

Proposed Residential Development Land off Malting Lane, Donnington

Flood Risk Assessment

January 2020

Minster Property Group

Report

This report consists of a Flood Risk Assessment and Drainage Strategy, produced to support the proposed residential development of the site located off Malting Lane, Donnington. It has been produced by FORTEM Civil Engineering Consultants Ltd for Minster Property Group.

Revision History

Rev Ref	Date	Amendments	By	Chk'd
1	24.01.2020	First Issue	BS	ADC

Contract

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Executive Summary

Site Description

The proposed development is located off Malting Lane, Donnington. The total site area is 3.6ha and is split into two phases, Phase 1, 1.2ha (Reserved Matters Application) and Phase 2.4ha (future development). The current use of the land is grassland paddock.

There is a 150mm foul sewer located in Malting Lane to the east of the development and a 225mm rising main crossing through the site located on the southern boundary. Unnamed watercourses are located on the northern, western and southern boundaries of Phase 1 and 2.

Proposed Development

It is proposed to construct 40 residential dwellings within Phase 1, with future development in Phase 2. Provision within the Phase 1 infrastructure is to be made for Phase 2.

Flood Risk

Environment Agency Flood Mapping confirms the site is located in Flood Zone 3. However a more detailed assessment of flood risk undertaken as part of the South Holland Strategic Flood Risk Assessment confirms the risk of fluvial or tidal flooding as Low.

The following mitigation measures are required:

- Finished floor levels to be set 300mm above the surrounding ground levels;
- Blockage/exceedance events should be considered ensuring the proposed development and surrounding areas are not put at risk from overland flows.

Drainage

It is proposed for the development surface water runoff to discharge to the existing unnamed watercourse located on the northern boundary of site.

The surface water discharge rate is to be limited to greenfield runoff (18l/s) and the surface water drainage designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.

It is proposed to discharge the foul water flows from the development to the 150mm foul network in Malting Lane. Flows are to be pumped at a maximum flow of 3.8l/s.

Contents

1.	Introduction	5
1.1	Report Background	5
1.2	Site Description	5
1.3	Proposed Development	6
1.4	Consultation	6
2.	Sources of Flood Risk	7
2.1	Summary	7
2.2	Fluvial/Tidal	7
2.3	Surface Water/Pluvial	7
2.4	Development Mitigation	8
3.	Development Drainage	9
3.1	Existing Site Drainage	9
3.2	Development Surface Water Drainage	9
3.3	Development Foul Water Drainage	9
3.4	Maintenance	10
4.	Conclusion	11
4.1	Flood Risk	11
4.2	Drainage	11

Appendix A Existing Site

Site Location Plan
 Drawing S219 579 - Topographical Survey
 Anglian Water Sewer Records
 Drawing 1087 - 001 - Existing Drainage Network

Appendix B Proposed Development

Drawing 19020 0102 P03 - Proposed Site Layout
 Drawing 1071 – 002 – Proposed Drainage Strategy
 Attenuation Calculation Phase 1 & Phase 1/2 Combined

Appendix C Flood Risk Mapping

EA Map Flood Zone
 EA Map Risk from Surface Water
 EA Map Risk from Reservoir
 South Holland Residual Flood Risk for the Fluvial (1% AEP) and Tidal (0.5% AEP) Flood Event plus an allowance for climate change Flood Map
 South Holland Flood Risk for Fluvial and Tidal (Extract)

1. Introduction

1.1. Report Background

- 1.1.1. This report has been produced to support the Reserved Matters Planning Application by Minster Property Group for the proposed residential development off Malting Lane, Donnington. It has been produced in accordance with the National Planning Policy Framework (NPPF) and guidance documents produced by Lincolnshire County Council and South Holland District Council.
- 1.1.2. The study consists of data collection, consultation and review with regulatory bodies and third parties in relation to flood risk and drainage. FORTEM cannot guarantee the reliability of third party information and/or changes in consultee conclusions/responses.

1.2. Site Description

- 1.2.1. The site is located off Malting Lane, Donnington, OS grid reference TF 20400 35179, see Appendix A for Location Plan. Details of the site are tabled below:

Site Area		3.60ha total (1.2ha Phase 1 (Reserved Matters Application), 2.4ha Phase 2 (future development).
Topography		There is little level change across the site with typical Phase 1 levels of 2.20m AOD, see appendix A for topographical survey.
Land Use		The proposed development site is currently grassland paddock.
Boundaries	North:	Watercourse extending to existing dwellings.
	South:	Existing dwellings and industrial building.
	East:	Existing dwellings (rear gardens) and Malting Lane (adopted highway).
	West:	Phase 2 (future development) and beyond this a watercourse extending to a commercial haulage yard.
Watercourses		An existing unnamed open watercourse is located on part of the northern boundary (Phase 1&2). This is linked to an unnamed watercourse on the western boundary of Phase 2. There is a further unnamed watercourse on the southern boundary of Phase 2. The watercourses fall under Black Sluice Internal Drainage Board (IDB). See Appendix A for drawing 1087-001 - Existing Drainage Network.
Public Sewers		Anglian Water confirm the existence of a 150mm foul water sewer located in Malting Lane at the development access and a 225mm rising main crossing through the site close to the southern boundary of Phase 1 (crossing Phase 2). Anglian Water record drawings confirm the nearest surface water sewer is located in Malting Lane approximately 100m north of the proposed development. See Appendix A for existing drainage networks
Other Drainage		Other than the watercourse covered above, there are no other known systems on or serving the site. It is anticipated that parts of the site could be served by land drains.

Ground	The Hydrock Desk Study and Ground Investigation Report MLD-HYD-XX-GI-RP-GE-1001 Rev P2 dated August 2017 confirms Made Ground overlaying natural Tidal Deposits (silty CLAY) overlaying Glacial Till (silty CLAY). Infiltration testing was undertaken in four number trial pits with insufficient infiltration to allow a rate to be calculated.
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1.3. Proposed Development

- 1.3.1. It is proposed to construct 40 No residential dwellings within Phase 1, with future development of Phase 2, see Appendix B for the JGA Architecture & Planning Phase 1 layout drawing 19020 0102 P04. It is proposed to submit a Reserved Matters Application for Phase 1 in accordance with the previously granted Outline approval in 2017, H04-0244-16 (covering Phase 1&2).
- 1.3.2. Drainage is to be provided for Phase 1, with provision for the extension/expansion of the infrastructure to serve Phase 2.

1.4. Consultation

- 1.4.1. Consultation with the relevant consultees has been undertaken, see summary below:

Consultee	Response Summary
South Holland District Council	SHDC were consulted as part of the Outline Planning Application (H04-0244-16), where the principles proposed as part of the Reserved Matters application were established.
Environment Agency (EA)	The EA were consulted on planning application H04-0244-16 and confirmed no objection to the development and low risk of flooding.
Lincolnshire County Council (LCC)	As part of the Outline Application LCC raised no objection to the scheme. An enquiry has been submitted for the Reserved Matters Application (awaiting for response).
Black Sluice Internal Drainage Board (IDB)	As part of consultation with the IDB, they confirmed: • Surface water can discharge from the development to the watercourses located on the development boundaries; • Discharge rate is to restricted in accordance with their charging schedule, but can be varied in accordance with the schedule.
Anglian Water	In accordance with the Outline Application and re-consultation, Anglian Water have confirmed: • There is capacity in the foul network for the development. If gravity is not achievable, the development has been granted a pumped discharge rate of 3.8l/s to the existing public foul sewer in Malting Lane. However • There is no capacity to accept surface water proposals from the development; • There must be a 3m easement either side of the existing 225mm rising main crossing the site. Anglian Water Records have been received for the site and are included in Appendix A.

2. Sources of Flood Risk

2.1. Summary

2.1.1. Below is a summary of the sources of flood risk and the potential risk associated to the proposed development:

Source	Risk Level	Notes
Fluvial/Tidal	High (see Section 2.2)	In accordance with the Environment Agency Flood Maps the site is located within Flood Zone 3, high probability (1 in 100 year, 1% AEP) or greater annual probability of flooding from rivers.
Surface Water/Pluvial	Low	Environmental Agency maps confirm low risk of surface water flooding for the site along the northern boundary and in sections central to the site and towards the eastern section. See Section 2.3.
Groundwater	Low	There are no known records of any historic groundwater flooding or risk.
Sewers	Low	Based upon searches undertaken, no historic incidents have been recorded within the vicinity of the proposed development.
Other Man-Made Sources	Low	The site is not in an area at risk from a major failure of a reservoir and there are no other known artificial sources of flood risk in the area.

