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FLOOD RISK ASSESSMENT

ON

**LAND OFF LINGARDS ROAD,
SLAITHWAITE
HUDDERSFIELD
WEST YORKSHIRE**

FOR

S. B. HOMES LTD.

E20/7567/FR01 Revision C

October 2022

T. Haigh. B.Sc., C.Eng., M.I.C.E.



1.0 INTRODUCTION

- 1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance with Planning Practise Guidance- Flood Risk and Coastal Change April 2015 (PPG-FRCC). The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect.

2.0 THE SITE

- 2.1 The site is located to the south of Manchester Road (A62) in Huddersfield, West Yorkshire. It lies approximately 1.0km to the southwest of Slaithwaite Town Centre. A site location plan (Fig. I) is attached in Appendix A
- 2.1 The site can be accessed from Lingards Road on its south east boundary. The Ordnance Survey co-ordinates for the centre of the site are 407290m E, 413350m N. The site is approximately 2.1 hectares in area and slopes steeply from south to north and from east to west. The site levels vary considerably with the north west boundary varying from 172m to 173.6 and from 177.6 to 178.2m AOD. The south eastern boundary falls from 203.1m to 184m whilst the western boundary falls from 203m down to 173.6m AOD. The levels to the north eastern boundary vary from 181.1 to 172.63 m AOD, A site survey is shown in the Appendices.
- 2.2 The site is irregularly shaped and located on the edge of a residential area. To the north, east and south there are single dwelling residential developments to the main roadways. Beyond these are open pastureland with steep slopes from the south. The land to the north all slopes away from the site down to Manchester Road and then down through wooded slopes to the River Colne.
- 2.3 There are two watercourses shown crossing the site one of which has been culverted. These flow from south to north and exit the site via a culvert on the north eastern boundary. The nearest water course beyond these are the River Colne which is approx. 100m away to the



north of the site. The water courses crossing the site issue from springs within the Millstone grit rock on the southern edge of the site. The catchment areas falling towards the site are substantial but there are a number of springs along this escarpment that allow the ground water to flow out of the rocks. The precise catchment areas are unknown. The River Colne flows from west to east through Huddersfield before flowing east to join the River Calder.

- 2.4 OS Maps shows an ordinary watercourse running south to north before changing direction to run north east which doesn't conform with the natural site contours. A second system feeds this line running south west to north east. This section may be man-made. Nothing is known about it, (are there other connections or where it goes thereafter). This should be investigated for flood routing and possible use as a surface water outfall for the site particularly if off-site improvements may be required, Surface waterflood maps don't really reveal anything of note. There may have been incidents of cellar flooding to adjacent properties at the eastern boundary. Kirklees MDC Land Drainage section have stated that they would expect an analysis of where water would go now if an extreme storm event landed on saturated ground above and on the site. Broad flood routes should be established from which a layout can be designed around. Flood routing past development should be designed to avoid property and curtilage, i.e. use road network and public open space.
- 2.5 Kirklees MDC Land Drainage section have advised that a survey of the culverted watercourse downstream of the site will be required. Any major defects on that culvert would need to be rectified. Before it can be accepted as an outfall for the site. Normally any remedial works required to off-site culverts on third party land should be strictly undertaken by the riparian landowner, a commuted sum may be required as a contribution to the cost of works as the developer has no rights to enter third party land to undertake such works. It is envisaged that land drains will need to be installed on the site to pick up all groundwater issues and direct them to the water to the watercourse in the centre of the site.



3.0 GEOLOGICAL CONSTRAINTS TO DRAINAGE

- 3.1 It is understood that the proposed development is for residential development with associated roads drives and car parking areas. An indicative schematic has been utilised for this Flood Risk Assessment to enable a drainage strategy to be developed. A preliminary site layout is attached in the appendices.
- 3.2 There is some site investigation information available at the time of writing this report a brief summary is given below. The British Geological society web site has been consulted and we would report as follows:-
- 3.3 The site is shown to be underlain by the East Carlton Gritstone Formation which is a fine grained sandstone sedimentary rock with little overlying superficial deposits. The strata can be permeable but relies on water passing through cracks and fissures rather than the rock itself. These groundwater systems can lead to ground water appearing at the surface when these become blocked and can change position over time.
- 3.4 The use of soakaways and other infiltration systems are not recommended on steeply sloping sites such as this due to the risk of ground water re-emerging lower down the slopes. For this reason, the use of infiltration systems for this site have been discarded. It is unknown whether the watercourse is suitable as an out fall and should be analysed on and off site. Alternatively, there is a combined sewer located in Manchester Road to the north and there appears to be a suitable route down to this point. There should be no pumping of surface from the site as this introduces a flood risk not currently present.

4.0 FLOOD RISK

- 4.1 On reviewing the Environmental Agency new website showing the flood risk maps for planning, the site falls wholly within zone 1. The site is therefore considered not to be at risk from fluvial flooding from rivers or sea for the 1 in 100 or the 1 in 1000 year flood event. The proposed use of the site for residential development would be classified as More Vulnerable in



Table 2 of the (PPG-FRCC). In accordance with NPPG the proposed development would be considered appropriate.

- 4.2 The Long-Term Surface Water Flooding Low Risk maps for the area around the site show it not to be affected by surface water flooding. The DEFRA maps on Long term Surface water flooding around the site does not show any ingress of flood water even under very low risk events.
- 4.3 The site does not appear to fall within an area subject to flooding from reservoirs according to the EA maps. The site does not fall within a flood warning zone or within a Flood Alert Area.
- 4.4 Due to the size of the development over 1Ha it would be necessary to prepare a site Specific Flood Risk Assessment for the site.
- 4.5 There are a number of potential flooding mechanisms that NPPG now requires evaluation for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The normal requirement of the document is for no flooding of properties for storms up to a 1% probability or a once in a 100 years storm. The risk assessment also includes for flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse. (PPG-FRCC). also requires that the effects of severe storms above the normal 1% probability are reviewed together with the effects of climatic change relating to the design life of the development.
- 4.6 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures. Prior to this the Sequential Test or the Exceptions test as outlined in (PPG-FRCC), must also be applied to each development site. These are not covered in this report.
- 4.7 PPG-FRCC requires that each flooding mechanism is addressed, and levels of risk evaluated. We consider there are three main risks of flooding to the site the alternative mechanisms are not applicable to this site.



- 4.7.1 Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.
- 4.7.2 Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.
- 4.7.3 Overland flows from adjacent land sites due to surcharging of sewerage systems or other watercourses.
- 4.7.4 The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.
- 4.7.5 The risk of flows from ground water and existing watercourses across the site affecting the proposed development.

5.0 **DISCUSSION OF FLOOD RISKS**

5.1 **Flood Risk from Watercourses, River & Tidal**

- 5.1.1 The proposed development area does not fall within the 1% probability Flood Risk Maps (Zone 3) as published by the Environment Agency. The site is therefore considered not to be at risk from fluvial flooding for the once in 100 year flood event. Nor does it fall within the once in 1000 year flood event zone. We therefore consider the risk of flooding of the site from River and Sea is acceptable for this type of development.

5.2 **Risk of Flooding from overland flows from adjacent land.**

- 5.2.1 The site lies on a sloping site with small residential development to the north and east. The areas to the east are all served by public drainage systems and the ground falls away from the site. The topography is such that the land to the west and east falls steeply away to the north and overland flows would predominantly flow in that direction and not encroach on the site. The area of land to the north beyond the existing residential development does fall towards



the site but is shielded by Lindgards Road and the drainage systems within it which would deter flows away from the site. The level of risk of flooding from surcharged sewers or drains is still prevalent in this scenario but is considered to be less than 3%. There is always the risk of these systems blocking or being surcharged in extreme events but then the topography would channel waters away from the site along Lingards Road.

