – more vulnerable use. This matrix confirms that the finished floor levels must be informed by the predicted flood depth maps (year 2115) with single storey proposals must use the 0.1% event 2115 scenario for setting the FFL. Two storey dwellings must use; Depths 0 to 0.25m the FFL must be set 300mm above ground level.

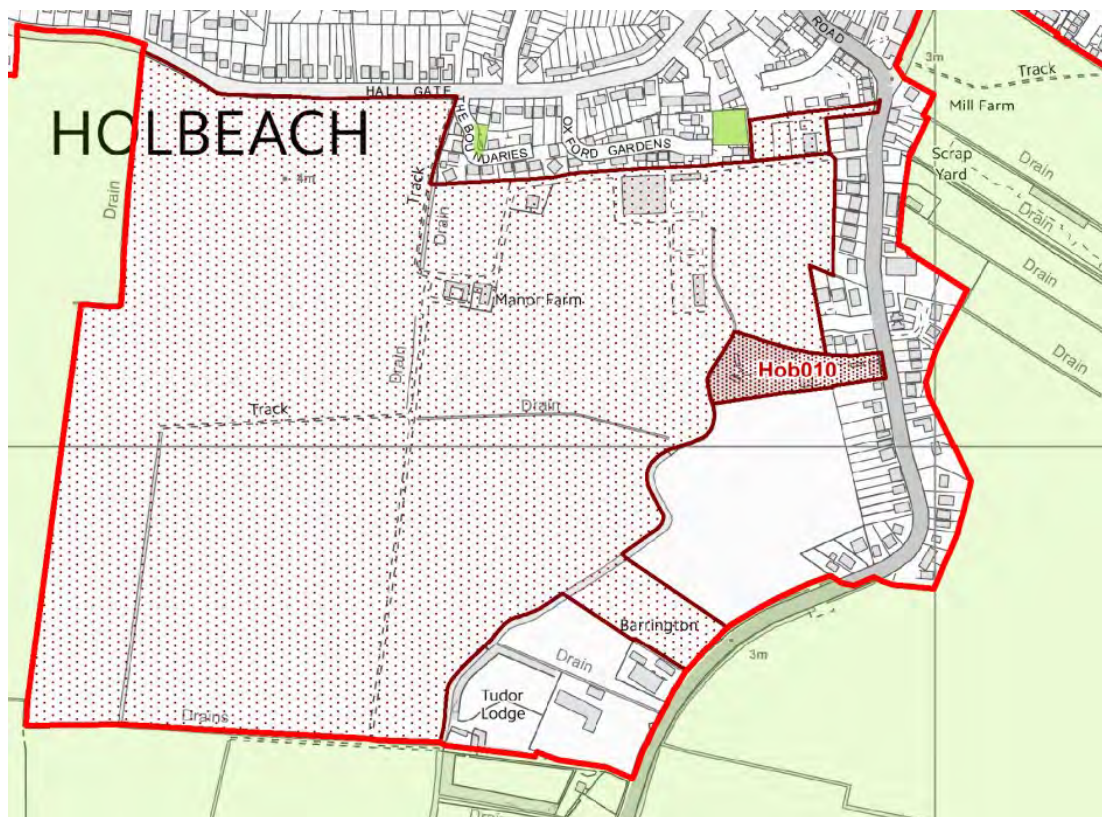
3.3 Anglian Water (AW)

- 3.3.1 Anglian Water have been consulted and have provided a Pre-Planning Assessment Report for used water (Ref:PPE-0122675 Published 24.05.21).
- 3.3.2 The report concludes that the water recycling centre is Holbeach Recycling Centre which currently does not have capacity to treat the flows from the development site. Anglian Water are obligated to accept the foul flows from the development with the benefit of planning consent and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the planning authority grant planning permission.
- 3.3.3 In terms of the used water sewer network the nearest practicable connection point is to the 150mm diameter sewer at manhole 9802 in Fen Road. Anglian Water have assessed a pumped connection to this manhole and confirm that the foul sewerage system, as present, has capacity for the development site. Connection of the rising main to the existing adopted system will need to be by an intermediate manhole positioned such that at least 5m of appropriately sized gravity sewer between the rising main outfall and the existing adopted sewer is provided.

4 SEQUENTIAL AND EXCEPTION TESTS

4.1 Sequential Test

- 4.1.1 The site has been assessed in line with the NPPF and the South East Lincolnshire SFRA with regard to assessment of which flood zone the site is contained within.
- 4.1.2 The site is located within Flood Zone 3 High Probability.
- 4.1.3 The site is identified as part of a wider site of housing commitment (Policy 11)



- 4.1.4 Policy 11 refers to the distribution of new housing. Holbeach allocations amount to approximately 2202 in the local plan period.
- 4.1.5 As the land is identified as 'housing commitment' in the adopted local plan, it is deemed that the Sequential Test is passed and requires no further assessment in terms of the Sequential Test.

4.2 Exception Test

- 4.2.1 The Exception Test is applied as the development site sits within the flood map for planning Flood Zone 3.
- 4.2.2 Mitigation measures applied to this site to pass the exception test are in line with the Environment Agency Standing advice with regards to finished floor levels of the proposed dwellings being raised a minimum of 300mm above existing site levels.
- 4.2.3 With the proposed mitigation measures proposed it is considered that the development is safe and passes the exception test.

5 PROPOSED DEVELOPMENT

5.1 Summary of proposals

- 5.1.1 The development proposals consist of 38 new dwellings with associated highway, footways, sustainable drainage, and surface water attenuation. The development site overlaps the already consented planning permission for 10 dwellings immediately to the north of this development.
- 5.1.2 Essentially the development replaces 5no of the already consented dwellings and replaces these with a new vehicular access to this phase 2 development and 7 dwellings in the overlap area.
- 5.1.3 The development will increase impermeable areas by 4,110m² (0.411Ha) based upon the site layout contained in Appendix A.
- 5.1.4 Initial consultations have been held with the South Holland IDB who have confirmed that the maximum surface water discharge rate they will allow from this development site is 5 l/s.
- 5.1.5 There is very low potential for the use of infiltration on this site, A combined phase 1 and 2 site investigation report has been undertaken for this site which concludes the site is unlikely to be suitable for the use of soakaways due to the anticipated relatively low permeability of the near surface natural strata across the site.
- 5.1.6 Therefore, in line with the hierarchy of surface water drainage outfall methods, as infiltration is not viable then outfall to a watercourse is the next sustainable approach to discharge surface water.

5.2 Proposed Drainage Strategy

- 5.2.1 The surface water drainage strategy for this site is shown on drawing MA11419/200 contained in Appendix A.
- 5.2.2 The proposals for the development apply the sustainable drainage standards for the adopted highways for the development by utilising a roadside filter strip in accordance with LCC specification figure 5/11 to collect the water from the adopted highway into an underdrain (filter material and pipework to be adopted and maintained by Anglian Water through a S104 approval process). The LCC specification states in clause 1.1.21 that filter drains will be accepted on Major, minor and shared surface roads. The scale of this development essentially falls within these road hierarchy categories, The carriageway area and the filter drain grass would be adopted and maintained by Lincolnshire County Council through a S38 adoption process.
- 5.2.3 The surface water will be collected via driveway gullies and linear drainage, roof water via down pipes and adopted roads via the filter drains. The surface water is then conveyed to the flow control with an offline attenuation pond where flows are proposed to be restricted to 5 l/s which is the minimum viable discharge rate agreed with the South Holland IDB.
- 5.2.4 The surface water drainage system is designed to accommodate a 1 in 100 year plus 40% climate change event (including 6% urban creep allowance) whilst not exceeding the maximum 5 l/s discharge rate. Hydraulic calculations are contained within Appendix E.
- 5.2.5 The surface water drainage strategy provides the minimum 1 treatment train for roof areas and two treatment trains for the roads in line with CIRIA C697.
- 5.2.6 The IDB maintained watercourse has a 9m easement and no proposed dwellings, above ground structures or fence lines are proposed within this 9m easement.
- 5.2.7 The formal consent of the IDB will be required for any works within 9m of the watercourse and construction of any new surface water outfall into the watercourse system, This would be undertaken as part of the detailed design of the development.