Copies of the Environment Agency flood maps are included in Appendix C.

2.2. Fluvial/Tidal

2.2.1. A more detailed assessment of Fluvial and Tidal flood risk has been undertaken as part of the South Holland SFRA (2017). This considers a number of scenarios:

- Flooding from the sea;
- Flooding from main rivers;
- Flooding from IDB watercourses;
- Flood Risk Management measures, including flood defences;
- Overtopping and breach of flood defences.

The published South Holland SFRA mapping is included in Appendix B. The predicted flood mapping is based upon merged flooding events/sources (Fluvial (1% AEP), Tidal (0.5% AEP) plus allowance for climate change and overtopping). An enlarged extract of the mapping for the area of the proposed development is included in Appendix B, confirming no predicted inundation for the proposed development.

2.2.2. The Environment Agency were consulted as part of the Outline Approval (H04-0244-16) and confirmed the site will be unaffected if a breach of the flood defences were to occur and as such the fluvial/tidal flood risk to the site is low.

2.2.3. As a result of the supplementary assessment work undertaken by the South Holland SFRA and the Outline consultation with the Environment Agency, Fluvial/Tidal flood risk for the proposed development can be considered as Low.

2.3. Surface Water/ Pluvial

2.3.1. Environment Agency maps confirm low levels of surface water flood risk on the northern boundary, centrally and to the eastern boundary. The flood risk coincides with the watercourses along the northern boundary and depressions within the existing site levels, see topographical survey in Appendix A.

- 2.3.2. The redevelopment of the site will mitigate the potential surface water flood risk by reprofiling the site and providing a new foul and surface water drainage systems to current local and national design standards.

2.4. Development Mitigation

- 2.4.1. In accordance with the Outline Approval and this assessment the following mitigation measures are recommended:
- 2.4.2. Finished floor levels to be set 300mm above existing (EA Outline);
- 2.4.3. Within the detailed drainage design blockage/exceedance events should be considered ensuring the proposed development and surrounding areas are not put at risk from overland flows;
- 2.4.4. The proposed development surface water drainage is to be designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year plus climate change (30%) event.

3. Development Drainage

3.1. Existing Site Drainage

- 3.1.1. As covered in section 1.2 Anglian Water record drawings confirm there is an existing 150mm diameter foul water sewer located in Malting Lane at the development access and an existing 225mm diameter rising main crossing through the site close to the southern boundary.
- 3.1.2. An existing unnamed open watercourses are located on the northern, western and southern boundaries of Phase 1 and Phase 2, see drawing 1087-001, Appendix A.
- 3.1.3. Based upon the topography of the site the existing surface water runoff discharges unnamed watercourses. Based upon a standard greenfield runoff rate of 5l/s/ha the existing greenfield runoff for Phase 1&2 is 18l/s (principles in accordance with Black Sluice IDB consultation).

3.2. Development Surface Water Drainage

- 3.2.1. The potential surface water outfall/discharge options have been considered and summarised below:

Outfall/Discharge Option (Ranked in order of Preference)	✓/✗	Notes
1. Infiltration	✗	Infiltration testing undertaken as part of the Hydrock Desk Study and Ground Investigation Report MLD-HYD-XX-GI-RP-GE-1001 Rev P2 confirms infiltration drainage is not suitable for the development.
2. Discharge to Watercourse	✓	Existing open watercourse is located along part of the northern boundary of the site. Consultation with Black & Sluice IDB confirms surface water discharge to the open watercourses is acceptable (in accordance with the payment schedule).
3. Discharge to Public Surface Water Sewer	✗	There are no surface water sewers within suitable proximity of the proposed development.
4. Discharge to Public Combined Sewer	✗	No combined sewers within the vicinity of the site.

- 3.2.2. Based upon the findings of the review above and in accordance with surface water drainage hierarchy, it is proposed to discharge the surface water from the proposed residential development to the existing open watercourse located on the northern boundary. Surface water will be restricted to the existing greenfield runoff of 18l/s (Phase 1&2).
- 3.2.3. It is proposed to construct Phase 1 at a restricted rate of 18l/s, with the restricted discharge maintained at 18l/s when Phase 2 is constructed.
- 3.2.4. The proposed development surface water drainage is to be designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.
- 3.2.5. Based upon a discharge rate of 18l/s, the attenuation required for Phase 1 is 242m³ (1 in 100 + 30% c/c event). The attenuation required for Phase 1&2 based upon a discharge rate of 18l/s is 888m³, see Appendix B for attenuation calculations and drawing 1087-002.

3.3. Development Foul Water Drainage

- 3.3.1. It is proposed to discharge the foul water flows from the development to the existing 150mm foul drainage system in Malting Lane.
- 3.3.2. Due to topography and existing highway levels of Malting Lane, it is not feasible to discharge foul via gravity. It is therefore proposed to pump foul flows at 3.8l/s (based upon Anglian Water requirements).

3.4. Maintenance

- 3.4.1. It is proposed for both the foul and surface water drainage networks to be adopted by Anglian Water under a Section 104 agreement. Therefore the long term maintenance of the adoptable drainage system will be the responsibility of Anglian Water.

4. Conclusion

4.1. Flood Risk

- 4.1.1. Environment Agency Flood Mapping confirms the site is located in Flood Zone 3. However a more detailed assessment of flood risk undertaken as part of the South Holland Strategic Flood Risk Assessment confirms the risk of fluvial or tidal flooding as Low.
- 4.1.2. All other forms of flood risk are low.
- 4.1.3. The following mitigation measures are required:
 - Finished floor levels to be set 300mm above the surrounding ground levels;
 - Blockage/exceedance events should be considered ensuring the proposed development and surrounding areas are not put at risk from overland flows.

4.2. Drainage

- 4.2.1. It is proposed for the development surface water runoff to discharge to the existing unnamed watercourse located on the northern boundary of site.
- 4.2.2. The surface water discharge rate is to be limited to greenfield runoff (18l/s) and the surface water drainage designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.
- 4.2.3. It is proposed to discharge the foul water flows from the development to the 150mm foul network in Malting Lane. Flows are to be pumped at a maximum flow of 3.8l/s.