- 5.2.2 We would however recommend that an overland flood route is provided through the site to cater for such extreme events, as is normal under the Sewers for Adoption criteria and floor levels are based a minimum of 300mm above existing ground levels.

5.3 **Risk of Flooding from Rainwater Falling on Site**

- 5.3.1 The risk of flooding from water falling on site and not being able to leave the site is relatively high. The impermeable area of the site will increase markedly due to the development and this would increase the run off from the site. The current site is undeveloped and has no impermeable area. For the purposes of this report it is assumed that the site is taken as an open field, un-developed site with greenfield run off only.
- 5.3.2 The normal hierarchy for surface water discharge is primarily the use of infiltration systems, in accordance with current policies of the EA and Kirklees MDC. There has not been a site investigation for this site, but British Geological Information would suggest that due to the steep nature of the site and the underlying geological formations the use of infiltration systems would not be suitable for the site. For the purposes of this report we have considered the site not to be suitable for infiltration systems.
- 5.3.3 If infiltration systems are not feasible, then storm water attenuation systems should be utilised to ensure the flows from the site to a suitable watercourse, or surface water sewer, are reduced to agreed agricultural discharge rates. These can take the form of open swales, ponds, or detention basins but these do tend to take a substantial area of developable land and due to the steep nature of the land are unlikely to be feasible. The systems would therefore utilise underground tanks and over-sized pipes to store storm-water before discharge at agreed rates to a suitable outfall.



- 5.3.4 These systems would all have to limit flows down to an acceptable level. At present there is no impermeable surface on the site. The discharge rate for the site would have to reduce to agreed agricultural rates of discharge. The provision of open space on the site would have probably allowed the use of open swales and ponds for such a purpose, subject to suitable adoption arrangements. If these cannot be achieved, then a storage facility would have to be provided in the form of an underground concrete tank or a series of oversized pipes. These may not provide a suitable level of treatment of the run off from the site and biological systems at source may be needed to ensure suitable discharge contaminants are dealt with. Primary treatment for the roads would be the use of trapped gullies for all hard standings; driveways can be drained via a gravel filled channel alongside the drives which can afford a modicum of biological treatment to surface water run-off. Roof drainage systems can utilise water butts to recycle some of the runoff for horticultural use. The use of permeable pavements is not feasible on this site due to the underlying ground and the risk of re-emergence of infiltration into the fissures in the underlying sandstone.
- 5.3.5 The size of the storm water storage facilities would need to be determined accurately in the final detailed designs. These should be all in accordance with the PPG-FRCC Technical guidance issued in March 2014. The volumes of storage can include flooding to roads and designated areas such as carpark areas or public open space, but must ensure that no buildings are flooded.
- 5.3.6 The existing area of the site is estimated at 21000sq.m. which has a wholly greenfield run off towards the north west and north east corner of the site. It is therefore proposed to collect the flows from the site and attenuate these flows to an agreed level and provide storage on site. Kirklees MDC and the EA have a policy of agricultural discharge rates not exceeding 3.0 lit/s/ha because of downstream flooding problems. The calculated greenfield run off from the FEH Handbook for such a steep catchment in this area is in excess of this. It is therefore proposed to limit flows to 6.6 lit/s for the whole site to allow an adoptable system to be designed.
- 5.3.7 The estimated volumes of storage required for each of the storm profiles is based on not exceeding the agricultural discharge of 6.6 lit/s for the whole site. Yorkshire Water have previously stated that there is no capacity for surface water drainage into their systems but



may allow an agricultural discharge rate as a last resort. Based on the allowable discharge rate of 6.6 lit /sec, the estimated volumes of storage required from the Win DES suite of design programs are 625cu.m for the 1 in 100 year storm including for a 30% increase due to climate change effects.

- 5.3.8 The proposed discharge point and discharge rates from the site needs to be formally agreed with Yorkshire Water and the Local Land Drainage Authority, prior to detail design being undertaken. YW may accept, as a last resort, a discharge of 6.6 lit/s into their surface water system in Manchester Road but this would have to be confirmed and proved as a last resort.

5.4 Impact on existing drainage systems.

- 5.4.1 If the site is developed with attenuation systems and an agreed discharge rate reduced to agricultural rates of discharge, there would be no increase in the flood risk to properties off site or in the drainage networks downstream of the site. In real terms there would be slight reduction in flood risk to adjacent land due to the attenuation provided for the 1 in 100 year storms with the discharge rate cut to below the 1 in 1 year storm discharge rate.

6.0 CONCLUSIONS

- 6.1 The site to be developed currently falls within Flood Zone 1 as defined by the EA Flood maps. The flood risk is considered to be acceptable for this type of development.
- 6.2 The development of the site utilising infiltration techniques is not considered to be feasible. The use of attenuation systems to reduce the run-off from the site to an agricultural discharge rates would be required in the final site designs to ensure there is no increase in flood risk to the downstream catchment.
- 6.3 The risk of overland flows entering the site is considered to be low due to the topography of the area around the site and the drainage systems to the previously developed areas to the south. The only risk is from land to the south which has a limited catchment and this risk can



be further minimised by providing an overland flood water route through the site to ensure flood water flows are directed away from the existing and proposed housing.

- 6.4 The floor levels of the proposed buildings should be a minimum of 300mm above the existing finished road or ground level.
- 6.5 Attenuation systems to reduce run off to agricultural discharge rates are required to ensure discharges into the drainage system does not increase flood risks in the downstream catchment.