- 5.2.8 Foul drainage is proposed to connect into the adjoining S104 approved foul network for the adjacent approved development. Whilst the pre development enquiry confirms that the approved connection point for this site is to be MH 9802 in Fen Road. The proposed connection point still ultimately connects into the same adopted manhole but utilises the drainage to be installed as part of the other phase which is offline from the existing Fen Road carriageway. Therefore, this reduces the number of physical connections to the existing AW adopted manhole (9802) and reduces the excavation work required in Fen Road to the benefit of all.
- 5.2.9 Due to site levels, the foul drainage will require to be pumped from the site to the intended connection point adjacent to Fen Road. A type 1 pump station is situated to the south eastern corner of the site.
- 5.2.10 A type 1 pump station is proposed on this site as 16 no proposed dwellings are proposed to be drained via private gravity sewers originally designed as part of the phase 1 proposals. This leaves 22 dwellings to be discharged via a pumped foul system. Anglian Waters local practice for pumping stations (Effective as of 22nd June 2020) confirms that in order to achieve consistency between flow assessments made as part of the pre planning process and adoptable pumping stations delivered by developers, the following actual water consumption figures should be used to calculate the dry weather flow. This reduces pump sizes, reduced power costs, smaller rising mains and lower emergency storage requirement.
- 5.2.11 Using the AW pump station local practice, the dry weather flow amounts to 0.2 l/s peak flow, less than 0.25 l/s therefore a Type 1 Pump station can apply here with a stand off distance of 5m in accordance with the SSG.

6 FLOOD RISK

6.1 Flooding From Fluvial and Tidal Sources

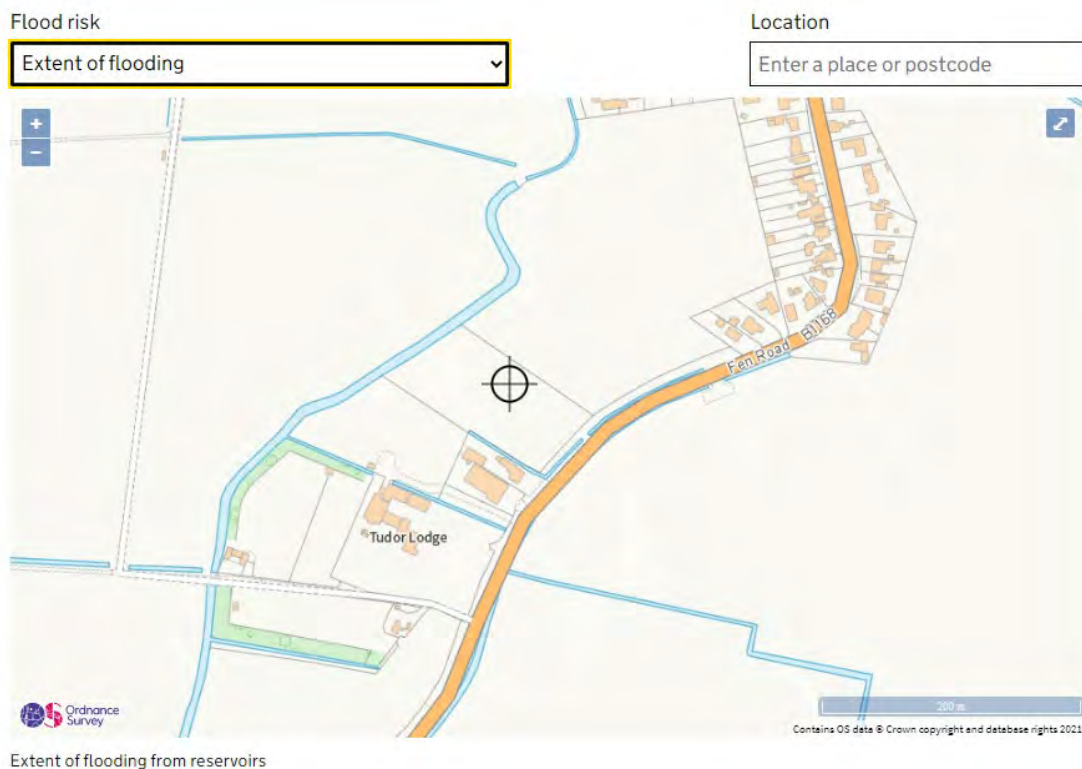
- 6.1.1 The development area is shown within Flood Zone 3 following detailed review of the EA and SFRA maps, which means the land has 1 in 100 chance or greater annual probability of flooding from river (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
- 6.1.2 The SFRA hazard mapping extract shows the development site to be within 'Low Hazard' Rating area. (Extract from plan Residual Flood Hazard Year 2115 1% Fluvial / 0.5% Tidal Event Probability) February 2017.
- 6.1.3 Holbeach is defended by significant tidal flood defences (South bank of the River Welland, North bank of the River Nene and alongside the coast) and whilst the Flood Zone is 3a this does not take into account the presence of these flood defences.
- 6.1.4 As the risk of flooding from the EA flood map for planning is considered **HIGH** there are mitigation measures applied to this development in terms of minimum finished floor levels confirmed at 300mm above existing ground levels to reduce the residual risk of flooding from this source.

6.2 Flooding from Land / Adjacent Development

- 6.2.1 The main risk of flooding to this site from this source is from adjacent land to the north south and east.
- 6.2.2 Any overland flow from the north is highly unlikely as the residential development to the north has been designed to accommodate the 1 in 100 year plus climate change event scenario as part of a previously approved scheme. Therefore, the risk of flooding from the north is considered **LOW**.
- 6.2.3 Land to the east of the site (Fen Road and the land beyond) is flat in terms of topography and there are existing ditches running parallel with the road. Therefore, any overland flow would be intercepted by the drainage ditches. If the ditches were to fill and overflow, the water would be shallow and slow moving. FFLs on the site will be raised so there should be minimal risk to the development.
- 6.2.4 Therefore, the overall risk of flooding from this source is considered to be **LOW**.

6.3 Flooding From Infrastructure Failure

- 6.3.1 The site is not within an area deemed to be at risk of flooding from reservoirs (according to the data on the EA website) as per the below extract.



- 6.3.2 As the site is outside the limits of any deemed flood extents from reservoir failure, the risk of flooding to the site is considered **LOW**.

6.4 Flooding From Groundwater

- 6.4.1 There are no confirmed records of groundwater flooding in the vicinity of the site in the SFRA. Groundwater levels could be relatively shallow in this area as its close to a watercourse. However, as site levels are due to be raised the residual risk from flooding from this source is considered **LOW**.

6.5 Flooding From Sewers

- 6.5.1 It is very well documented that the existing sewer network in Holbeach is essentially close to or exceeding capacity. Therefore, there is a residual risk of flooding to deal with.
- 6.5.2 The proposed FFL's are anticipated to be higher than the cover levels of the sewers in Fen Road, hence reducing the risk of flooding from infrastructure.
- 6.5.3 Flow velocities and depths are expected to be relatively slow and shallow respectively towards the site and likely to be constrained within the carriageways initially then directed into the IDB maintained drains realistically.
- 6.5.4 Overall taking into account the proximity of the sewers and topography of the area, the risk of flooding from this source is considered to be **LOW**.
- 6.5.5 However, mitigation measures are proposed as part of measures to counteract other sources of flooding which will essentially reduce any likelihood of flooding of properties on the site from this source.

6.6 Flooding From Climate Change

- 6.6.1 The site is within the Anglian river basin district and the development is classed as more vulnerable. The higher central and upper end allowances should be used in accordance with the latest climate change guidance.
- 6.6.2 Using the table 2 in the latest government guidance for climate change for the Anglian river basin district a maximum climate change allowance is 40% for peak rainfall intensity. This would apply to the proposed surface water drainage system.
- 6.6.3 Flooding from watercourses or the sea is already taken into account with the raised finished floor levels of the dwellings based upon the 2115 forecast of flood extents and depth in the South East Lincolnshire SFRA.
- 6.6.4 Overall, the residual risk of flooding from this source is considered to be **LOW** bearing in mind the raised finished floor levels of the proposed dwellings and the proposed surface water drainage designed to accommodate the 1 in 100 year plus 40% climate change events plus 6% urban creep.

6.7 Off-Site Flood Risks

- 6.7.1 The site proposals increase the impermeable areas within the site; therefore, the proposals for the surface water drainage for the site will be designed to accommodate the 1 in 100 year plus 40% climate change event without flooding.
- 6.7.2 Consideration at the detailed design stage will be given to either a land drain / land drains to intercept any surface water flow from the site which may approach the adjacent or existing site boundaries where there are gardens to the north-east of the site boundary. This would be reviewed at detailed design stage once final proposed floor levels, layout and finished level contours are produced to confirm any flow routes.
- 6.7.3 With regard to flood risk to adjacent areas, the residual risk is considered to be **LOW**.

7 MITIGATION MEASURES

7.1 Essential Mitigation Measures

- 7.1.1 The assessment of flood risk in Section 7 of this assessment confirms a **HIGH** risk of flooding from Fluvial / Tidal, sewers and climate change. There is a **LOW** risk of flooding from all other sources including infrastructure failure, groundwater and off site risks.
- 7.1.2 Therefore, there are several essential mitigation measures to be applied as part of the development.
- 7.1.3 Finished floor levels of the dwellings are to be set a minimum of 300mm higher than the existing ground level in accordance with the EA standing advice.
- 7.1.4 Surface water drainage for the site must be designed to accommodate the 1 in 100 year event storm scenarios including a 40% allowance for climate change without any flood waters leaving the development site and no flood waters leave the site boundary.