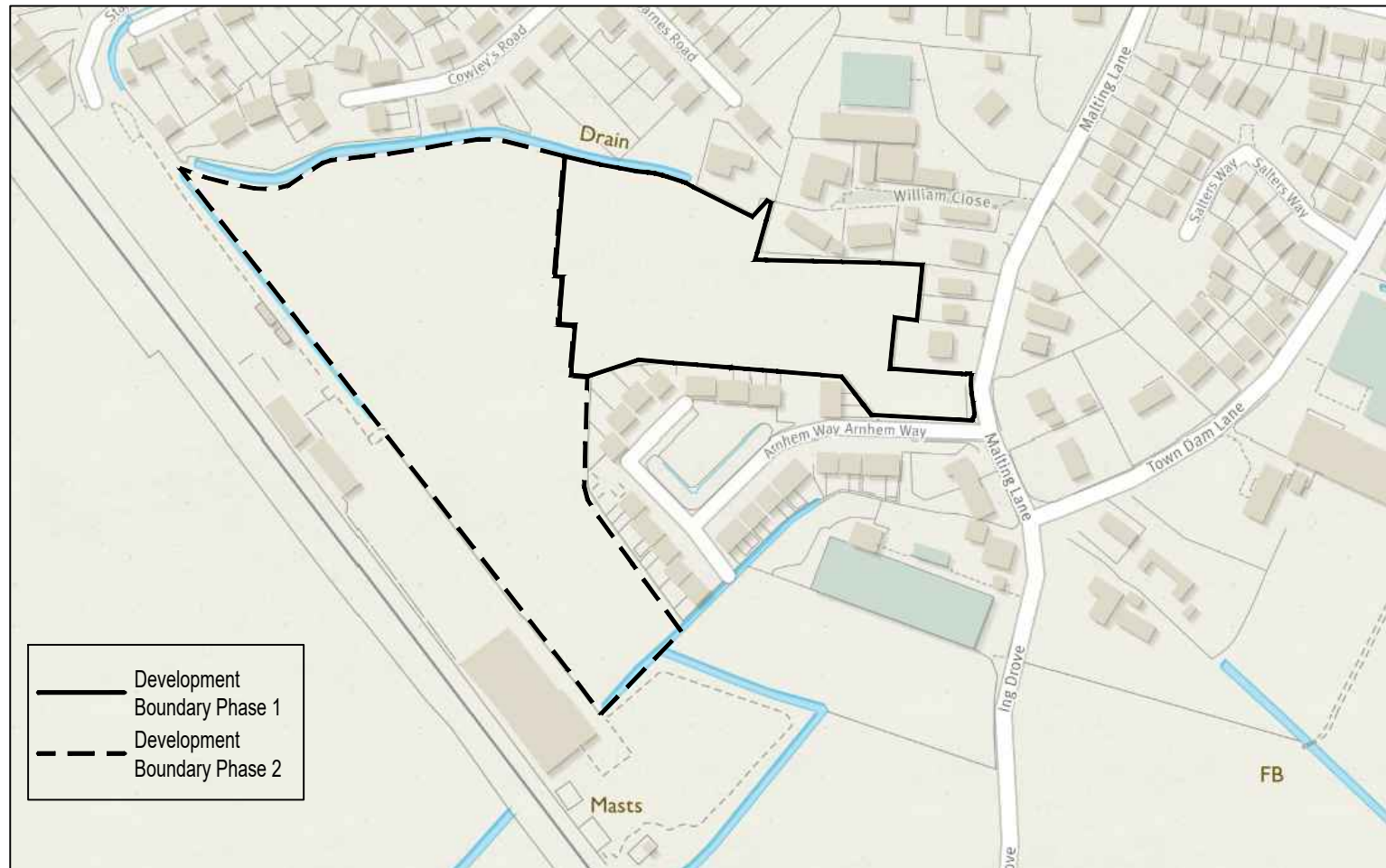
Appendix A Existing Site

Site Location Plan

Drawing S219 579 - Topographical Survey

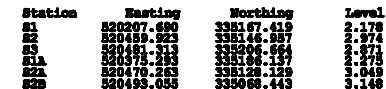
Anglian Water Sewer Records

Drawing 1087-001 – Existing Drainage Networks



MALTING LANE, DONNINGTON DEVELOPMENT LOCATION PLAN

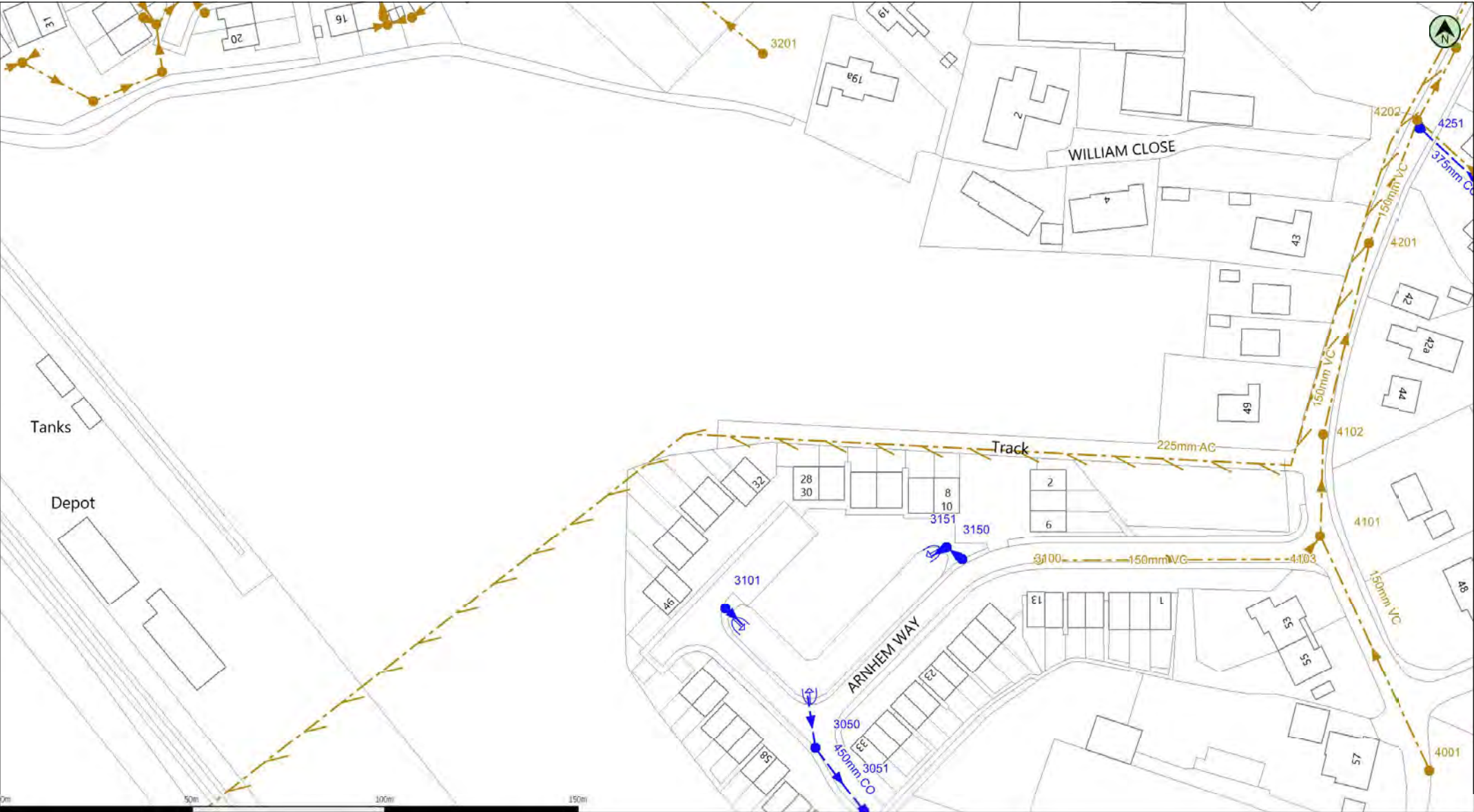
EXTRACT TAKEN 22.01.2020 : NTS



▲ STN 2 SURVEY SECTION
—11.50— CONTOUR VALUE

This survey has been originated to the Ordnance Survey (O.S. National Grid) (OSGB36) via a Global Position System (GPS) and the O.S. Active Network (OS Net).
A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN02 & OSGM02 transformation models. The survey has been correlated to this point and a further one or more OSGB36 points established to create a true O.S. bearing for angle orientation.
No correction has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.
Please refer to Survey Station Table to enable establishment of the on-site grid.
3D Information frozen on layer TRIANGLES.

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Date: 09/05/19

Scale: 1:957

Map Centre: 520313,335164

Data updated: 30/04/19

Wastewater Plan A3

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2019 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer		Outfall*		Sewage Treatment Works	
Surface Sewer		Inlet*		Public Pumping Station	
Combined Sewer		Manhole*		Decommissioned Pumping Station	
Final Effluent					
Rising Main*					
Private Sewer*					
Decommissioned Sewer*					