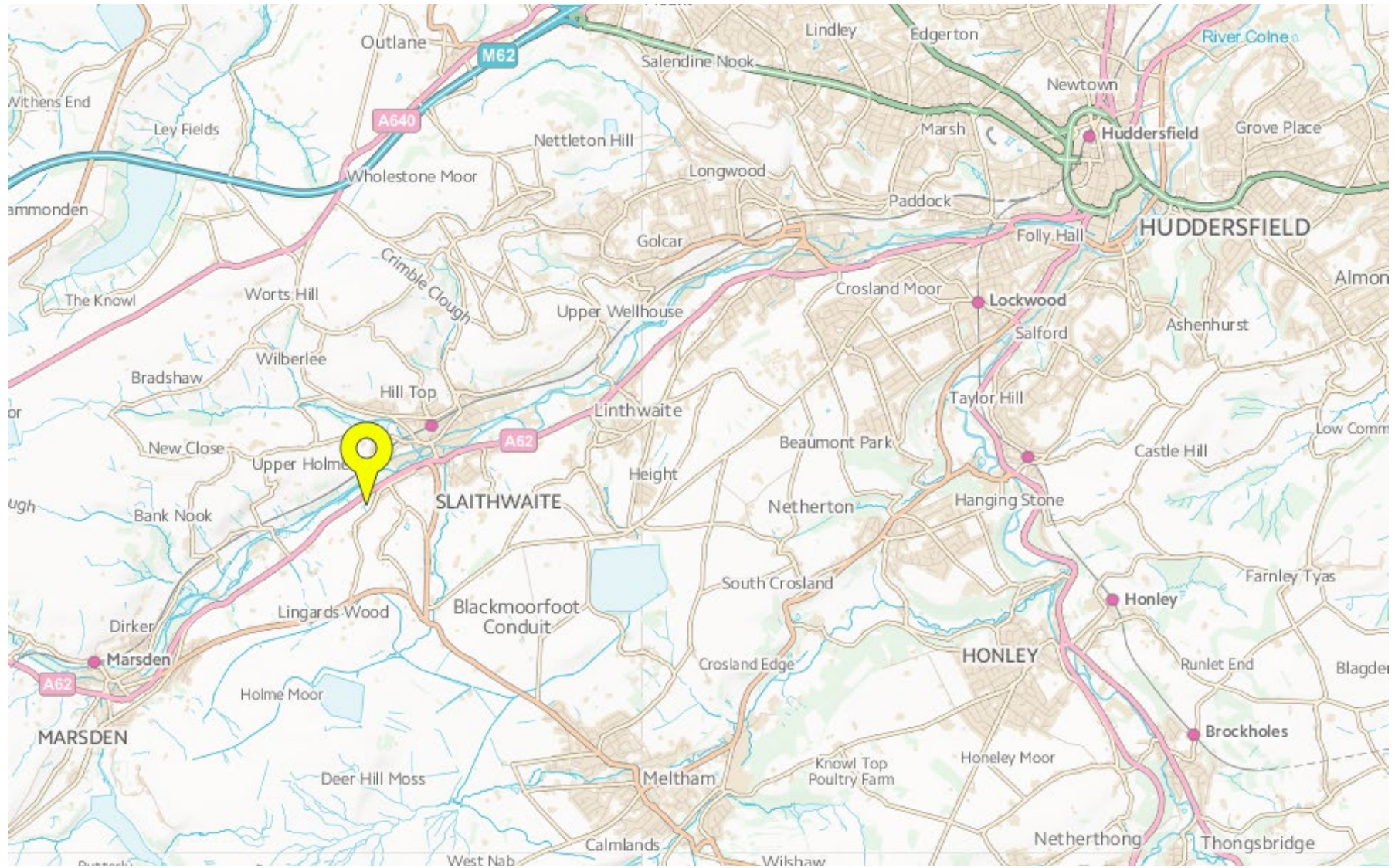
Trevor Haigh B.Sc., C.Eng., M.I.C.E.

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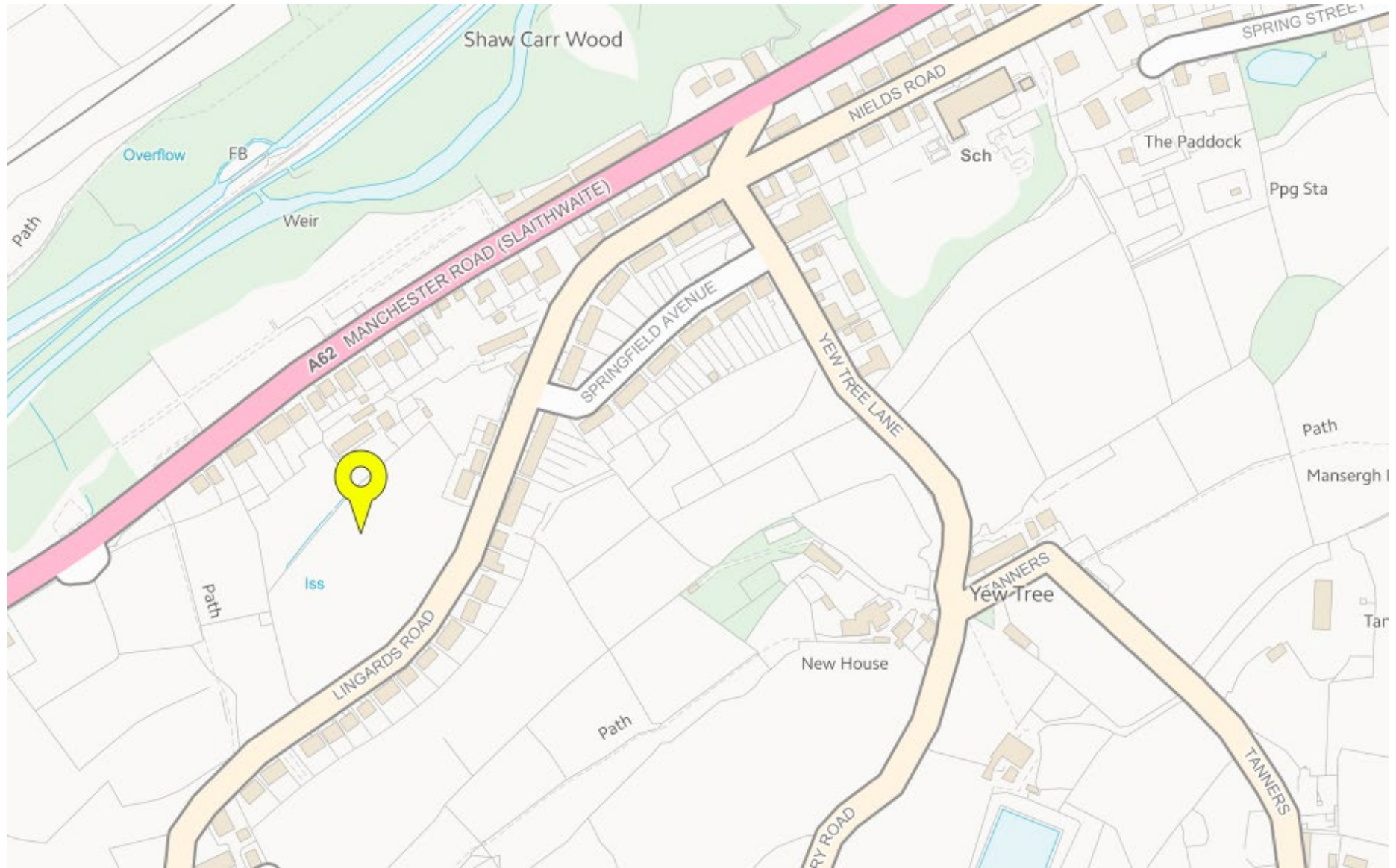
Appendix A