7.2 Recommended Mitigation Measures

- 7.2.1 All dwellings should have concrete ground floor slabs.
- 7.2.2 The site is within the Environment Agency Flood Warning area and the properties should be signed up to this warning service;

[Sign up for flood warnings - GOV.UK \(www.gov.uk\)](https://www.gov.uk/sign-up-for-flood-warnings)
- 7.2.3 It is recommended that FFL to properties should be above any adjacent roads levels where possible.
- 7.2.4 Where external gradients are flat or towards the dwelling entrances, provision of linear drainage should be provided to the level threshold access points only.
- 7.2.5 Plaster work at ground floor to be laid with the boarding horizontal which allows for easy replacement at the lower level without excessive breaking out or cutting of plasterboard.

8 CONCLUSIONS

- 8.1 This Flood Risk Assessment serves to review, assess and quantify (where applicable) the sources, or any potential flooding, the pathways of this flooding and potential receptors within the vicinity of the site.
- 8.2 The assessment of flood risk in Section 7 of this assessment confirms a **HIGH** risk of flooding from Fluvial / Tidal, sewers and climate change. There is a **LOW** risk of flooding from adjacent land, infrastructure failure, groundwater and off site.
- 8.3 The mitigation measures will provide further protection to the development and reduce any residual risk (however low) as far as practicable. It is recommended that compliance with the recommendations of this FRA are conditioned as part of any planning permission.
- 8.4 This assessment concludes that the site is suitable for development for residential use without unacceptable risk of flooding from all sources to the site itself and elsewhere for the lifetime of the development.

Appendix A – Drawings

MA11419/100: Site Location Plan

MA11419/200: Proposed Drainage Strategy



ASSOCIATED DRAWINGS	
No.	TITLE

NOTES	

REV	DATE	BY	DETAILS	CHKD
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AMENDMENTS	
CLIENT	

PROJECT	Fen Road Phase 2 Holbeach Lincolnshire
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TITLE	Site Location Plan
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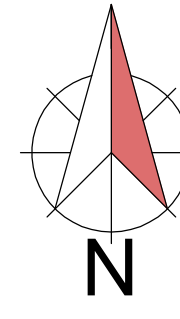
DRAWING No:	MA11419-100	DRAWING STATUS	PRELIMINARY
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SCALE	NTS @A1	DRAWN	JMcK	ENGINEER	JMcK
DATE	25/06/21	CHECKED	JMcK	APPROVED BY	JMcK



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ASSOCIATED DRAWINGS	
No.	TITLE

NOTES	

REV	DATE	BY	DETAILS	CHKD

CLIENT

PROJECT

**Fen Road Phase 2
Holbeach**

TITLE

**Proposed Foul & Surface Water
Drainage Strategy**

DRAWING No. MA11419-200

DRAWING STATUS

PLANNING

SCALE 1:250 AT A3

DATE June 2021

DRAWN JMK

CHECKED JMK

ENGINEER JMK

APPROVED BY JMK

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Ashwood
different through Design

Appendix B – Consultations

Environment Agency Flood Map For Planning Anglian Water Pre Development Enquiry Report IDB Discharge Confirmation

Flood map for planning

Your reference
MA11419

Location (easting/northing)
535719/323838

Created
25 Jun 2021 10:37

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

This means:

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

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Flood map for planning

Your reference

MA11419

Location (easting/northing)

535719/323838

Scale

1:2500

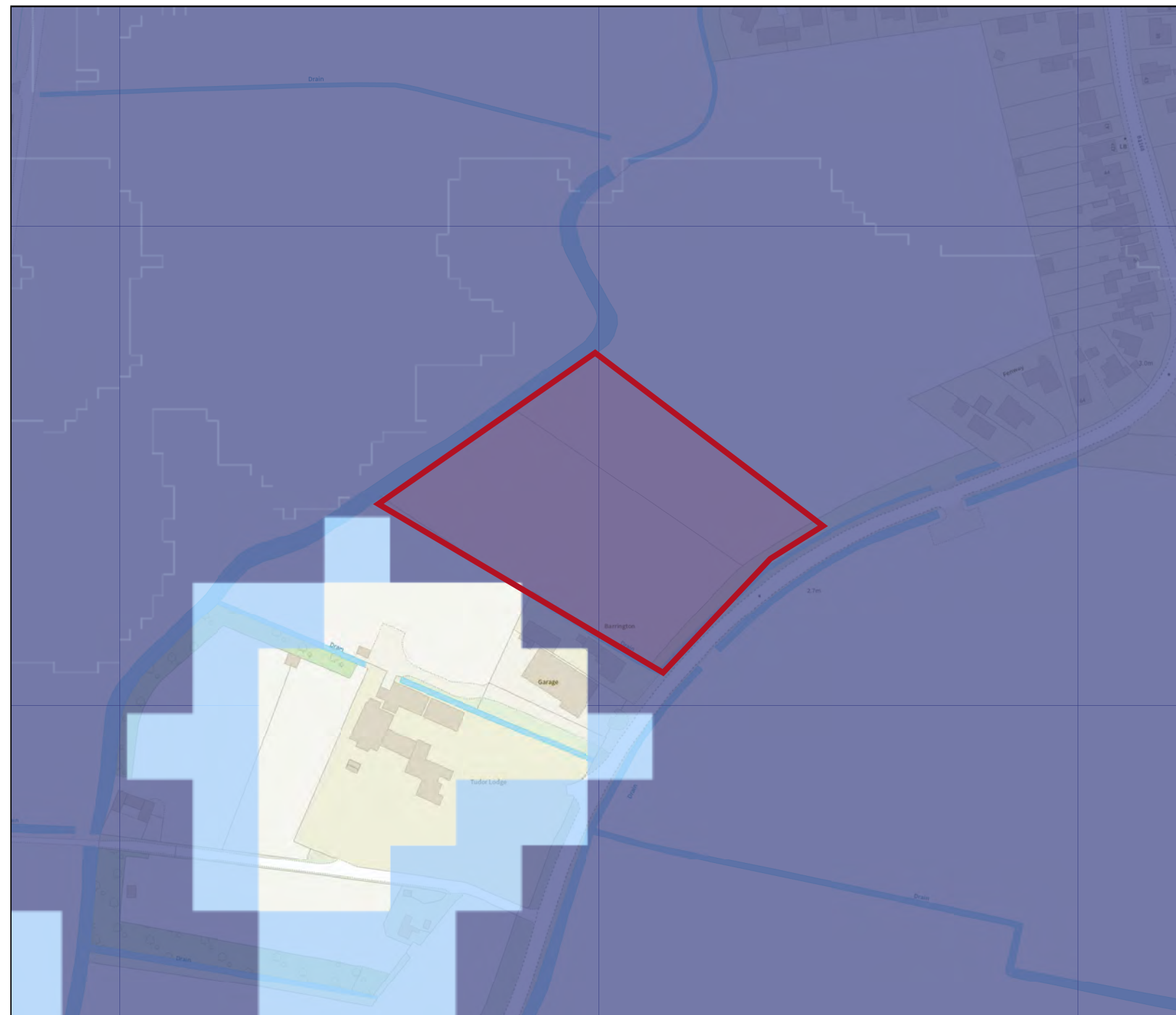
Created

25 Jun 2021 10:37

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

0 20 40 60m

Page 2 of 2





Pre-Planning Assessment Report

Fen Road Phase 2

InFlow Reference: PPE-0122675

Assessment Type: Used Water

Report published: 24/05/2021



Thank you for submitting a pre-planning enquiry.

This has been produced for Millward.

Your reference number is **PPE-0122675**.

This report can be submitted as a drainage strategy for the development should it seek planning permission.

If you have any questions upon receipt of this report, you can submit a further question via InFlow. Alternatively, please contact the Planning & Capacity team on **07929 786 955** or email planningliaison@anglianwater.co.uk

Section 1 - Proposed development

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	No. Of units
Dwellings	29

The anticipated residential build rate is:

Year	Y1
Build rate	29

Development type: Greenfield
Planning application status: Unknown
Site grid reference number: TF3571423832

The comments contained within this report relate to the public water mains and sewers indicated on our records.

Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2 - Assets affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used water easement information		
Asset type	Pipe size (mm)	Total easement required (m)
Water mains	514	9.00 m either side of the centre line
Water mains	Unknown	3.00 m either side of the centre line
Water mains	514	9.00 m either side of the centre line

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3 - Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and effluent quality arising from your development.

Water recycling centre

The foul drainage from this development is in the catchment of Holbeach Water Recycling Centre, which currently does not have capacity to treat the flows from your development site. Anglian Water are obligated to accept the foul flows from your development with the benefit of planning consent and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the planning authority grant planning permission.