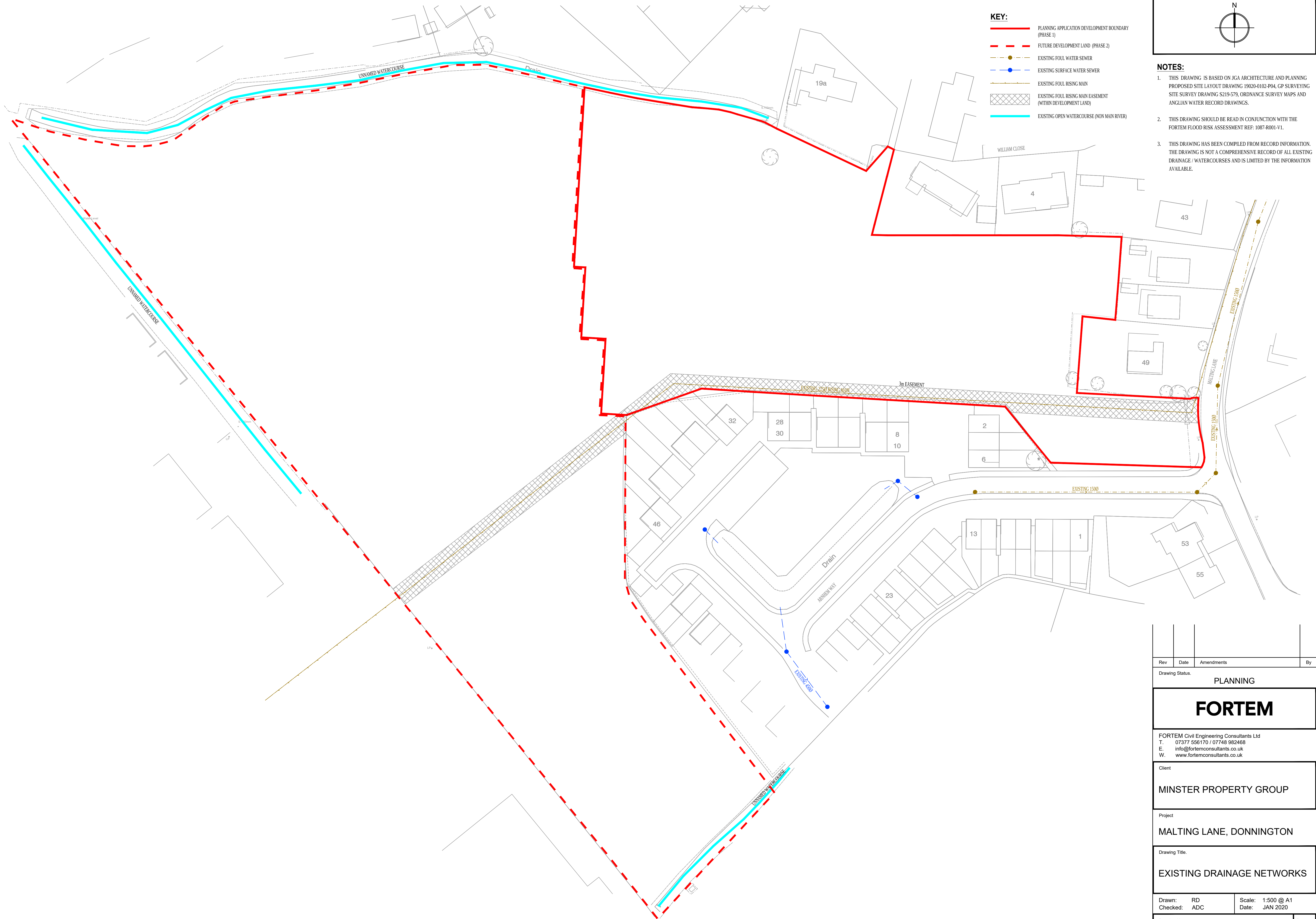
*(Colour denotes effluent type)

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MPG



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- KEY:**
- PLANNING APPLICATION DEVELOPMENT BOUNDARY (PHASE 1)
 - FUTURE DEVELOPMENT LAND (PHASE 2)
 - EXISTING FOUL WATER SEWER
 - EXISTING SURFACE WATER SEWER
 - EXISTING FOUL RISING MAIN
 - EXISTING FOUL RISING MAIN EASEMENT (WITHIN DEVELOPMENT LAND)
 - EXISTING OPEN WATERCOURSE (NON MAIN RIVER)

- NOTES:**
- THIS DRAWING IS BASED ON JGA ARCHITECTURE AND PLANNING PROPOSED SITE LAYOUT DRAWING 19020-0102-P04, GP SURVEYING SITE SURVEY DRAWING S219-579, ORDNANCE SURVEY MAPS AND ANGLIAN WATER RECORD DRAWINGS.
 - THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE FORTEM FLOOD RISK ASSESSMENT REF: 1087-R001-V1.
 - THIS DRAWING HAS BEEN COMPILED FROM RECORD INFORMATION. THE DRAWING IS NOT A COMPREHENSIVE RECORD OF ALL EXISTING DRAINAGE / WATERCOURSES AND IS LIMITED BY THE INFORMATION AVAILABLE.

Rev	Date	Amendments	By
Drawing Status.			
PLANNING			
FORTEM			
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Client			
MINSTER PROPERTY GROUP			
Project			
MALTING LANE, DONNINGTON			
Drawing Title.			
EXISTING DRAINAGE NETWORKS			
Drawn: RD		Scale: 1:500 @ A1	
Checked: ADC		Date: JAN 2020	
Drawing No.			Rev.
1087 - 001			-

Appendix B Proposed Development

Drawing 19020-0102-P04 - Proposed Site Layout

Drawing 1087-002 – Proposed Drainage Strategy

Attenuation Calculations Phase 1 & Phase 1/2 Combined

Proposed Site Layout

Scale: 1:500



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Source File:
19020 Site Model.pln

Rev	Date	Drawn	Note
P02	20/12/2019	JKG	Plots 01-04 and 23-26 amended. Layout status updated to 'Planning'
P03	16/01/2020	JKG	Plots 01-02 amended, SoA updated.
P04	23/01/2020	JKG	Plots 12-17 amended. Easement updated.

Key

- Application site boundary
- Proposed Housing material combination 01
- Proposed Housing material combination 02
- Existing Surrounding Buildings
- Private Rear Garden Area
- Public Open / Green Space
- Principal Highway / Road
- Private Drive
- Car Parking Spaces
- Pedestrian Footpaths
- Existing Tree Planting (approximate locations)
- Proposed Tree Planting (for illustrative purposes only - subject to detailed design / planting scheme by Landscape Architect)
- Proposed Hedge / Shrub Planting (for illustrative purposes only - subject to detailed design / planting scheme by Landscape Architect)
- Housetypes - Primary Point of Access
- Primary Site Access

schedule of accommodation

housetype	code	area	quantity
2B4P House	A	70m ²	15 no. units
3B5P House	B	82m ²	07 no. units
4B6P House	E	96m ²	02 no. units
2B3P Bungalow	C	61m ²	04 no. units
1B2P Maisonette	D	46m ²	06 no. units
3B5P House	G	84m ²	06 no. units

Total Number of Units 40 no. units

approximate site area :	1.20Ha / 2.96 acres
density :	33.3 dwellings per hectare
parking provision :	200% / 100%



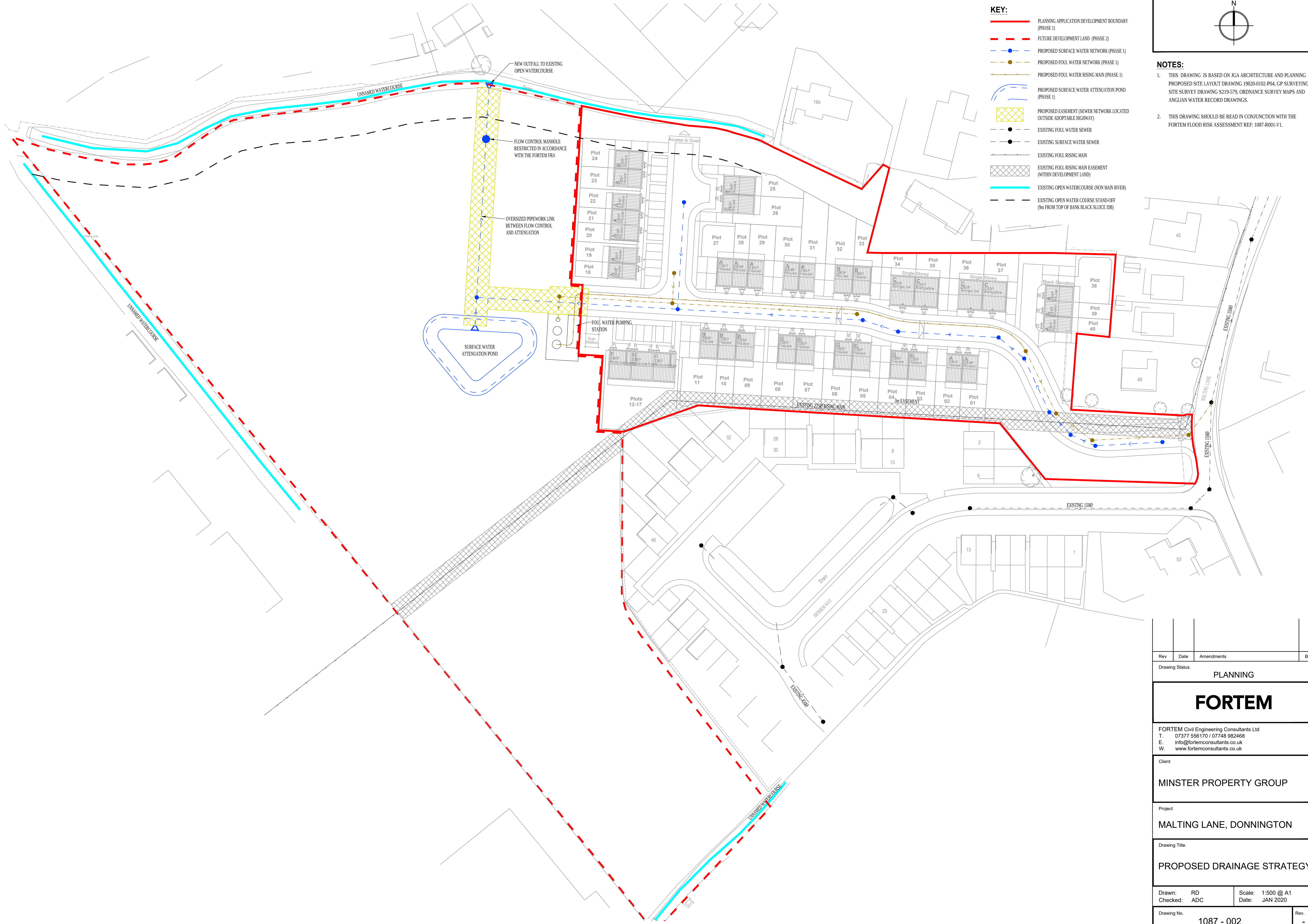
Client
Minster Property Group Ltd.