SITE LOCATION MAPS

SITE LOCATION PLAN 1



SITE LOCATION PLAN 2



Appendix B

AERIAL VIEW OF SITE

AERIAL PHOTOGRAPH OF SITE



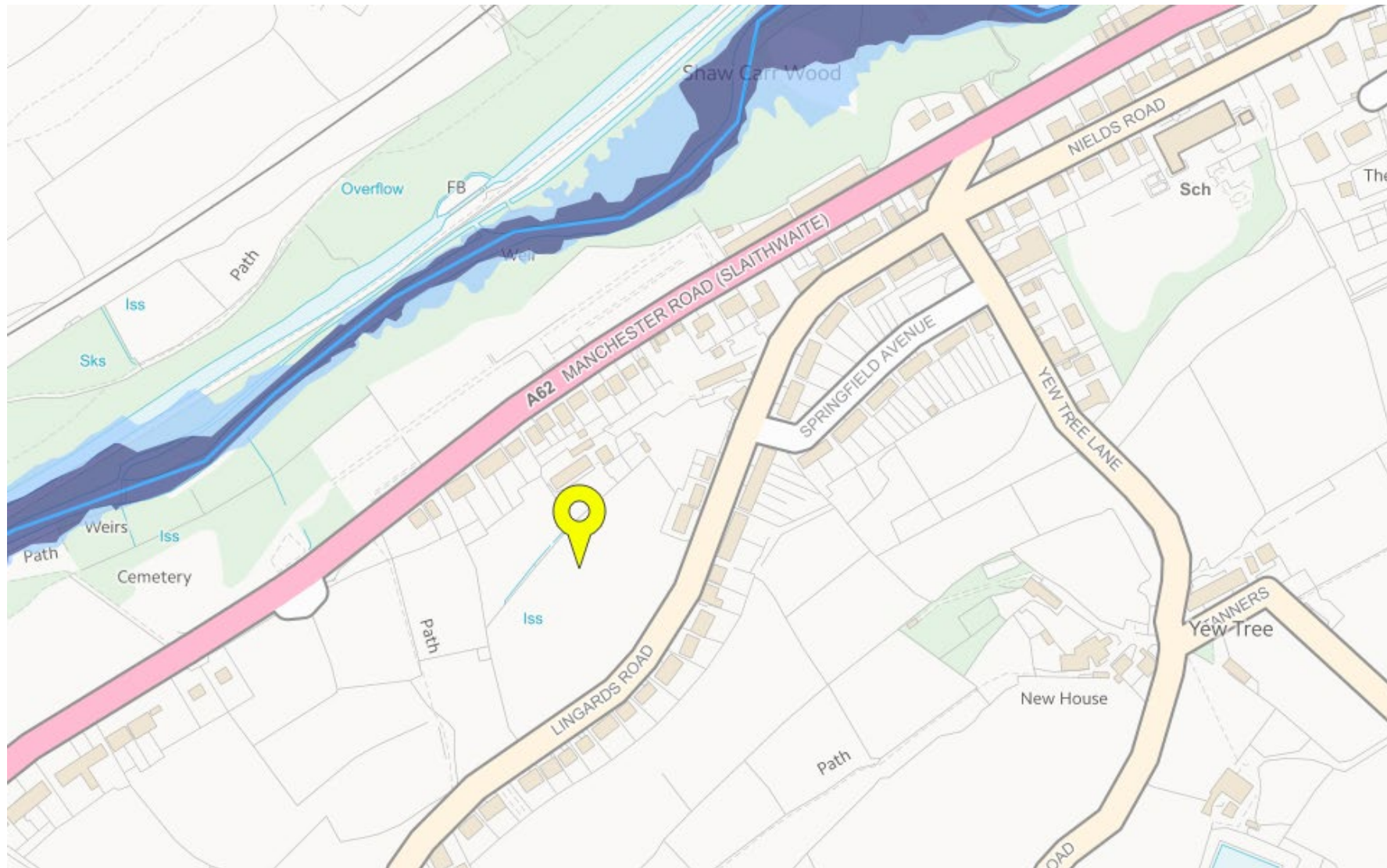
Appendix C

SITE SURVEY AND DEVELOPMENT PROPOSALS

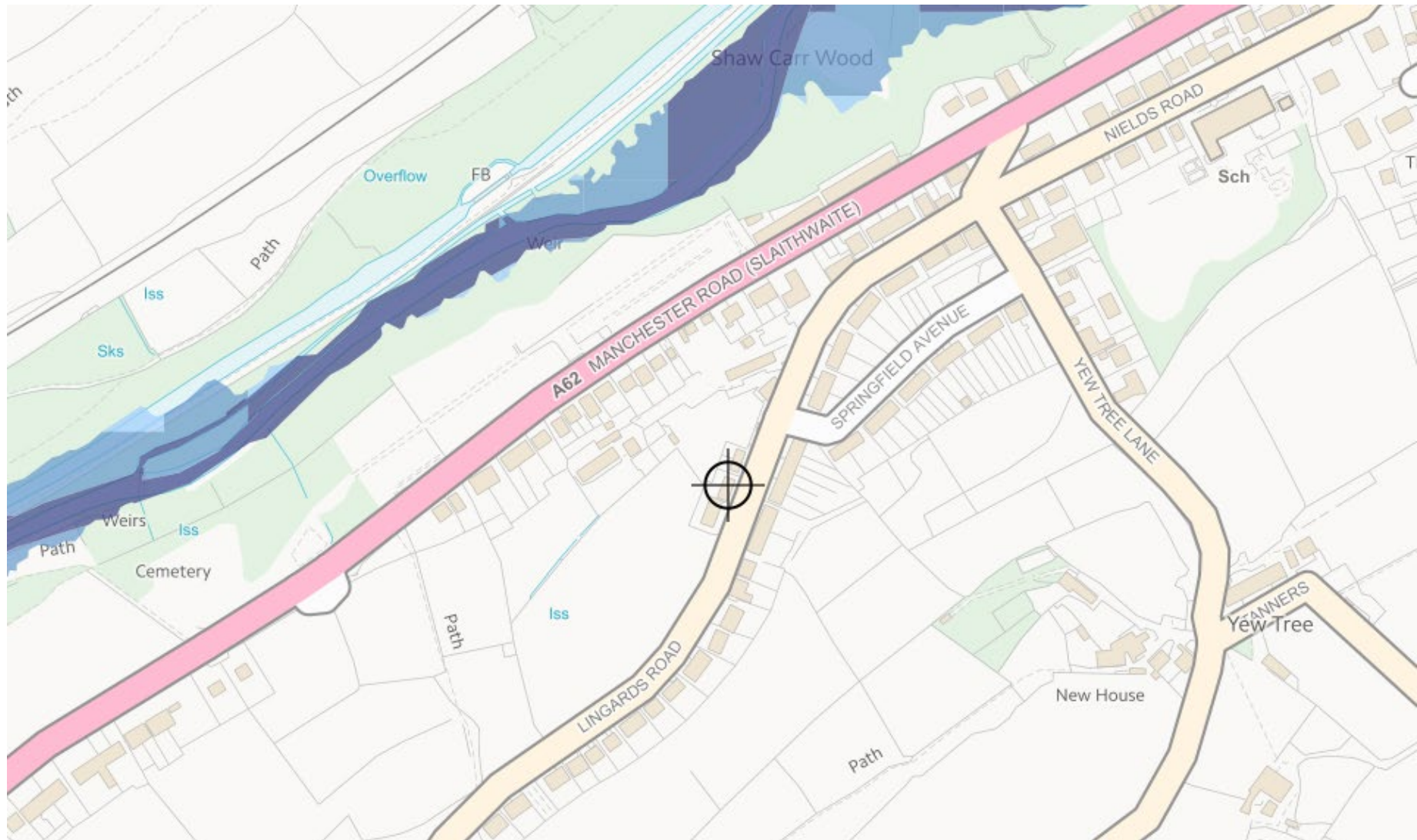
Appendix D

FLOOD RISK MAPS

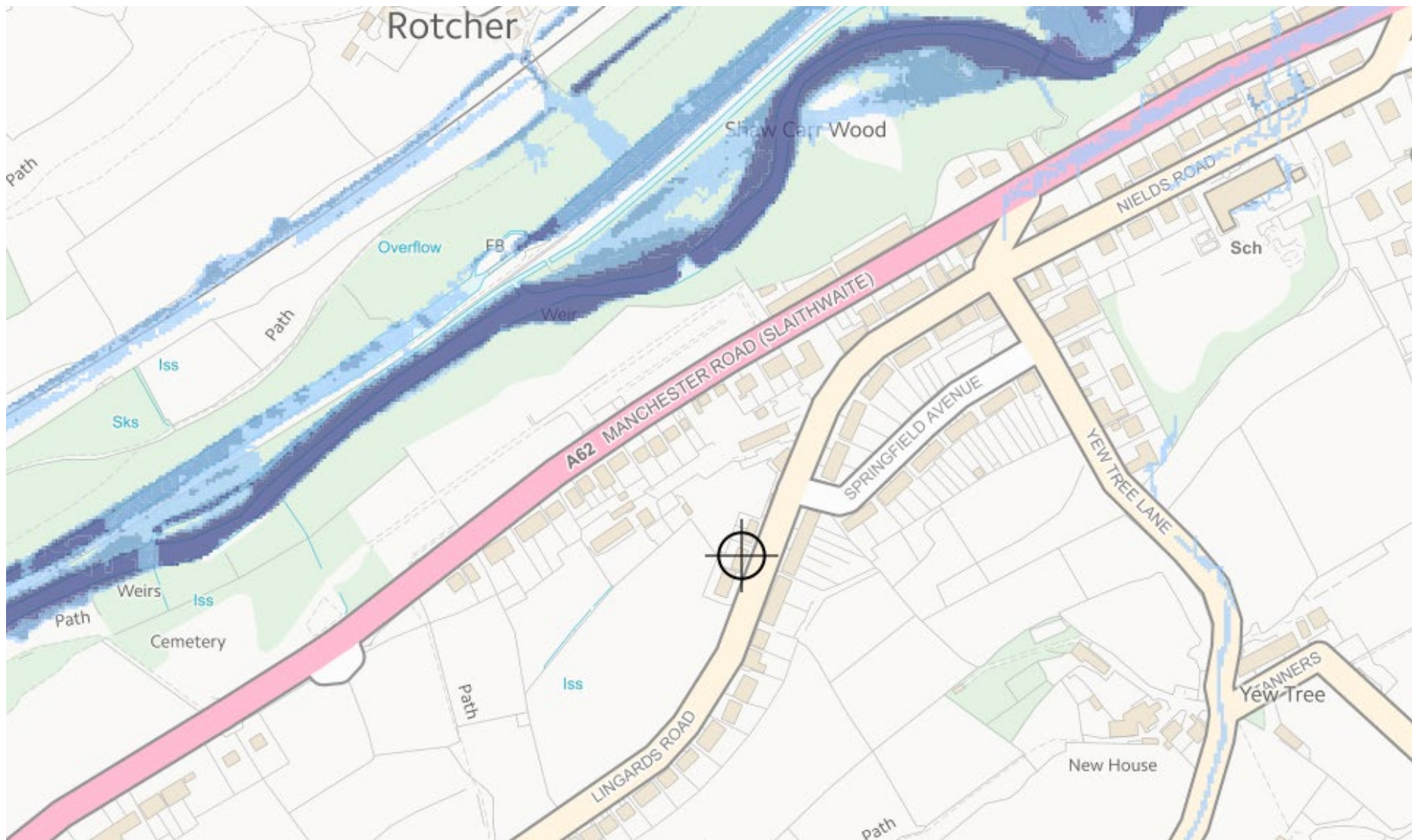
FLOOD RISK MAP FOR PLANNING



FLOOD RISK FROM RIVERS AND SEA - EXTENTS

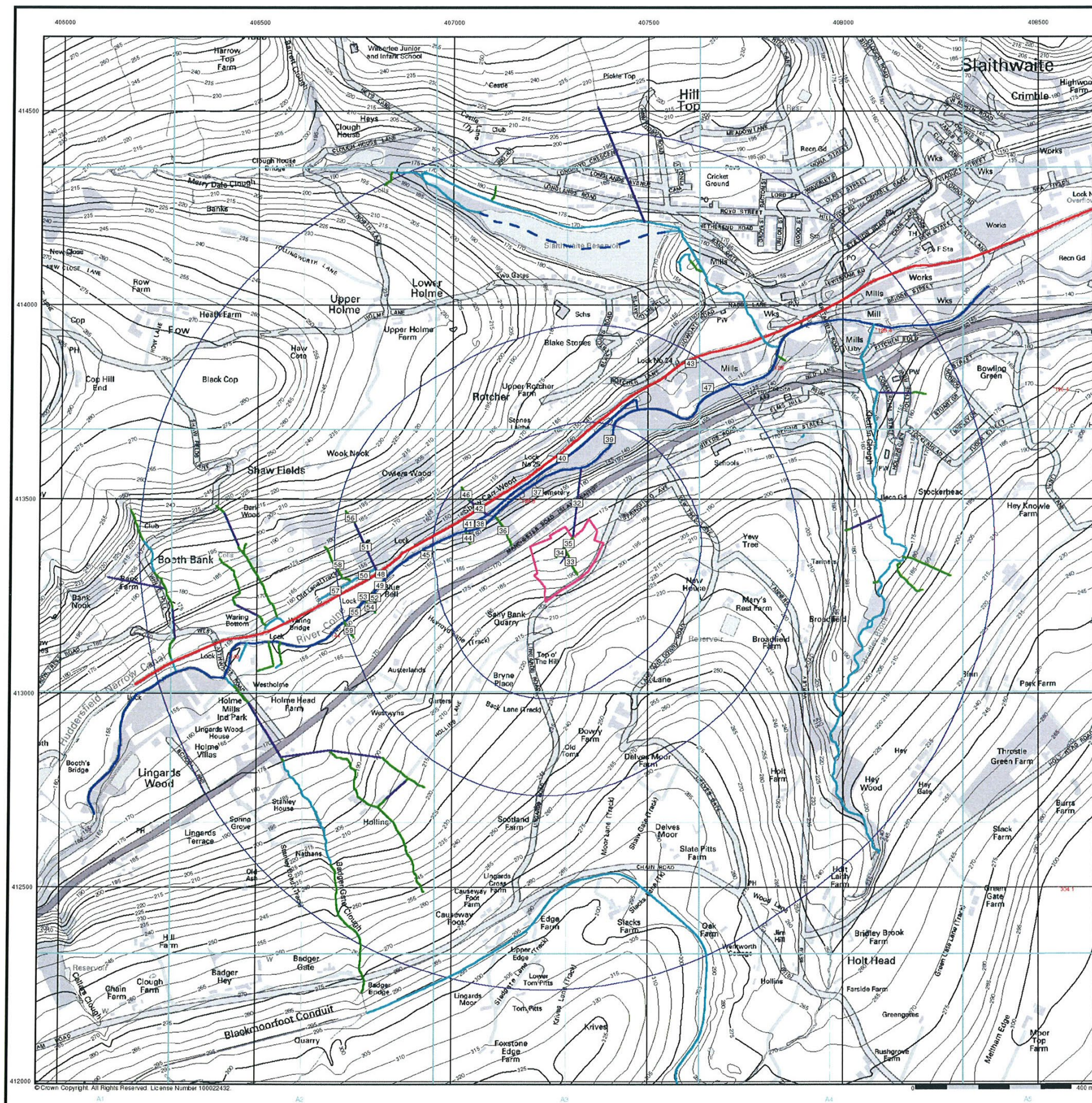


FLOOD RISK FROM SURFACE WATER FLOODING - LOW RISK



FLOOD RISK FROM SURFACE WATER FLOODING - RESERVOIRS





General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

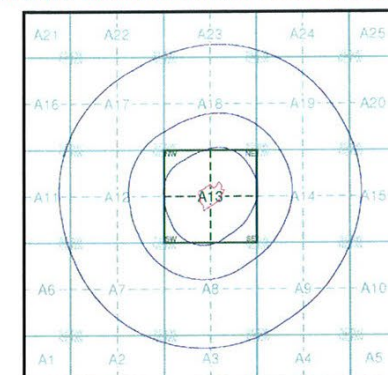
Detailed River Network Data

- Primary River
- Secondary River
- Tertiary River
- Canal
- Canal Tunnel
- Undefined River
- Lake/Reservoir
- Offline Drainage Feature
- Extended Culvert (greater than 50m)
- Underground River (inferred)
- Underground River (local knowledge)
- Downstream of High Water Mark
- Downstream of Seaward Extension
- Not assigned River feature

Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

EA/NRW Detailed River Network Map - Slice A



Order Details

Order Number: 62546774_1_1
 Customer Ref: 7364
 National Grid Reference: 407290, 413350
 Slice: A
 Site Area (Ha): 2.11
 Search Buffer (m): 1000

Site Details

50 Lingards Road, Slaithwaite, HUDDERSFIELD, HD7 5HY



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Appendix E

SURFACE WATER STORAGE CALCULATION

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Firth Buildings 99-101 Leeds Road Dewsbury WF12 7BU	SB HOMES LINGARDS ROAD SURFACE WATER 1 RevE	
Date 11/10/2022 14:40 File Lingards5.MDX	Designed by HH Checked by	
Micro Drainage	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for LINGARDS SURFACE3.SWS

Pipe Sizes LINGARDS SURFACE2 Manhole Sizes LINGARDS SURFACE2

FSR Rainfall Model - England and Wales					
Return Period (years)	2	PIMP (%)	100		
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0		
Ratio R	0.350	Minimum Backdrop Height (m)	0.000		
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	0.000		
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)	0.75		
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500		

Designed with Level Soffits

Network Design Table for LINGARDS SURFACE3.SWS

- Indicates pipe length does not match coordinates

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	12.737	0.159	80.0	0.010	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	21.490	0.269	80.0	0.042	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	12.062	0.151	80.0	0.254	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	61.102	0.764	80.0	0.121	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	40.214	0.402	100.0	0.166	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	49.182	0.492	100.0	0.033	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.006	10.154	0.911	11.1	0.122	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.007	4.200#	0.420	10.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.008	6.240#	0.042	148.6	0.000	0.00	0.0	0.600	o	225	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)
S1.000	66.99	4.15	180.200	0.010	0.0	0.0	0.0	1.46	58.2	1.8
S1.001	65.56	4.39	180.041	0.052	0.0	0.0	0.0	1.46	58.2	9.2
S1.002	64.80	4.53	179.772	0.306	0.0	0.0	0.0	1.46	58.2	53.7
S1.003	62.16	5.03	179.471	0.427	0.0	0.0	0.0	2.03	223.9	71.9
S1.004	60.37	5.40	175.300	0.593	0.0	0.0	0.0	1.81	200.1	97.0
S1.005	58.35	5.85	174.898	0.626	0.0	0.0	0.0	1.81	200.1	98.9
S1.006	58.23	5.88	174.331	0.748	0.0	0.0	0.0	6.12	972.7	118.0
S1.007	58.19	5.89	173.420	0.748	0.0	0.0	0.0	6.46	1027.0	118.0
S1.008	67.28	4.10	172.950	0.000	6.6	0.0	0.0	1.07	42.6	6.6

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Micro Drainage

SB HOMES
LINGARDS ROAD
SURFACE WATER 1 RevE

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Network 2020.1

Micro Drainage

Manhole Schedules for LINGARDS SURFACE3.SWS

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)	Backdrop (mm)
S1	181.661	1.461	Open Manhole	1200	S1.000	180.200	225				
S2	182.474	2.433	Open Manhole	1200	S1.001	180.041	225	S1.000	180.041	225	
S3	184.076	4.304	Open Manhole	1200	S1.002	179.772	225	S1.001	179.772	225	
S4	184.541	5.070	Open Manhole	1350	S1.003	179.471	375	S1.002	179.621	225	
S5	180.961	5.661	Open Manhole	1350	S1.004	175.300	375	S1.003	178.708	375	3408
S6	181.501	6.603	Open Manhole	1350	S1.005	174.898	375	S1.004	174.898	375	
S7	182.020	7.689	Open Manhole	1350	S1.006	174.331	450	S1.005	174.406	375	
S8	181.342	7.922	Open Manhole	1350	S1.007	173.420	450	S1.006	173.420	450	
S9	180.800	7.850	Open Manhole	2100	S1.008	172.950	225	S1.007	173.000	450	275
S10	178.500	5.592	Open Manhole	1200		OUTFALL		S1.008	172.908	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	407353.168	413416.236	407353.168	413416.236	Required	
S2	407365.126	413411.851	407365.126	413411.851	Required	
S3	407357.728	413391.674	407357.728	413391.674	Required	
S4	407360.178	413379.864	407360.178	413379.864	Required	
S5	407300.799	413365.454	407300.799	413365.454	Required	
S6	407267.559	413342.821	407267.559	413342.821	Required	
S7	407219.036	413334.793	407219.036	413334.793	Required	
S8	407217.459	413344.824	407217.459	413344.824	Required	
S9	407212.522	413344.034	407212.522	413344.034	Required	
S10	407152.591	413343.992			No Entry	

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Micro Drainage	Network 2020.1	

Area Summary for LINGARDS SURFACE3.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.010	0.010	0.010
1.001	-	-	100	0.042	0.042	0.042
1.002	-	-	100	0.254	0.254	0.254
1.003	-	-	100	0.121	0.121	0.121
1.004	-	-	100	0.166	0.166	0.166
1.005	-	-	100	0.033	0.033	0.033
1.006	-	-	100	0.122	0.122	0.122
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.748	0.748	0.748

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Online Controls for LINGARDS SURFACE3.SWS

Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.008, Volume (m³): 27.6

Unit Reference	MD-SHE-0100-6600-2500-6600
Design Head (m)	2.500
Design Flow (l/s)	6.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	172.950
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	6.6	Kick-Flo®	0.896	4.1
Flush-Flo™	0.438	5.1	Mean Flow over Head Range	-	5.1

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	3.3	1.200	4.7	3.000	7.2	7.000	10.7
0.200	4.6	1.400	5.0	3.500	7.7	7.500	11.1
0.300	5.0	1.600	5.4	4.000	8.2	8.000	11.4
0.400	5.1	1.800	5.7	4.500	8.7	8.500	11.8
0.500	5.1	2.000	5.9	5.000	9.1	9.000	12.1
0.600	5.0	2.200	6.2	5.500	9.6	9.500	12.4
0.800	4.6	2.400	6.5	6.000	10.0		
1.000	4.3	2.600	6.7	6.500	10.4		

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Firth Buildings 99-101 Leeds Road Dewsbury WF12 7BU	SB HOMES LINGARDS ROAD SURFACE WATER 1 RevE													
Date 11/10/2022 14:40 File Lingards5.MDX	Designed by HH Checked by													
Micro Drainage		Network 2020.1												
<u>Storage Structures for LINGARDS SURFACE3.SWS</u> <u>Tank or Pond Manhole: S9, DS/PN: S1.008</u> Invert Level (m) 173.300 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>180.0</td><td>2.200</td><td>180.0</td><td>2.250</td><td>0.0</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	180.0	2.200	180.0	2.250	0.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)									
0.000	180.0	2.200	180.0	2.250	0.0									
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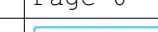
Summary of Critical Results by Maximum Level (Rank 1) for LINGARDS
SURFACE3.SWS

Simulation Criteria

Synthetic Rainfall Details

```
Margin for Flood Risk Warning (mm) 300.0      DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON
```

PN	US/MH Name	Storm	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	+0%					180.227	-0.198
S1.001	S2	15 Winter	+0%					180.097	-0.168
S1.002	S3	15 Winter	+0%					179.935	-0.062
S1.003	S4	15 Winter	+0%					179.608	-0.238
S1.004	S5	15 Winter	+0%					175.477	-0.198
S1.005	S6	15 Winter	+0%					175.078	-0.195
S1.006	S7	15 Winter	+0%					174.464	-0.318
S1.007	S8	180 Winter	+0%					173.765	-0.105
S1.008	S9	180 Winter	+0%	+0%/15 Winter				173.765	0.590