Used water network

Our assessment has been based on development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from of the point of connection, including making the connection to our existing network. This connection point has been determined in reference to the calculated discharge flow and on this basis, a 150mm internal diameter pipe is required to drain the development site. The nearest practicable connection is to the 150mm diameter sewer at manhole 9802 in Fen Road at National Grid Reference NGR TF3590323856. The cover level is 3.06 and the invert level is 1.58. Anglian Water has assessed the impact of a pumped conveyance from the planned development to the public foul sewerage network and we can confirm that this connection is acceptable as the foul sewerage system, at present, has available capacity for your site. In line with Sewers for Adoption, the pumped discharge will need to connect via an intermediate manhole and at least 5 metres of an appropriately sized gravity sewer. The pump rate and configuration of the connection will be determined with your detailed design. You should submit this detail with your Section 106 new connection application. Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

You indicated on the Pre-Planning Application form that a connection to the public surface water sewer network is not required as infiltration and a connection to a watercourse is to be utilised. A new surface water sewer can be used as a mechanism to discharge surface water to a watercourse or as part of a Suds scheme where appropriate. Subject to the sewer being designed in accordance with the current version of Sewers For Adoption, the sewer can be put forward for adoption by Anglian Water under Section 104 of the Water Industry Act 1991. If the outfall is to a watercourse, the applicant will be required to obtain consent to discharge via the appropriate body. Therefore a capacity assessment has not been made on the public surface water network. However, should this situation change and you wish to have a surface water connection assessment on the local network, then we will provide this free of charge if requested within 12 months of this report and you are able to provide the relevant evidence that your original strategy was unviable.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our [website](#). We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating that the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our [website](#)

As the proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

Your development site will be required to pay an infrastructure charge for each new property connecting to the public sewer that benefits from Full planning permission.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

Payment of the infrastructure charge must be made before premises are connected to the public sewer.

Infrastructure charge for water recycling:	£ 573.00
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The Water Recycling Infrastructure charge for your dwellings is:

Infrastructure charge	Number of units	Total
£ 573.00	29	£ 16617

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non- household premises, the fixed element is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge.

Details of the relevant multiplier for each fitting can be found at our [website](#).

It has been assumed that the onsite used water network will be provided under Section 104 of the Water Industry Act

It is recommended that you also budget for connection costs.

Please note that we offer alternative types of connections depending on your needs and these costs are available at our [website](#).

Section 4 - Map of Proposed Connection Points



Figure 1: Showing your used water point of connection

Section 5 - Useful information

Water Industry Act – Key used water sections

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our [website](#) or via our Development Services team on **0345 60 66 087**.

Sustainable drainage systems

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. .

Our preferred method of surface water disposal is through the use of Sustainable Drainage Systems or SuDS.

SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our [website](#)

We recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for your site to discuss your application.

Private sewer transfers

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

Surface water sewers and lateral drains that do not discharge to the public sewer, e.g. those that discharged to a watercourse.

Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.

Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

It is anticipated that all new sewer applications will need to have an approved Section 104 application ahead of a Section 106 connection

Encroachment

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our [website](#)

Locating our assets

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from [digdat](#)

All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge.

We have more information on our [website](#)

Charging arrangements

Our charging arrangements and summary for this year's water and used water connection and infrastructure charges can be found on our [website](#)

Section 6 - Disclaimer

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content. Furthermore, in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid for the date printed and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s).

Jason McKellar

From: Planning <planning@wlma.org.uk>
Sent: 22 March 2021 08:47
To: Jason McKellar
Subject: RE: Fen Road Holbeach Additional Development Area

Good morning Jason,

I have consulted the South Holland IDB team with your proposed discharge figures. There is no possibility of a maximum rate of 9 l/s being allowed from this site. The Board has to take into account the cumulative effect of the various developments which will all have an impact on the Holbeach Old River sub-catchment. This proposed site would need a flow control device limited to no more than 5 l/s.

I trust that this information is of help.

Kind regards,
Philippa

Philippa Noon

Senior Sustainable Development Officer

t: +44 (0)7733 105048 | e: philippa.noon@wlma.org.uk | e: planning@wlma.org.uk



Water Management Alliance

Kettlewell House, Austin Fields Industrial Estate, King's Lynn, Norfolk, [PE30 1PH](http://www.pe301ph.co.uk), UK

t: +44 (0)1553 819600 | f: +44 (0)1553 819639 | e: info@wlma.org.uk | www.wlma.org.uk

Membership: [Broads Drainage Board](#), [East Suffolk Drainage Board](#), [King's Lynn Drainage Board](#), [Norfolk Rivers Drainage Board](#), [South Holland Drainage Board](#) and [Waveney, Lower Yare and Lothingland IDB](#).
In association with [Pevensey and Cuckmere Water Level Management Board](#), [Upper Medway IDB](#) and [Lower Medway IDB](#).

The information in this e-mail, and any attachments, is confidential and intended solely for the use of the individual or entity to whom it is addressed. The views expressed in this e-mail may not represent those of the Board(s). Nothing in this email message amounts to a contractual or legal commitment unless confirmed by a signed communication. All inbound and outbound emails may be monitored and recorded. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for any litigation. E-mail messages and attachments sent to or from the Water Management Alliance e-mail address may also be accessed by someone other than the sender or recipient, for business purposes.

With our commitment to ISO 14001, please consider the environment before printing this e-mail.

From: Jason McKellar <jason@millward.co.uk>
Sent: 17 March 2021 10:50
To: Philippa Noon <Philippa.Noon@wlma.org.uk>
Subject: Fen Road Holbeach Additional Development Area
Importance: High

Hi Philippa,

Hope you are well.

We are looking at a feasibility of some additional development just south of the Fen 10 development location as outlined below.

Site area is circa 0.9Ha additional development area.

In terms of a surface water outfall from this development into the IDB drain, 1.4 l/s/ha would not be viable to control to 1.26 l/s.

Therefore we would be looking at a surface water discharge rate of 10l/s/ha in principle meaning an outfall rate of 9l/s from this parcel of land.

Subject to a formal application is this rate acceptable or would you insist on a rate below what I am proposing? Just after a bit of informal guidance as to what your constraints would be in this location.



Kind Regards



Jason McKellar – MIHE
Director

Mobile 07817 831 742
email jason@millward.co.uk
web www.millward.co.uk

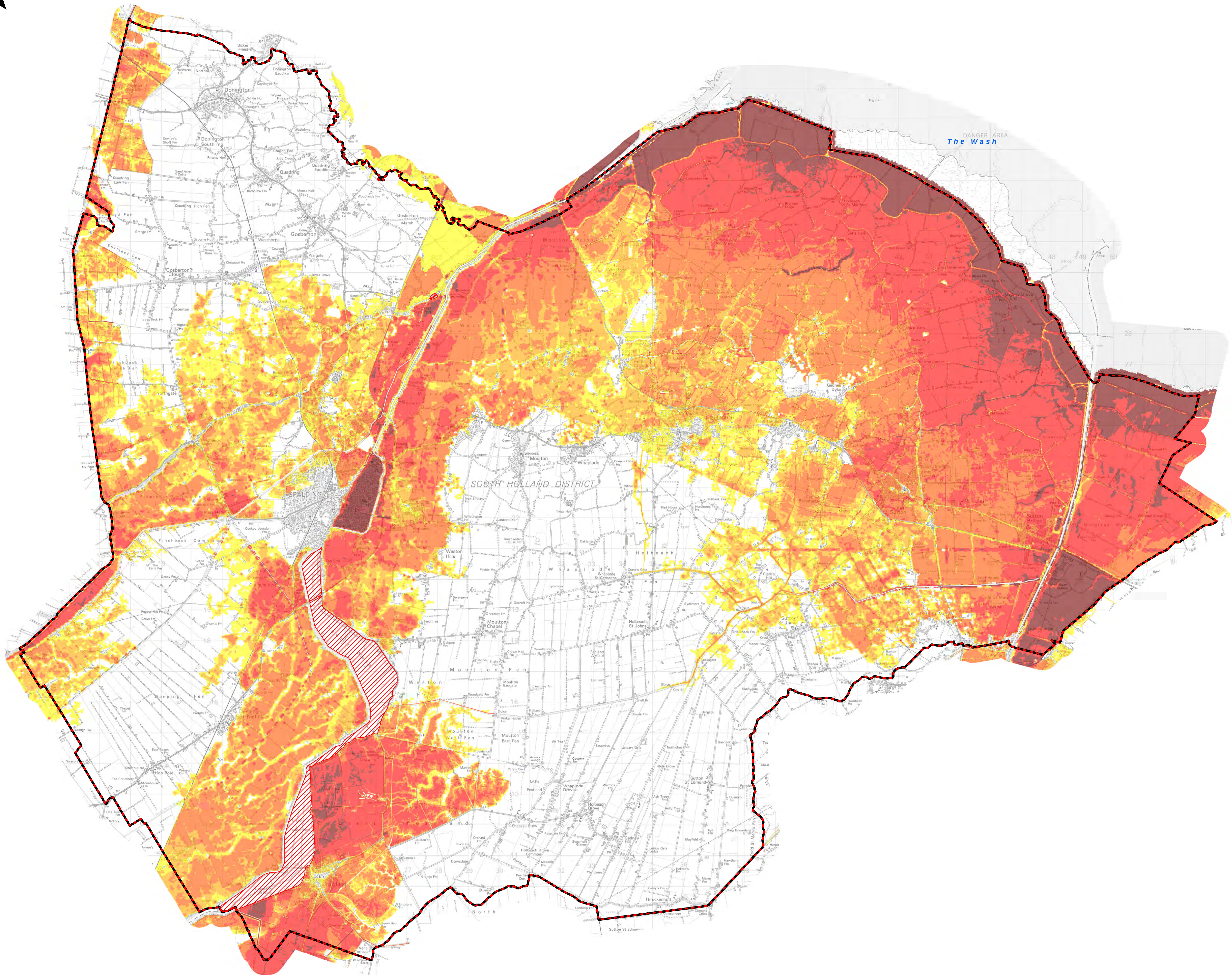
Linked in /// Facebook /// Twitter
1 Malin Hill, Nottingham NG1 1JQ Tel **0115 941 4560**