Project Title
Proposed residential development at Land off Malting Lane, Donington

Drawing Title
Proposed Site Layout

Planning		
Scale(s): 1:500	Original Paper Size: A2	
Drawn: JKG	Date: 16.09.19	
Project Number: 19020	Drawing Number: 0102	Revision: P04

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11 The Covert York YO24 1JN		Malting Lane Donnington Phase 1			
Date 26/01/2020 File 200121 QSE 18ls Front O...		Designed by Ricky Dale Checked by Andrew Calvert			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	1.743	0.643	18.0	133.8	O K
30 min Summer	1.930	0.830	18.0	172.6	O K
60 min Summer	2.070	0.970	18.0	201.8	O K
120 min Summer	2.115	1.015	18.0	211.0	O K
180 min Summer	2.095	0.995	18.0	206.9	O K
240 min Summer	2.060	0.960	18.0	199.6	O K
360 min Summer	1.972	0.872	18.0	181.5	O K
480 min Summer	1.877	0.777	18.0	161.5	O K
600 min Summer	1.784	0.684	18.0	142.3	O K
720 min Summer	1.702	0.602	18.0	125.3	O K
960 min Summer	1.564	0.464	18.0	96.5	O K
1440 min Summer	1.386	0.286	17.8	59.4	O K
2160 min Summer	1.287	0.187	16.0	38.8	O K
2880 min Summer	1.256	0.156	13.1	32.5	O K
4320 min Summer	1.226	0.126	9.6	26.2	O K
5760 min Summer	1.209	0.109	7.6	22.7	O K
7200 min Summer	1.198	0.098	6.4	20.4	O K
8640 min Summer	1.190	0.090	5.5	18.7	O K
10080 min Summer	1.184	0.084	4.8	17.5	O K
15 min Winter	1.830	0.730	18.0	151.8	O K
30 min Winter	2.041	0.941	18.0	195.7	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	121.269	0.0	150.5	24	
30 min Summer	79.695	0.0	198.0	37	
60 min Summer	49.937	0.0	248.7	64	
120 min Summer	30.267	0.0	301.6	110	
180 min Summer	22.297	0.0	333.3	140	
240 min Summer	17.851	0.0	355.8	174	
360 min Summer	12.957	0.0	387.4	244	
480 min Summer	10.330	0.0	411.8	310	
600 min Summer	8.659	0.0	431.5	374	
720 min Summer	7.492	0.0	448.0	436	
960 min Summer	5.959	0.0	475.1	554	
1440 min Summer	4.309	0.0	515.2	778	
2160 min Summer	3.110	0.0	558.2	1108	
2880 min Summer	2.466	0.0	590.0	1472	
4320 min Summer	1.775	0.0	636.9	2204	
5760 min Summer	1.405	0.0	672.4	2936	
7200 min Summer	1.171	0.0	700.4	3672	
8640 min Summer	1.008	0.0	723.9	4344	
10080 min Summer	0.889	0.0	744.0	5136	
15 min Winter	121.269	0.0	168.7	24	
30 min Winter	79.695	0.0	221.9	38	
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11 The Covert York YO24 1JN		Malting Lane Donnington Phase 1			
Date 26/01/2020 File 200121 QSE 18ls Front O...		Designed by Ricky Dale Checked by Andrew Calvert			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	2.204	1.104	18.0	229.6	O K
120 min Winter	2.265	1.165	18.0	242.3	O K
180 min Winter	2.235	1.135	18.0	236.1	O K
240 min Winter	2.187	1.087	18.0	226.2	O K
360 min Winter	2.064	0.964	18.0	200.6	O K
480 min Winter	1.931	0.831	18.0	172.9	O K
600 min Winter	1.780	0.680	18.0	141.4	O K
720 min Winter	1.654	0.554	18.0	115.3	O K
960 min Winter	1.461	0.361	18.0	75.1	O K
1440 min Winter	1.292	0.192	16.4	40.0	O K
2160 min Winter	1.247	0.147	12.1	30.7	O K
2880 min Winter	1.227	0.127	9.7	26.3	O K
4320 min Winter	1.204	0.104	7.0	21.5	O K
5760 min Winter	1.191	0.091	5.5	18.8	O K
7200 min Winter	1.182	0.082	4.6	17.0	O K
8640 min Winter	1.175	0.075	4.0	15.6	O K
10080 min Winter	1.170	0.070	3.5	14.6	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	49.937	0.0	278.6	64	
120 min Winter	30.267	0.0	337.8	118	
180 min Winter	22.297	0.0	373.3	148	
240 min Winter	17.851	0.0	398.5	186	
360 min Winter	12.957	0.0	433.9	264	
480 min Winter	10.330	0.0	461.3	340	
600 min Winter	8.659	0.0	483.3	400	
720 min Winter	7.492	0.0	501.8	462	
960 min Winter	5.959	0.0	532.1	570	
1440 min Winter	4.309	0.0	577.1	758	
2160 min Winter	3.110	0.0	625.3	1112	
2880 min Winter	2.466	0.0	660.9	1468	
4320 min Winter	1.775	0.0	713.4	2176	
5760 min Winter	1.405	0.0	753.1	2920	
7200 min Winter	1.171	0.0	784.5	3576	
8640 min Winter	1.008	0.0	810.8	4400	
10080 min Winter	0.889	0.0	833.4	5032	
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FORTEM Civil Engineering Consultants Ltd		Page 3
11 The Covert York YO24 1JN	Malting Lane Donnington Phase 1	
Date 26/01/2020 File 200121 QSE 18ls Front O...	Designed by Ricky Dale Checked by Andrew Calvert	
XP Solutions	Source Control 2017.1.2	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.665

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4	0.222	4	8	0.222
				8	12
					0.222

FORTEM Civil Engineering Consultants Ltd		Page 4
11 The Covert York YO24 1JN	Malting Lane Donnington Phase 1	
Date 26/01/2020 File 200121 QSE 18ls Front O...	Designed by Ricky Dale Checked by Andrew Calvert	
XP Solutions Source Control 2017.1.2		

Model Details

Storage is Online Cover Level (m) 2.700

Tank or Pond Structure

Invert Level (m) 1.100

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	208.0	1.200	208.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0187-1800-1185-1800
Design Head (m)	1.185
Design Flow (l/s)	18.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	187
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.185	18.0
Flush-Flo™	0.372	18.0
Kick-Flo®	0.816	15.1
Mean Flow over Head Range	-	15.4

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	6.5	1.200	18.1	3.000	28.1	7.000	42.2
0.200	16.9	1.400	19.5	3.500	30.2	7.500	43.6
0.300	17.9	1.600	20.8	4.000	32.2	8.000	45.0
0.400	18.0	1.800	22.0	4.500	34.1	8.500	46.4
0.500	17.8	2.000	23.1	5.000	35.9	9.000	47.7
0.600	17.4	2.200	24.2	5.500	37.6	9.500	48.9
0.800	15.4	2.400	25.2	6.000	39.2		
1.000	16.6	2.600	26.2	6.500	40.7		