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Micro Drainage	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for LINGARDS
SURFACE3.SWS

Simulation Criteria

Synthetic Rainfall Details

```
Margin for Flood Risk Warning (mm) 300.0    DVD Status ON
      Analysis Timestep   Fine Inertia Status ON
            DTS Status      ON
```

								Water	Surcharged
PN	US/MH		Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth
	Name	Storm	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)
S1.000	S1	15 Winter	+0%	+0%/15 Winter				180.455	0.030
S1.001	S2	15 Winter	+0%	+0%/15 Winter				180.451	0.185
S1.002	S3	15 Winter	+0%	+0%/15 Winter				180.416	0.419
S1.003	S4	15 Winter	+0%					179.692	-0.155
S1.004	S5	15 Winter	+0%					175.653	-0.022
S1.005	S6	15 Winter	+0%					175.245	-0.028
S1.006	S7	15 Winter	+0%					174.532	-0.249
S1.007	S8	240 Winter	+0%	+0%/15 Winter				174.404	0.533
S1.008	S9	240 Winter	+0%	+0%/15 Winter				174.403	1.228

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Micro Drainage	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for LINGARDS SURFACE3.SWS

Pipe Sizes LINGARDS SURFACE2 Manhole Sizes LINGARDS SURFACE2

FSR Rainfall Model - England and Wales					
Return Period (years)	2	PIMP (%)	100		
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0		
Ratio R	0.350	Minimum Backdrop Height (m)	0.000		
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	0.000		
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)	0.75		
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500		

Designed with Level Soffits

Network Design Table for LINGARDS SURFACE3.SWS

- Indicates pipe length does not match coordinates

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	12.737	0.159	80.0	0.010	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	21.490	0.269	80.0	0.042	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	12.062	0.151	80.0	0.254	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	61.102	0.764	80.0	0.121	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	40.214	0.402	100.0	0.166	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	49.182	0.492	100.0	0.033	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.006	10.154	0.911	11.1	0.122	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.007	4.200#	0.420	10.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.008	6.240#	0.042	148.6	0.000	0.00	0.0	0.600	o	225	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)
S1.000	66.99	4.15	180.200	0.010	0.0	0.0	0.0	1.46	58.2	1.8
S1.001	65.56	4.39	180.041	0.052	0.0	0.0	0.0	1.46	58.2	9.2
S1.002	64.80	4.53	179.772	0.306	0.0	0.0	0.0	1.46	58.2	53.7
S1.003	62.16	5.03	179.471	0.427	0.0	0.0	0.0	2.03	223.9	71.9
S1.004	60.37	5.40	175.300	0.593	0.0	0.0	0.0	1.81	200.1	97.0
S1.005	58.35	5.85	174.898	0.626	0.0	0.0	0.0	1.81	200.1	98.9
S1.006	58.23	5.88	174.331	0.748	0.0	0.0	0.0	6.12	972.7	118.0
S1.007	58.19	5.89	173.420	0.748	0.0	0.0	0.0	6.46	1027.0	118.0
S1.008	67.28	4.10	172.950	0.000	6.6	0.0	0.0	1.07	42.6	6.6

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Manhole Schedules for LINGARDS SURFACE3.SWS

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)	Backdrop (mm)
S1	181.661	1.461	Open Manhole	1200	S1.000	180.200	225				
S2	182.474	2.433	Open Manhole	1200	S1.001	180.041	225	S1.000	180.041	225	
S3	184.076	4.304	Open Manhole	1200	S1.002	179.772	225	S1.001	179.772	225	
S4	184.541	5.070	Open Manhole	1350	S1.003	179.471	375	S1.002	179.621	225	
S5	180.961	5.661	Open Manhole	1350	S1.004	175.300	375	S1.003	178.708	375	3408
S6	181.501	6.603	Open Manhole	1350	S1.005	174.898	375	S1.004	174.898	375	
S7	182.020	7.689	Open Manhole	1350	S1.006	174.331	450	S1.005	174.406	375	
S8	181.342	7.922	Open Manhole	1350	S1.007	173.420	450	S1.006	173.420	450	
S9	180.800	7.850	Open Manhole	2100	S1.008	172.950	225	S1.007	173.000	450	275
S10	178.500	5.592	Open Manhole	1200		OUTFALL		S1.008	172.908	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	407353.168	413416.236	407353.168	413416.236	Required	
S2	407365.126	413411.851	407365.126	413411.851	Required	
S3	407357.728	413391.674	407357.728	413391.674	Required	
S4	407360.178	413379.864	407360.178	413379.864	Required	
S5	407300.799	413365.454	407300.799	413365.454	Required	
S6	407267.559	413342.821	407267.559	413342.821	Required	
S7	407219.036	413334.793	407219.036	413334.793	Required	
S8	407217.459	413344.824	407217.459	413344.824	Required	
S9	407212.522	413344.034	407212.522	413344.034	Required	
S10	407152.591	413343.992			No Entry	

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Area Summary for LINGARDS SURFACE3.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.010	0.010	0.010
1.001	-	-	100	0.042	0.042	0.042
1.002	-	-	100	0.254	0.254	0.254
1.003	-	-	100	0.121	0.121	0.121
1.004	-	-	100	0.166	0.166	0.166
1.005	-	-	100	0.033	0.033	0.033
1.006	-	-	100	0.122	0.122	0.122
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.748	0.748	0.748

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Online Controls for LINGARDS SURFACE3.SWS

Hydro-Brake® Optimum Manhole: S9, DS/PN: S1.008, Volume (m³): 27.6

Unit Reference	MD-SHE-0100-6600-2500-6600
Design Head (m)	2.500
Design Flow (l/s)	6.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	172.950
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	6.6	Kick-Flo®	0.896	4.1
Flush-Flo™	0.438	5.1	Mean Flow over Head Range	-	5.1

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	3.3	1.200	4.7	3.000	7.2	7.000	10.7
0.200	4.6	1.400	5.0	3.500	7.7	7.500	11.1
0.300	5.0	1.600	5.4	4.000	8.2	8.000	11.4
0.400	5.1	1.800	5.7	4.500	8.7	8.500	11.8
0.500	5.1	2.000	5.9	5.000	9.1	9.000	12.1
0.600	5.0	2.200	6.2	5.500	9.6	9.500	12.4
0.800	4.6	2.400	6.5	6.000	10.0		
1.000	4.3	2.600	6.7	6.500	10.4		

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Firth Buildings 99-101 Leeds Road Dewsbury WF12 7BU	SB HOMES LINGARDS ROAD SURFACE WATER 1 RevE													
Date 11/10/2022 14:41 File Lingards5.MDX	Designed by HH Checked by													
Micro Drainage		Network 2020.1												
<u>Storage Structures for LINGARDS SURFACE3.SWS</u> <u>Tank or Pond Manhole: S9, DS/PN: S1.008</u> Invert Level (m) 173.300 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>180.0</td><td>2.200</td><td>180.0</td><td>2.250</td><td>0.0</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	180.0	2.200	180.0	2.250	0.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)									
0.000	180.0	2.200	180.0	2.250	0.0									
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Firth Buildings

99-101 Leeds Road

Dewsbury WF12 7BU

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SB HOMES

LINGARDS ROAD

SURFACE WATER 1 RevE

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Micro Drainage

Summary of Critical Results by Maximum Level (Rank 1) for LINGARDS SURFACE3.SWS

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 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 Offline Controls 0