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Appendix C – South East Lincolnshire SFRA

Plan Extracts

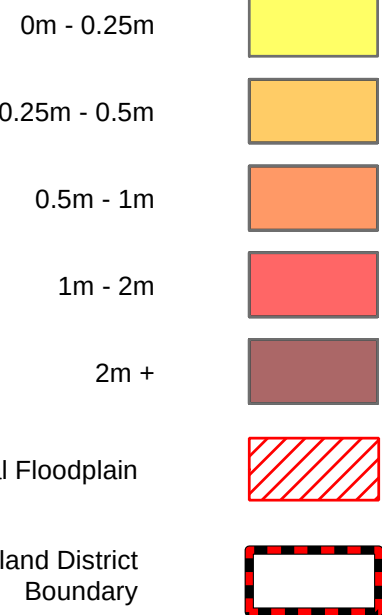


NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.
2. This update only included new flood risk information from River Welland (Fluvial), River Glen (Fluvial) and Tidal hazard mapping (River Welland, River Nene and the Wash sea defences). No new information from the Internal Drainage Boards and associated systems was used for this update.
3. In addition to the potential flood extents shown on this map, there may be shallow flooding in low-lying rural areas
4. The consequences designated as being a Residual Risk arise from direct overtopping of defences, where this would occur, together with breach failure which is assumed could occur at any point along the defences.
5. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.
6. Land outside South Holland District is not considered.
7. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Peak Depth



2	Feb 17	Modelling and Mapping Update
1	Dec 16	Modelling and Mapping Update
REV	DATE	REMARKS

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COUNCIL OFFICES
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SPALDING
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PE11 2XE

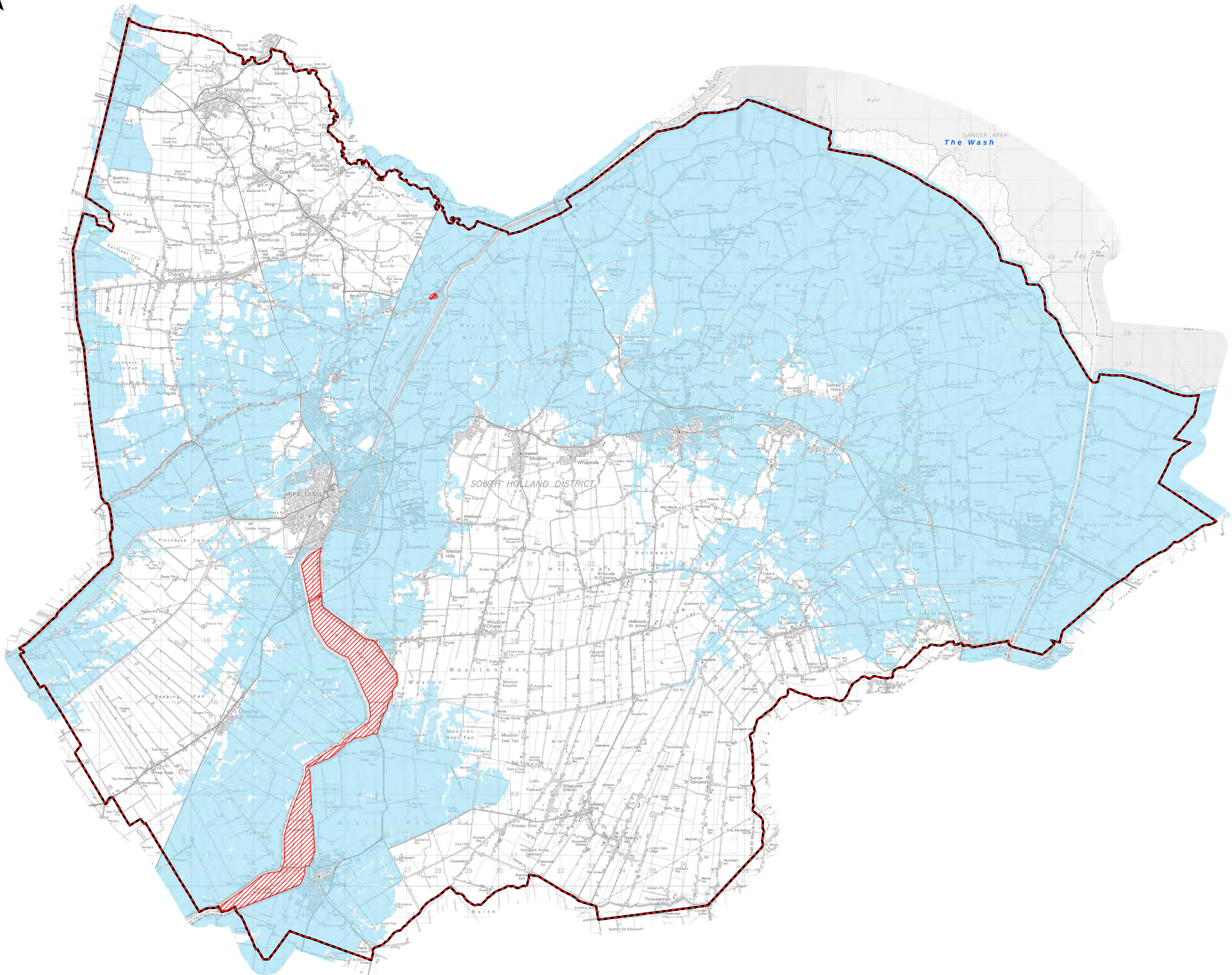
UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

**Residual Peak Depth
District - Year 2115
1% Fluvial / 0.5% Tidal Event Probability**

DATE OF ISSUE: Feb 2017 REV NO: 2

SCALE:
1 : 60,000 @ A1

MAP NO:



NOTES

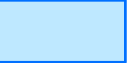
1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.
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3. In addition to the potential flood extents shown on this map, there may be shallow flooding in low-lying rural areas.
4. The consequences designated as being a Residual Risk arise from direct overtopping of defences, where this would occur, together with breach failure which is assumed could occur at any point along the defences.
5. The potential flooding consequences relate to flood probability bandings as follows:

Probability Band	Annual probability of Flooding	
	from a river (fluvial)	from the sea (tidal)
Low	<0.1%	<0.1%
Medium	1%-0.1%	0.5%-0.1%
High	>1%	>0.5%

6. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.
7. Land outside South Holland District is not considered.
8. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Flooding Probability bands :

- High 
- Low or medium, but reliant on protection by flood defences for this standard 
- Functional Floodplain 
- South Holland District Boundary 