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FORTEM Civil Engineering Consultants Ltd					Page 1
11 The Covert York YO24 1JN		Malting Lane Donnington Phase 1 and 2			
Date 26/01/2020 File 200121 QSE 18ls.SRCX		Designed by Ricky Dale Checked by Andrew Calvert			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	1.622	0.522	18.0	391.4	O K
30 min Summer	1.780	0.680	18.0	510.2	O K
60 min Summer	1.936	0.836	18.0	626.7	O K
120 min Summer	2.067	0.967	18.0	725.4	O K
180 min Summer	2.120	1.020	18.0	764.6	O K
240 min Summer	2.138	1.038	18.0	778.8	O K
360 min Summer	2.130	1.030	18.0	772.7	O K
480 min Summer	2.112	1.012	18.0	759.0	O K
600 min Summer	2.091	0.991	18.0	742.9	O K
720 min Summer	2.068	0.968	18.0	725.7	O K
960 min Summer	2.019	0.919	18.0	689.0	O K
1440 min Summer	1.912	0.812	18.0	609.0	O K
2160 min Summer	1.750	0.650	18.0	487.3	O K
2880 min Summer	1.618	0.518	18.0	388.5	O K
4320 min Summer	1.433	0.333	18.0	249.4	O K
5760 min Summer	1.332	0.232	17.3	174.1	O K
7200 min Summer	1.289	0.189	16.1	141.7	O K
8640 min Summer	1.268	0.168	14.3	126.1	O K
10080 min Summer	1.253	0.153	12.7	115.1	O K
15 min Winter	1.687	0.587	18.0	440.3	O K
30 min Winter	1.866	0.766	18.0	574.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	121.269	0.0	399.4	26	
30 min Summer	79.695	0.0	526.9	40	
60 min Summer	49.937	0.0	669.2	70	
120 min Summer	30.267	0.0	811.8	126	
180 min Summer	22.297	0.0	897.4	184	
240 min Summer	17.851	0.0	958.1	242	
360 min Summer	12.957	0.0	1043.4	346	
480 min Summer	10.330	0.0	1109.1	402	
600 min Summer	8.659	0.0	1162.1	464	
720 min Summer	7.492	0.0	1206.6	528	
960 min Summer	5.959	0.0	1279.3	664	
1440 min Summer	4.309	0.0	1386.7	944	
2160 min Summer	3.110	0.0	1508.5	1320	
2880 min Summer	2.466	0.0	1594.1	1680	
4320 min Summer	1.775	0.0	1718.5	2380	
5760 min Summer	1.405	0.0	1818.4	3016	
7200 min Summer	1.171	0.0	1893.9	3680	
8640 min Summer	1.008	0.0	1956.6	4408	
10080 min Summer	0.889	0.0	2009.0	5144	
15 min Winter	121.269	0.0	448.1	26	
30 min Winter	79.695	0.0	590.7	40	
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FORTEM Civil Engineering Consultants Ltd					Page 2
11 The Covert York YO24 1JN		Malting Lane Donnington Phase 1 and 2			
Date 26/01/2020 File 200121 QSE 18ls.SRCX		Designed by Ricky Dale Checked by Andrew Calvert			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	2.042	0.942	18.0	706.5	O K
120 min Winter	2.193	1.093	18.0	819.9	O K
180 min Winter	2.257	1.157	18.0	867.7	O K
240 min Winter	2.283	1.183	18.0	887.5	O K
360 min Winter	2.284	1.184	18.0	887.9	O K
480 min Winter	2.260	1.160	18.0	870.0	O K
600 min Winter	2.230	1.130	18.0	847.8	O K
720 min Winter	2.201	1.101	18.0	826.0	O K
960 min Winter	2.135	1.035	18.0	776.1	O K
1440 min Winter	1.988	0.888	18.0	665.7	O K
2160 min Winter	1.736	0.636	18.0	477.4	O K
2880 min Winter	1.542	0.442	18.0	331.8	O K
4320 min Winter	1.325	0.225	17.3	168.9	O K
5760 min Winter	1.272	0.172	14.6	129.0	O K
7200 min Winter	1.249	0.149	12.3	112.0	O K
8640 min Winter	1.235	0.135	10.7	101.3	O K
10080 min Winter	1.225	0.125	9.4	93.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	49.937	0.0	749.9	68	
120 min Winter	30.267	0.0	909.7	124	
180 min Winter	22.297	0.0	1005.5	182	
240 min Winter	17.851	0.0	1073.5	238	
360 min Winter	12.957	0.0	1169.0	348	
480 min Winter	10.330	0.0	1242.6	450	
600 min Winter	8.659	0.0	1301.9	484	
720 min Winter	7.492	0.0	1351.8	560	
960 min Winter	5.959	0.0	1433.2	716	
1440 min Winter	4.309	0.0	1553.2	1024	
2160 min Winter	3.110	0.0	1689.9	1412	
2880 min Winter	2.466	0.0	1785.8	1764	
4320 min Winter	1.775	0.0	1925.7	2376	
5760 min Winter	1.405	0.0	2036.8	3000	
7200 min Winter	1.171	0.0	2121.5	3680	
8640 min Winter	1.008	0.0	2192.0	4408	
10080 min Winter	0.889	0.0	2251.3	5136	
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FORTEM Civil Engineering Consultants Ltd		Page 3
11 The Covert York YO24 1JN	Malting Lane Donnington Phase 1 and 2	
Date 26/01/2020 File 200121 QSE 18ls.SRCX	Designed by Ricky Dale Checked by Andrew Calvert	
XP Solutions	Source Control 2017.1.2	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.800

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4	0.600	4	8	0.600
				8	12
					0.600

FORTEM Civil Engineering Consultants Ltd		Page 4
11 The Covert York YO24 1JN	Malting Lane Donnington Phase 1 and 2	
Date 26/01/2020 File 200121 QSE 18ls.SRCX	Designed by Ricky Dale Checked by Andrew Calvert	
XP Solutions Source Control 2017.1.2		

Model Details

Storage is Online Cover Level (m) 2.700

Tank or Pond Structure

Invert Level (m) 1.100

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	750.0	1.200	750.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0187-1800-1185-1800
Design Head (m)	1.185
Design Flow (l/s)	18.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	187
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.185	18.0
Flush-Flo™	0.372	18.0
Kick-Flo®	0.816	15.1
Mean Flow over Head Range	-	15.4

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	6.5	1.200	18.1	3.000	28.1	7.000	42.2
0.200	16.9	1.400	19.5	3.500	30.2	7.500	43.6
0.300	17.9	1.600	20.8	4.000	32.2	8.000	45.0
0.400	18.0	1.800	22.0	4.500	34.1	8.500	46.4
0.500	17.8	2.000	23.1	5.000	35.9	9.000	47.7
0.600	17.4	2.200	24.2	5.500	37.6	9.500	48.9
0.800	15.4	2.400	25.2	6.000	39.2		
1.000	16.6	2.600	26.2	6.500	40.7		

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Appendix C Flood Risk Mapping