2	Feb 17	Modelling and Mapping Update
1	Dec 16	Modelling and Mapping Update
REV	DATE	REMARKS

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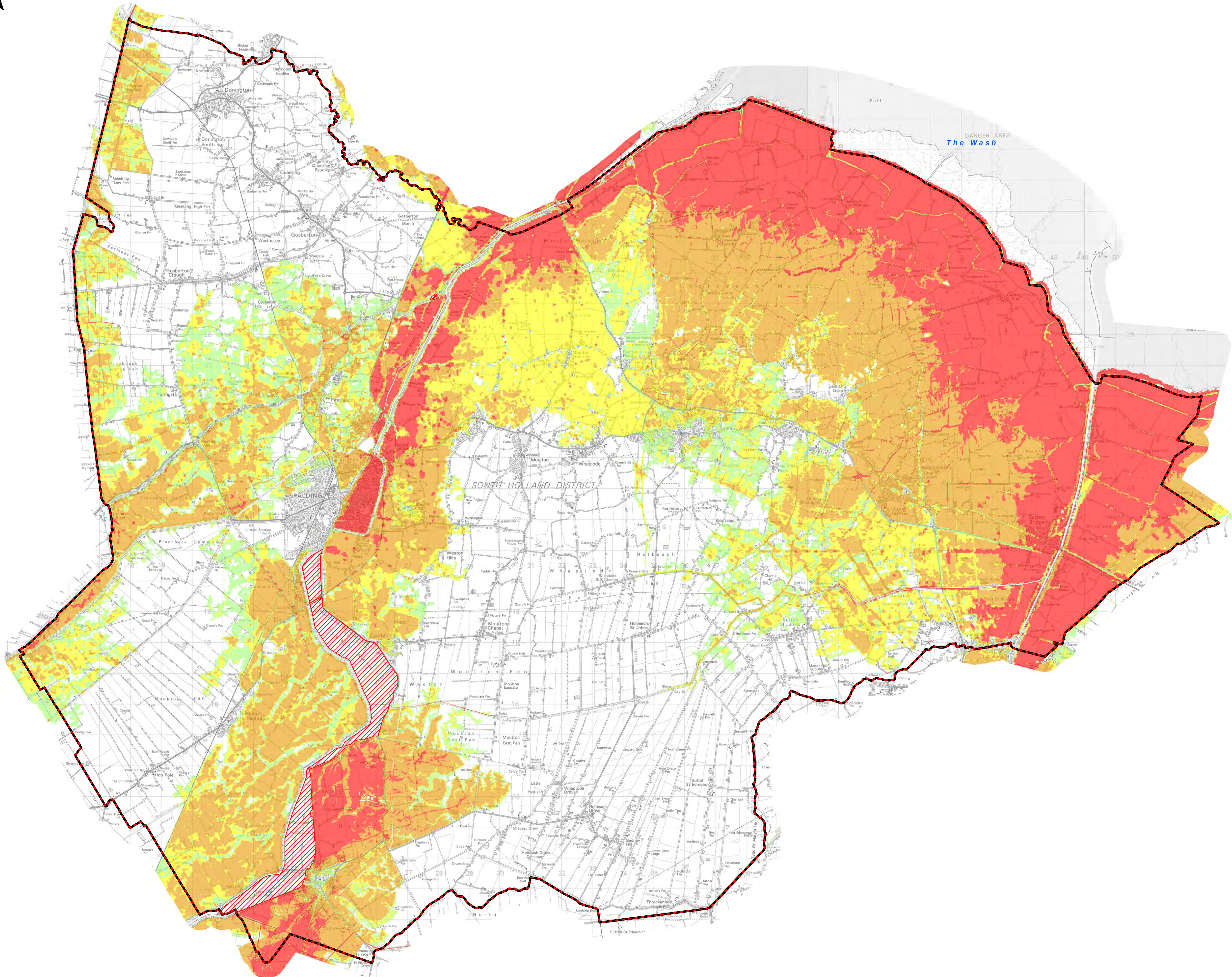
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UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Risk Extent
District - Year 2115
1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017	REV NO: 2
SCALE: 1 : 60,000 @ A1	MAP NO:



NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.
2. This update only included new flood risk information from River Welland (Fluvial), River Glen (Fluvial) and Tidal hazard mapping (River Welland, River Nene and the Wash sea defences). No new information from the Internal Drainage Boards and associated systems was used for this update.
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5. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.
6. Land outside South Holland District is not considered.
7. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Max Hazard
(Flood Risk to People : FD2320)

Less than 0.75 (Low Hazard)	
Between 0.75 and 1.25 (Danger for Some)	
Between 1.25 and 2.0 (Danger for Most)	
Greater than 2.0 (Danger for All)	

Functional Floodplain

South Holland District Boundary

2	Feb 17	Modelling and Mapping Update
1	Dec 16	Modelling and Mapping Update
REV	DATE	REMARKS
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UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT

Residual Flood Hazard
District - Year 2115
1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017	REV NO: 2
SCALE: 1 : 60,000 @ A1	MAP NO:

Appendix D – Site Investigation

Relevant Extracts relating to infiltration.



Geotechnical &
Environmental
Consultants

Fen Road 10 Plus
Holbeach

**Combined Phase I Desk Study &
Phase II Exploratory Investigation
For
Ashwood Homes**



GeoDyne Limited
9 Brunel Parkway, Pride Park
Derby DE4 8HR

Tel: 01332 290 798 email: info@geodyne.co.uk

EXECUTIVE SUMMARY

GEOTECHNICAL CONSIDERATIONS	
Ground Conditions	TOPSOIL with an average thickness of approximately 0.25m overlying firm SILT to depths of between 0.70m and 2.00m begl. Firm silty CLAY was encountered underlying the Silt which reduced in strength with increased depth, becoming soft below depths of between 1.35m and 2.15m begl, and becoming very soft below depths of between 2.00m and 2.90m begl.
Foundation Design	Structural Engineer designed strip or raft foundations, or potentially piles.
Floor Slab Design	Where strip foundations are considered appropriate, ground bearing floor slabs may be adopted provided that there is less than 0.60m of suitably compacted geotechnically competent sub-slab fill and subject to the requirements of NHBC Chapter 4.2. Where in excess of 0.60m of sub-slab fill is present, a suspended slab may be adopted.
Ground Gas	No precautions required.
Radon	No precautions required.
Building Near Trees	Foundation designs may need to be locally adjusted where building near existing, proposed or recently removed trees and hedgerows. Soils of high volume change potential should be assumed for design purposes.
Water	Water seepages may be encountered within excavations for construction purposes at the site and dewatering of excavations may be necessary.
Excavations / Stability	Excavations deeper than approximately 2.00m begl are likely to require trench support for health and safety reasons. The assessment of excavations and provision of support will be the responsibility of the contractor on site
Sulphate Classification	DS1 – AC1s.
Coal Mining	No precautions required.
CBRs	The remoulded soaked CBR testing has revealed CBR values for the Natural Strata ranging between 0.6% and 2.5%. No frost susceptible material should be within 450mm of the ground surface in road construction.
Surface Water Drainage	The site is unlikely to be suitable for the use of soakaways.
ENVIRONMENTAL CONSIDERATIONS	
Soil Contamination Assessment	The soils may be considered to be uncontaminated for the proposed end-use (i.e. in relation to human health). There are considered to be no specific risks posed to Controlled Waters by the findings of the laboratory analysis undertaken.
Remediation Proposals	No specific remediation works anticipated.
GENERAL CONSIDERATIONS	
Construction Workers	A copy of this report should be included in the site health and safety file, and site workers should be made fully aware of the sites setting.
Utilities	Prior to development of the site, we would recommend that a copy of this report is supplied to utility companies, and that their recommendations relating to appropriate supply pipes are adhered to.
Unforeseen Circumstances	Should any areas of potentially contaminated soil be encountered during site construction works we would recommend consultation with GeoDyne to ensure that our recommendations continue to apply.
Licences etc	The Contractor / Developer is responsible for, and must ensure that, all necessary licences, permits, plans, registrations and approvals are in place prior to commencing with the construction works at the site.
Statutory Consultation	In accordance with normal planning requirements, we would recommend that a copy of our report is issued by the Client to the Local Authority (and NHBC or other Warranty Provider, if necessary) for review / comment and approval prior to commencing with the development of the site.

9.2.12 Surface Water Drainage

The use of traditional soakaways is not recommended due to the anticipated relatively low permeability of the near surface Natural Strata across the site. Therefore, at this stage, it is recommended that alternative methods of surface water drainage should be investigated.

9.3 Environmental Considerations

9.3.1 Soil Contamination Assessment

Human Health

On the basis of the chemical contamination assessment undertaken, the soils may be considered to be uncontaminated for the proposed end-use (i.e. in relation to human health).

Controlled Waters

Given the low contaminant concentrations revealed by the testing, there are considered to be no specific risks posed to Controlled Waters by the findings of the laboratory analysis undertaken.

9.3.2 Remediation Proposals / Re-Use of Soils

Human Health

No specific remediation works will be required other than the provision of suitable topsoil in proposed gardens to provide a suitable growing media for plants. As the existing topsoil is considered suitable for re-use at the site (based on laboratory testing), it is considered unlikely that there will be a requirement to import topsoil. Should there be a requirement to import topsoil to the site, all topsoil should be tested at source to ensure it is suitably clean (prior to importation) in accordance with CLEA / generic guidance. The topsoil should also conform to BS3882: 2015 '*Specification for topsoil*', with respect to the presence of foreign objects, and ideally nutrient levels etc. The results of the chemical analysis for any topsoil proposed for importation should be forwarded to the Local Authority (Environmental Health Officer) for approval (prior to importation).

Controlled Waters

No specific remediation in relation to Controlled Waters is considered to be necessary at the site on the basis of the available information.

Off-Site Disposal

Excess uncontaminated soils (for example underlying Natural Strata) should be regarded as a potential asset and we would recommend that the re-use of excess uncontaminated soils on site or off-site is investigated in the first instance (subject to appropriate permits, plans and registrations etc).