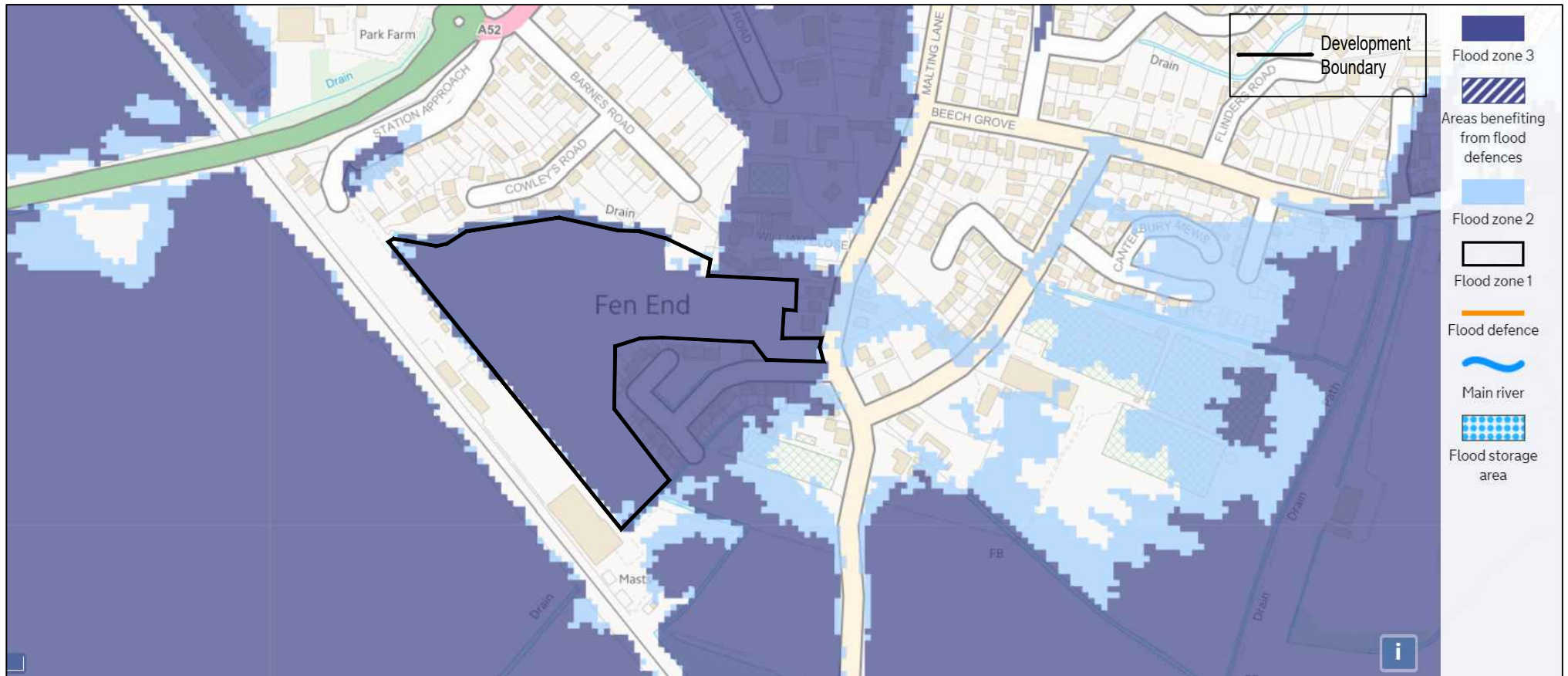
EA Map Risk from Rivers or Sea

EA Map Risk from Surface Water

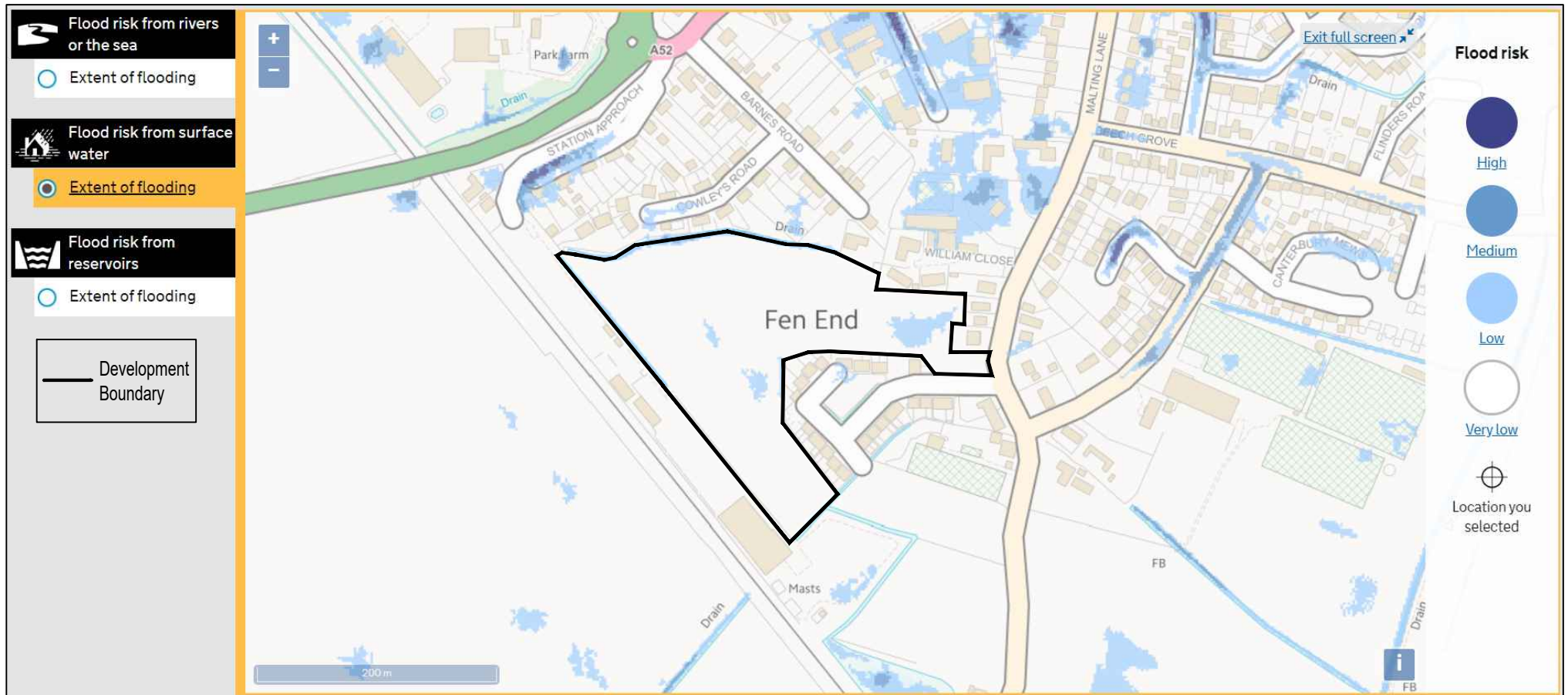
EA Map Risk from Reservoir

South Holland Residual Flood Risk for the Fluvial (1% AEP) and
Tidal (0.5% AEP) Flood Event plus an allowance for climate
change Flood Map

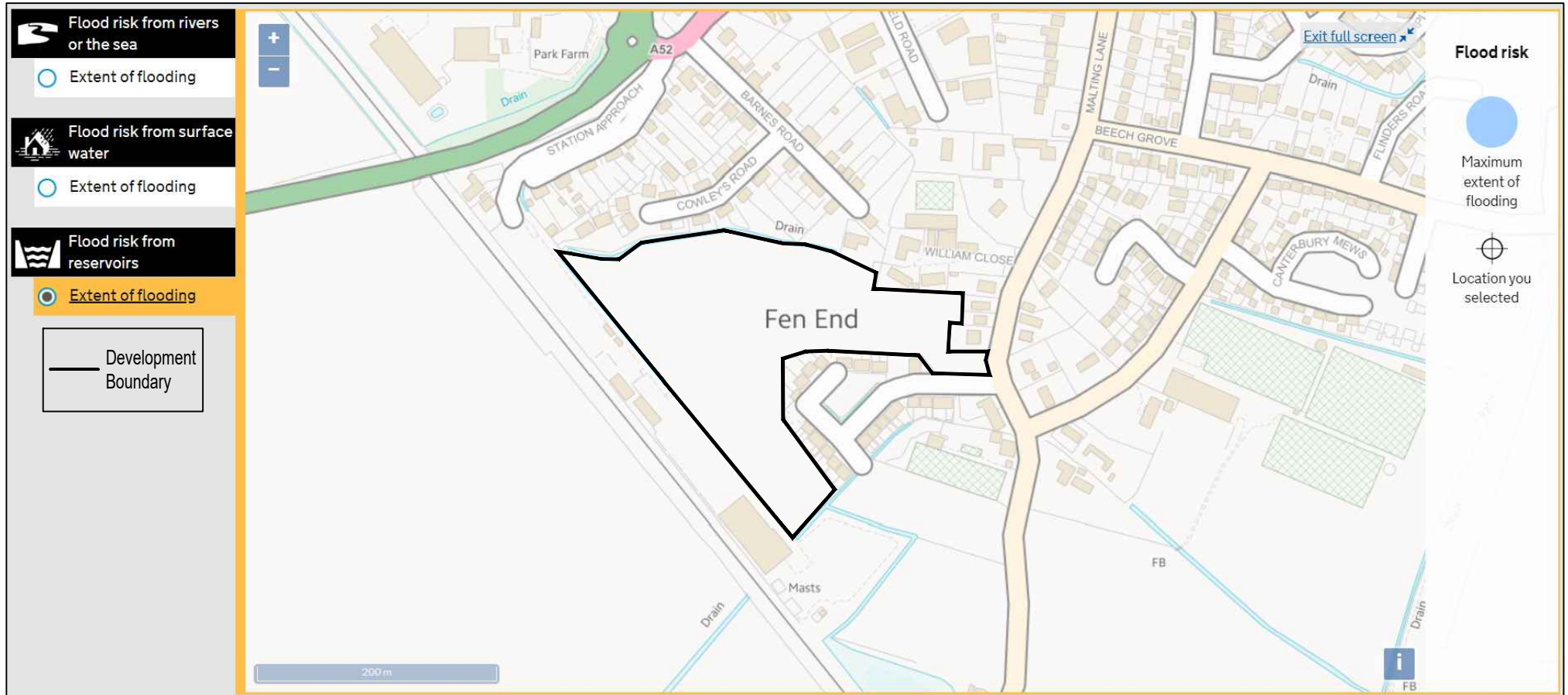
South Holland Flood Risk for Fluvial and Tidal (Extract)