The Natural Strata may be regarded as suitable for re-use within proposed garden areas as subsoil (to raise levels, as appropriate) or for landscaping / capping on alternative developments (subject to regulatory approval and the production of any necessary plans or permits) where surplus arisings are generated from the site and adequate control measures are in place.

Appendix E – Calculations

Preliminary hydraulic model

The Millward Partnership		Page 1
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	6
Ratio R	0.403	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	20.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.241	4-8	0.170

Total Area Contributing (ha) = 0.411

Total Pipe Volume (m³) = 37.861

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	25.796	0.152	169.7	0.037	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	5.184	0.030	172.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	22.999	0.046	500.0	0.044	0.00	0.0	0.600	o	600	Pipe/Conduit	
S2.000	16.765	0.034	493.1	0.075	5.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	25.964	0.052	499.3	0.019	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	5.43	2.134	0.037	0.0	0.0	0.0	1.00	39.8	0.0
S1.001	0.00	5.52	1.982	0.037	0.0	0.0	0.0	0.99	39.4	0.0
S1.002	0.00	5.87	1.577	0.080	0.0	0.0	0.0	1.08	306.0	0.0
S2.000	0.00	5.26	1.565	0.075	0.0	0.0	0.0	1.09	308.1	0.0
S1.003	0.00	6.27	1.531	0.175	0.0	0.0	0.0	1.08	306.2	0.0

The Millward Partnership		Page 2
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.004	25.964	0.052	499.3	0.045	0.00	0.0	0.600	o	600	Pipe/Conduit	
S3.000	10.752	0.063	170.7	0.046	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	16.747	0.099	169.2	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	14.570	0.086	169.4	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.003	10.311	0.061	169.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.004	7.562	0.044	171.9	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	5.959	0.012	496.6	0.031	5.00	0.0	0.600	o	600	Pipe/Conduit	
S4.001	8.374	0.017	492.6	0.006	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.005	13.217	0.026	508.3	0.027	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.006	10.741	0.107	100.4	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.007	19.312	0.193	100.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.004	0.00	6.67	1.479	0.219	0.0	0.0	0.0	1.08	306.2	0.0
S3.000	0.00	5.18	2.154	0.046	0.0	0.0	0.0	1.00	39.7	0.0
S3.001	0.00	5.46	2.091	0.062	0.0	0.0	0.0	1.00	39.9	0.0
S3.002	0.00	5.70	1.992	0.079	0.0	0.0	0.0	1.00	39.8	0.0
S3.003	0.00	5.87	1.906	0.090	0.0	0.0	0.0	1.00	39.9	0.0
S3.004	0.00	6.00	1.845	0.123	0.0	0.0	0.0	0.99	39.5	0.0
S4.000	0.00	5.09	1.455	0.031	0.0	0.0	0.0	1.09	307.0	0.0
S4.001	0.00	5.22	1.443	0.037	0.0	0.0	0.0	1.09	308.3	0.0
S1.005	0.00	6.88	1.426	0.405	0.0	0.0	0.0	1.07	303.4	0.0
S1.006	0.00	7.05	1.400	0.411	0.0	0.0	0.0	1.00	17.7	0.0
S1.007	0.00	7.37	1.293	0.411	0.0	0.0	0.0	1.00	17.8	0.0

The Millward Partnership		Page 3
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backd (mm)
S1	3.450	1.316	Open Manhole	1200	S1.000	2.134	225				
S2	3.550	1.568	Open Manhole	1200	S1.001	1.982	225	S1.000	1.982	225	
S3	3.700	2.123	Open Manhole	1500	S1.002	1.577	600	S1.001	1.952	225	
S4	3.700	2.135	Open Manhole	1500	S2.000	1.565	600				
S5	3.600	2.069	Open Manhole	1500	S1.003	1.531	600	S1.002	1.531	600	
								S2.000	1.531	600	
S6	3.600	2.121	Open Manhole	1500	S1.004	1.479	600	S1.003	1.479	600	
S7	3.450	1.296	Open Manhole	1200	S3.000	2.154	225				
S8	3.450	1.359	Open Manhole	1200	S3.001	2.091	225	S3.000	2.091	225	
S9	3.400	1.408	Open Manhole	1200	S3.002	1.992	225	S3.001	1.992	225	
S10	3.300	1.394	Open Manhole	1500	S3.003	1.906	225	S3.002	1.906	225	
S11	3.300	1.455	Open Manhole	1500	S3.004	1.845	225	S3.003	1.845	225	
S12	3.500	2.045	Open Manhole	1500	S4.000	1.455	600				
S13	3.500	2.057	Open Manhole	1500	S4.001	1.443	600	S4.000	1.443	600	
S14	3.450	2.024	Open Manhole	1500	S1.005	1.426	600	S1.004	1.427	600	
								S3.004	1.801	225	
								S4.001	1.426	600	
S15	3.500	2.100	Open Manhole	1500	S1.006	1.400	150	S1.005	1.400	600	
S16	3.400	2.107	Open Manhole	1200	S1.007	1.293	150	S1.006	1.293	150	
SHeadwall	3.160	2.060	Open Manhole	0		OUTFALL		S1.007	1.100	150	

The Millward Partnership		Page 4
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1	3.450	2.134	1.091	Open Manhole	1200
S1.001	o	225	S2	3.550	1.982	1.343	Open Manhole	1200
S1.002	o	600	S3	3.700	1.577	1.523	Open Manhole	1500
S2.000	o	600	S4	3.700	1.565	1.535	Open Manhole	1500
S1.003	o	600	S5	3.600	1.531	1.469	Open Manhole	1500
S1.004	o	600	S6	3.600	1.479	1.521	Open Manhole	1500
S3.000	o	225	S7	3.450	2.154	1.071	Open Manhole	1200
S3.001	o	225	S8	3.450	2.091	1.134	Open Manhole	1200
S3.002	o	225	S9	3.400	1.992	1.183	Open Manhole	1200
S3.003	o	225	S10	3.300	1.906	1.169	Open Manhole	1500
S3.004	o	225	S11	3.300	1.845	1.230	Open Manhole	1500
S4.000	o	600	S12	3.500	1.455	1.445	Open Manhole	1500
S4.001	o	600	S13	3.500	1.443	1.457	Open Manhole	1500
S1.005	o	600	S14	3.450	1.426	1.424	Open Manhole	1500
S1.006	o	150	S15	3.500	1.400	1.950	Open Manhole	1500
S1.007	o	150	S16	3.400	1.293	1.957	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	25.796	169.7	S2	3.550	1.982	1.343	Open Manhole	1200
S1.001	5.184	172.8	S3	3.700	1.952	1.523	Open Manhole	1500
S1.002	22.999	500.0	S5	3.600	1.531	1.469	Open Manhole	1500
S2.000	16.765	493.1	S5	3.600	1.531	1.469	Open Manhole	1500
S1.003	25.964	499.3	S6	3.600	1.479	1.521	Open Manhole	1500
S1.004	25.964	499.3	S14	3.450	1.427	1.423	Open Manhole	1500
S3.000	10.752	170.7	S8	3.450	2.091	1.134	Open Manhole	1200
S3.001	16.747	169.2	S9	3.400	1.992	1.183	Open Manhole	1200
S3.002	14.570	169.4	S10	3.300	1.906	1.169	Open Manhole	1500
S3.003	10.311	169.0	S11	3.300	1.845	1.230	Open Manhole	1500
S3.004	7.562	171.9	S14	3.450	1.801	1.424	Open Manhole	1500
S4.000	5.959	496.6	S13	3.500	1.443	1.457	Open Manhole	1500
S4.001	8.374	492.6	S14	3.450	1.426	1.424	Open Manhole	1500
S1.005	13.217	508.3	S15	3.500	1.400	1.500	Open Manhole	1500
S1.006	10.741	100.4	S16	3.400	1.293	1.957	Open Manhole	1200
S1.007	19.312	100.1	SHeadwall	3.160	1.100	1.910	Open Manhole	0

1 Malin Hill
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NG1 1JQ

MA11419-Fen Rd Ph2
SWS PLANNING
REV-



Date	01/06/2021
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Setting Out Information - Site Coordinates (Storm)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
S1.000	S1	1200		535753.992	323855.484	
S1.001	S2	1200		535740.682	323833.386	
S1.002	S3	1500		535735.525	323833.909	
S2.000	S4	1500		535735.996	323806.615	
S1.003	S5	1500		535721.766	323815.478	
S1.004	S6	1500		535699.975	323829.595	
S3.000	S7	1200		535725.730	323808.131	
S3.001	S8	1200		535716.804	323814.126	
S3.002	S9	1200		535702.901	323823.462	
S3.003	S10	1500		535690.806	323831.585	
S3.004	S11	1500		535682.246	323837.333	
S4.000	S12	1500		535670.177	323831.825	
S4.001	S13	1500		535673.486	323836.780	
S1.005	S14	1500		535678.184	323843.712	
S1.006	S15	1500		535685.086	323854.984	
S1.007	S16	1200		535680.188	323864.544	