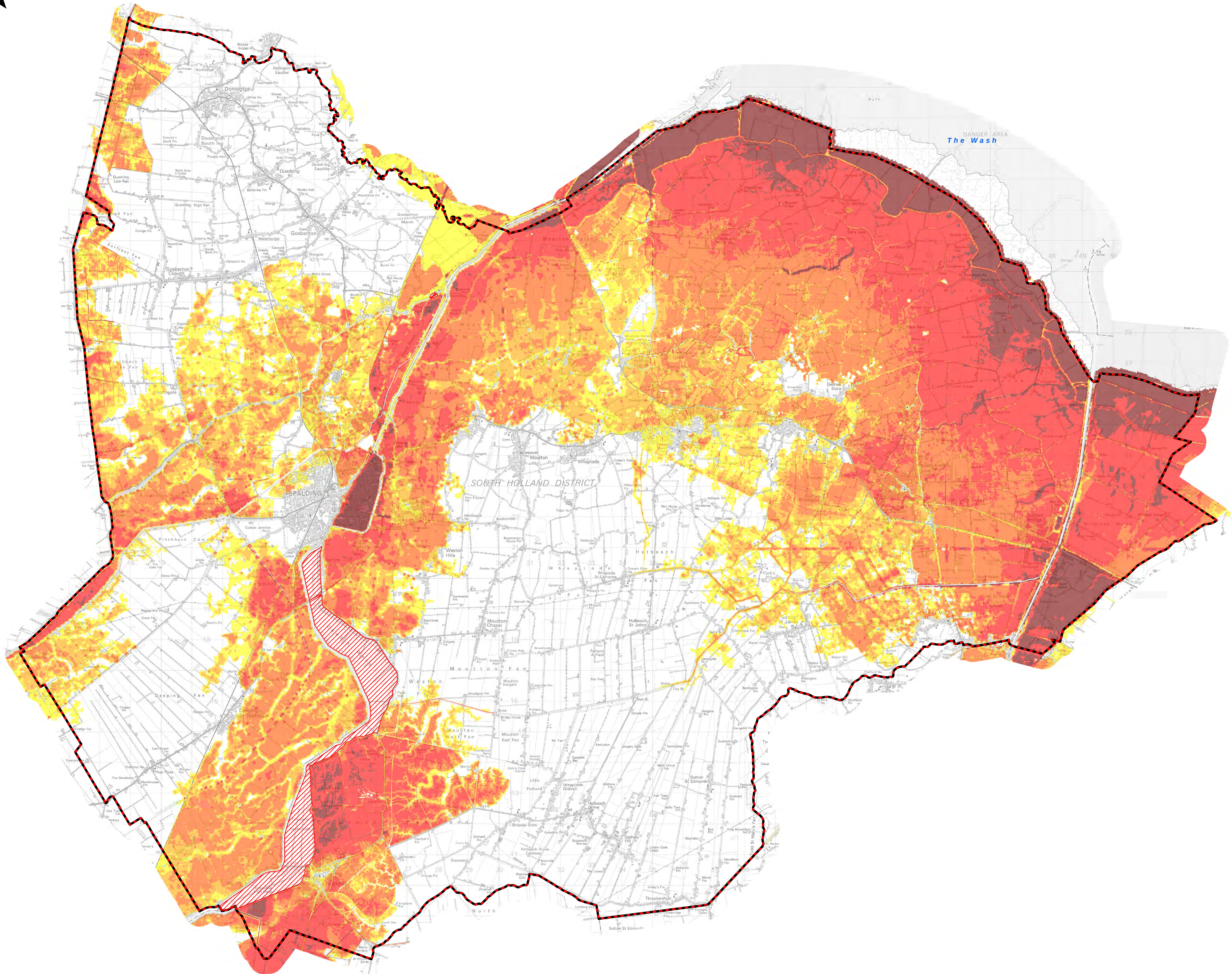
LAND OFF MALTINGS LANE, DONINGTON
 EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
 FLOOD ZONE MAP
 EXTRACT TAKEN 02.12.2019 : NTS



LAND OFF MALTINGS LANE, DONINGTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
RISK FROM FLOODING FROM SURFACE WATER
EXTRACT TAKEN 02.12.2019 : NTS



LAND OFF MALTINGS LANE, DONINGTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
RISK FROM FLOODING FROM RESERVOIR
EXTRACT TAKEN 02.12.2019 : NTS



- 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

- 0m - 0.25m
- 0.25m - 0.5m
- 0.5m - 1m
- 1m - 2m
- 2m +

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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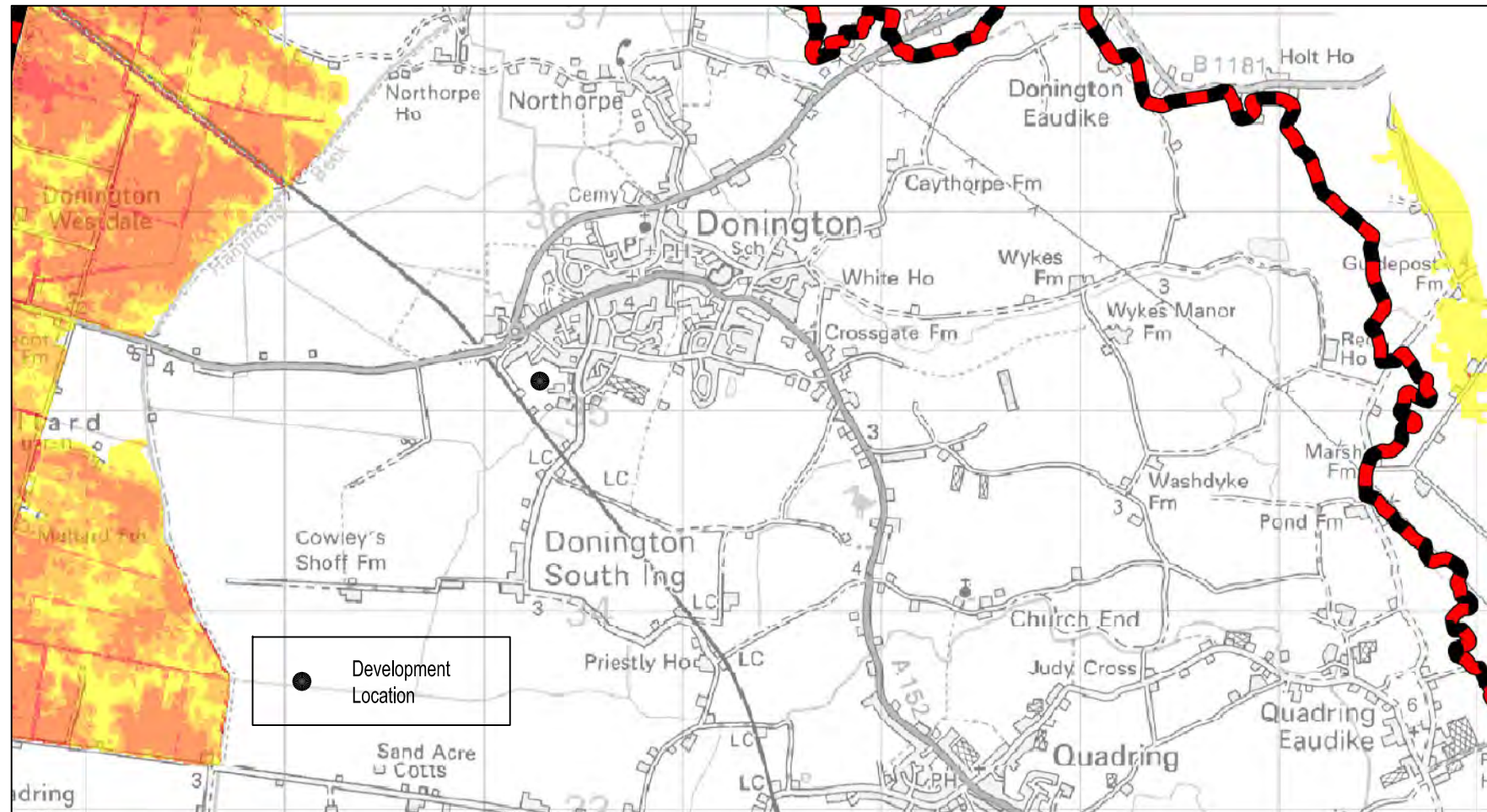
SOUTH HOLLAND DISTRICT COUNCIL
COUNCIL OFFICES
PRIORY ROAD
SPALDING
LINCOLNSHIRE
PE11 2XE

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:



MALTING LANE, DONNINGTON
SOUTH HOLLAND SFRA RESIDUAL FLOOD RISK MAP (EXTRACT)

EXTRACT TAKEN 22.01.2020 : NTS