The Millward Partnership		Page 8
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions Network 2017.1.2		

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.007	SHeadwall	3.160	1.100	1.100	0	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1200	1.000	3600	1.000	6000	1.000	8400	1.000	10800	1.000
2400	1.000	4800	1.000	7200	1.000	9600	1.000		

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	6.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.403		

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The Millward Partnership		Page 9
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S15, DS/PN: S1.006, Volume (m³): 7.0

Unit Reference	MD-SHE-0095-5000-1700-5000
Design Head (m)	1.700
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	1.400
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	5.0
Flush-Flo™	0.417	4.5
Kick-Flo®	0.851	3.6
Mean Flow over Head Range	-	4.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.3	3.000	6.5	7.000	9.7
0.200	4.2	1.400	4.6	3.500	7.0	7.500	10.1
0.300	4.5	1.600	4.9	4.000	7.5	8.000	10.4
0.400	4.5	1.800	5.1	4.500	7.9	8.500	10.7
0.500	4.5	2.000	5.4	5.000	8.3	9.000	11.0
0.600	4.4	2.200	5.6	5.500	8.7	9.500	11.3
0.800	3.9	2.400	5.9	6.000	9.0		
1.000	3.9	2.600	6.1	6.500	9.4		

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The Millward Partnership		Page 10
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

Storage Structures for Storm

Cellular Storage Manhole: S12, DS/PN: S4.000

Invert Level (m) 1.455 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	135.0	135.0	1.201	0.0	192.6
1.200	135.0	192.6			

The Millward Partnership		Page 11
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	6.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.403
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

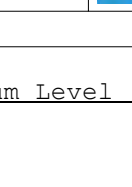
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1	+0%	100/30 Winter				2.190
S1.001	S2	15 Winter	1	+0%	100/15 Summer				2.045
S1.002	S3	15 Winter	1	+0%	100/30 Summer				1.743
S2.000	S4	15 Winter	1	+0%	100/30 Summer				1.742
S1.003	S5	15 Winter	1	+0%	100/15 Winter				1.741
S1.004	S6	15 Winter	1	+0%	100/15 Summer				1.736
S3.000	S7	15 Winter	1	+0%	100/15 Summer				2.221
S3.001	S8	15 Winter	1	+0%	100/15 Summer				2.165
S3.002	S9	15 Winter	1	+0%	30/15 Summer				2.075
S3.003	S10	15 Winter	1	+0%	30/15 Summer				1.997
S3.004	S11	15 Winter	1	+0%	30/15 Summer				1.960
S4.000	S12	120 Winter	1	+0%	100/30 Summer				1.644
S4.001	S13	15 Winter	1	+0%	100/15 Winter				1.675
S1.005	S14	15 Winter	1	+0%	100/15 Summer				1.727
S1.006	S15	15 Winter	1	+0%	1/15 Summer				1.726
S1.007	S16	15 Winter	1	+0%					1.346

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The Millward Partnership		Page 12
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		
S1.000	S1	-0.169	0.000	0.14	5.0	OK	
S1.001	S2	-0.162	0.000	0.18	5.1	OK	
S1.002	S3	-0.434	0.000	0.04	9.7	OK	
S2.000	S4	-0.423	0.000	0.05	10.0	OK	
S1.003	S5	-0.390	0.000	0.06	15.1	OK	
S1.004	S6	-0.343	0.000	0.06	15.3	OK	
S3.000	S7	-0.158	0.000	0.19	6.4	OK	
S3.001	S8	-0.151	0.000	0.23	8.3	OK	
S3.002	S9	-0.142	0.000	0.29	10.3	OK	
S3.003	S10	-0.134	0.000	0.34	11.5	OK	
S3.004	S11	-0.110	0.000	0.51	15.2	OK	
S4.000	S12	-0.411	0.000	0.03	6.3	OK	
S4.001	S13	-0.368	0.000	0.02	3.3	OK	
S1.005	S14	-0.299	0.000	0.06	9.2	OK	
S1.006	S15	0.176	0.000	0.28	4.5	SURCHARGED	
S1.007	S16	-0.097	0.000	0.27	4.5	OK	

The Millward Partnership		Page 13
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions Network 2017.1.2		

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	6.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.403
Region England and Wales Cv (Summer)	0.750		
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	450.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	100/30 Winter				2.225
S1.001	S2	15 Winter	30	+0%	100/15 Summer				2.086
S1.002	S3	15 Winter	30	+0%	100/30 Summer				2.006
S2.000	S4	15 Winter	30	+0%	100/30 Summer				2.001
S1.003	S5	15 Winter	30	+0%	100/15 Winter				1.994
S1.004	S6	120 Winter	30	+0%	100/15 Summer				1.986
S3.000	S7	15 Winter	30	+0%	100/15 Summer				2.293
S3.001	S8	15 Winter	30	+0%	100/15 Summer				2.272
S3.002	S9	15 Winter	30	+0%	30/15 Summer				2.235
S3.003	S10	15 Winter	30	+0%	30/15 Summer				2.163
S3.004	S11	15 Winter	30	+0%	30/15 Summer				2.086
S4.000	S12	120 Winter	30	+0%	100/30 Summer				1.985
S4.001	S13	180 Winter	30	+0%	100/15 Winter				1.985
S1.005	S14	180 Winter	30	+0%	100/15 Summer				1.985
S1.006	S15	120 Winter	30	+0%	1/15 Summer				1.985
S1.007	S16	960 Winter	30	+0%					1.346

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The Millward Partnership

Page 15

1 Malin Hill
Nottingham
NG1 1JQ

MA11419-Fen Rd Ph2
SWS PLANNING
REV-

Date 01/06/2021
File MA11419 Feasibility PLA...

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 6.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 0.000

Hot Start Level (mm) 0

Inlet Coeffiecient 0.800

Manhole Headloss Coeff (Global) 0.500

Flow per Person per Day (l/per/day) 0.000

Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 1

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.403

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 19.000

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 450.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 40

Water

Level

(m)

US/MH

Return Climate

First (X)

First (Y)

First (Z)

Overflow

Overflow

Act.

PN

Name

Storm

Period

Change

Surcharge

Flood

Overflow

Act.

S1.000

S1

240 Winter

100

+40%

100/30 Winter

S1.001

S2

240 Winter

100

+40%

100/15 Summer

S1.002

S3

240 Winter

100

+40%

100/30 Summer

S2.000

S4

240 Winter

100

+40%

100/30 Summer

S1.003

S5

240 Winter

100

+40%

100/15 Winter

S1.004

S6

240 Winter

100

+40%

100/15 Summer

S3.000

S7

240 Winter

100

+40%

100/15 Summer

S3.001

S8

240 Winter

100

+40%

100/15 Summer

S3.002

S9

240 Winter

100

+40%

30/15 Summer

S3.003

S10

240 Winter

100

+40%

30/15 Summer

S3.004

S11

240 Winter

100

+40%

30/15 Summer

S4.000

S12

240 Winter

100

+40%

100/30 Summer

S4.001

S13

240 Winter

100

+40%

100/15 Winter

S1.005

S14

240 Winter

100

+40%

100/15 Summer

S1.006

S15

240 Winter

100

+40%

1/15 Summer

S1.007

S16

240 Winter

100

+40%

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The Millward Partnership		Page 16
1 Malin Hill Nottingham NG1 1JQ	MA11419-Fen Rd Ph2 SWS PLANNING REV-	
Date 01/06/2021 File MA11419 Feasibility PLA...	Designed by JMcK Checked by	
XP Solutions	Network 2017.1.2	

100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
S1.000	S1	0.749	0.000	0.13		4.6	FLOOD RISK	
S1.001	S2	0.900	0.000	0.29		8.5	FLOOD RISK	
S1.002	S3	0.930	0.000	0.04		9.6	SURCHARGED	
S2.000	S4	0.942	0.000	0.06		10.2	SURCHARGED	
S1.003	S5	0.976	0.000	0.08		20.5	SURCHARGED	
S1.004	S6	1.028	0.000	0.10		24.1	SURCHARGED	
S3.000	S7	0.735	0.000	0.19		6.2	FLOOD RISK	
S3.001	S8	0.797	0.000	0.24		8.4	FLOOD RISK	
S3.002	S9	0.894	0.000	0.27		9.3	FLOOD RISK	
S3.003	S10	0.979	0.000	0.31		10.4	FLOOD RISK	
S3.004	S11	1.038	0.000	0.52		15.5	FLOOD RISK	
S4.000	S12	1.052	0.000	0.05		10.0	FLOOD RISK	
S4.001	S13	1.064	0.000	0.05		8.5	FLOOD RISK	
S1.005	S14	1.081	0.000	0.09		13.8	FLOOD RISK	
S1.006	S15	1.556	0.000	0.31		5.0	FLOOD RISK	
S1.007	S16	-0.094	0.000	0.30		5.0	OK	