Number of Time/Area Diagrams 0

Number of Online Controls 1

Number of Storage Structures 1

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.350

Return Period (years) 100

Cv (Summer) 0.750

Region England and Wales

Cv (Winter) 0.840

M5-60 (mm) 19.000

Margin for Flood Risk Warning (mm) 300.0

DVD Status ON

Analysis Timestep Fine

Inertia Status ON

DTS Status ON

Profile(s)

Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160

Sensitivity flows(s) (%) 0, +30

PN	US/MH Name	Storm	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	+30%	+0%/15 Winter				181.404	0.979
S1.001	S2	15 Winter	+30%	+0%/15 Winter				181.399	1.134
S1.002	S3	15 Winter	+30%	+0%/15 Winter				181.347	1.350
S1.003	S4	15 Winter	+30%	+30%/15 Winter				179.862	0.016
S1.004	S5	15 Winter	+30%	+0%/15 Winter				177.118	1.443
S1.005	S6	15 Winter	+30%	+0%/15 Winter				176.089	0.816
S1.006	S7	360 Winter	+30%	+0%/180 Winter				175.389	0.608
S1.007	S8	360 Winter	+30%	+0%/15 Winter				175.388	1.517
S1.008	S9	360 Winter	+30%	+0%/15 Winter				175.387	2.212

PN	US/MH Name	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.25		12.8	FLOOD RISK	
S1.001	S2	0.000	0.67		35.6	SURCHARGED	
S1.002	S3	0.000	3.08		153.2	SURCHARGED	
S1.003	S4	0.000	1.01		212.3	SURCHARGED	
S1.004	S5	0.000	1.58		286.5	SURCHARGED	
S1.005	S6	0.000	1.62		299.3	SURCHARGED	
S1.006	S7	0.000	0.11		58.3	SURCHARGED	
S1.007	S8	0.000	0.16		57.5	SURCHARGED	
S1.008	S9	0.000	0.22		6.5	SURCHARGED	

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Appendix F

SURFACE WATER DRAINAGE STRATEGY



1. ALL ADOPTABLE SEWER WORKS AND MATERIAL TO BE IN ACCORDANCE WITH "CODES FOR ADOPTION", THE RELEVANT BRITISH/EUROPEAN AND YORKSHIRE WATER'S STANDARDS/REQUIREMENTS/ADDENDUM TO THE MECHANICAL AND ELECTRICAL SPECIFICATION AND KITEMARKED.
2. MANHOLE COVERS SHALL MUST HAVE A CLEAR OPENING OF 600mm AND SHALL BE CLASS D400 TO BS EN 124 WITH 150mm DEEP FRAMES IN HIGHWAYS.
3. FILLED GROUND MUST BE FILLED AND CONSOLIDATED UNDER THE SUPERVISION AND TO THE SATISFACTION OF YORKSHIRE WATER BEFORE ANY SEWER WORKS ARE CARRIED OUT.
4. YORKSHIRE WATER IS **NOT** OBLIGED TO ACCEPT FILTER DRAIN/LAND DRAINAGE RUNOFF INTO THE PUBLIC SEWER NETWORK OR ADOPTABLE DRAINAGE SYSTEM (DIRECTLY OR INDIRECTLY). AN ALTERNATIVE METHOD OF DISPOSAL OF THE LAND DRAINAGE RUNOFF WILL THEREFORE BE REQUIRED AND YOU WILL HAVE TO LIAISE WITH THE LOCAL AUTHORITY, LAND DRAINAGE SECTION WITH REGARD TO THE DISPOSAL OF THE FILTER DRAIN/LAND DRAINAGE RUNOFF.
5. COVER SLABS MUST CARRY THE BSI KITEMARK OR WILL BE REJECTED BY YORKSHIRE WATER INSPECTOR. WHERE THE CLEAR OPENING OF THE KITEMARKED PRODUCT IS DIFFERENT TO THAT OF THE COVER AND FRAME, A LOADING BEARING SLAB SHOULD BE FITTED ABOVE THE COVER SLAB TO BRING THE SIZE DOWN TO 600x600mm FOR THE YORKSHIRE WATER SPECIFIED COVER SIZE. PLEASE REFER TO CONCRETE PIPE SYSTEMS ASSOCIATION (CPSA), TECHNICAL BULLETIN ISSUED AUTUMN 2004 FOR KITEMARKED COVER SLAB OPENING SIZES.
6. SULPHATE RESISTANT CEMENT (C20-DC2) AND PRECAST CONCRETE PRODUCTS MUST BE USED OR A LABORATORY REPORT PROVIDED PROVING THAT SUCH PRECAUTIONS ARE NOT NECESSARY.
7. THE ADOPTABLE SEWERS SHOULD BE A MINIMUM OF 1m AND MANHOLES 0.5m FROM KERB FACES.
8. SEWERS MUST HAVE 5m CLEARANCE FROM TREES AND HEDGES.
9. SEWERS TO BE LAID IN CLASS "S" BEDDING (150mm GRANULAR BED AND SURROUND), WHERE DEPTH OF COVER TO TOP OF THE SEWER IS LESS THAN 1.2m IN HIGHWAYS AND VERGES (OR LESS THAN 900mm IN NONE VEHICULAR ACCESS AREAS) THEN A 175mm CONCRETE SLAB OVER SEWER SHALL BE PROVIDED.
10. ALL PIPEWORK 300mm DIAM. OR LESS TO BE VITRIFIED CLAY CONFORMING WITH BS 65. MINIMUM CRUSHING STRENGTHS TO BE AS FOLLOWS: 100mm DIA. 40kN/m, 150mm DIA 40kN/m, 225mm DIA 45kN/m, 300mm DIA 72kN/m.
11. ALL PIPEWORK 375mm DIAM. OR GREATER TO BE CONCRETE CLASS 120 TO EN 1916/ BS 5911-1: 2002.
12. THE CHAMBER SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION IN THEM MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTIONS AND BENDS.
13. YORKSHIRE WATER POLICY IS NOT TO ACCEPT TYPE "C" BRICK MANHOLES AND 1050mm DIAM. MANHOLE RINGS. INSTEAD IT IS PREFERRED THAT YOU USE A TYPE "B" MANHOLE WITH 1200mm DIAM. OR 1500mm DIAM. RINGS, WITH THE OPENING SIGHTED OVER THE CHANNEL WHERE DEPTH OF COVER TO PIPE SOFFIT IS 1-1.5m.
14. ALL HIGHWAY WORKS AND MATERIAL TO CONFORM WITH KIRKLEES COUNCIL DESIGN GUIDANCE AND SPECIFICATION.
15. GULLY COVER AND FRAMES SHALL BE D400 DUCTILE IRON AND COMPLY WITH EUROPEAN STANDARD BS EN 124. THOSE SIGHTED IN ACCESSWAYS AND MEWS COURTS MUST BE SUITABLE FOR USE IN PEDESTRIAN AREAS.
16. BEDDING AND BACKFILL MATERIAL TO CONFORM TO THE REQUIREMENT OF WATER INDUSTRY SPECIFICATION 4-08-2 (TABLE A2).
17. PLASTIC CHANNEL SECTIONS IN MANHOLES ARE NOT ACCEPTABLE AND YORKSHIRE WATER WOULD PREFER CLAYWARE CHANNELS IN MANHOLES. YORKSHIRE WATER HAVE FOUND THAT PLASTIC CHANNELS ARE DIFFICULT TO SET IN CONCRETE AS THEY FLOAT AND A SATISFACTORY FINISH CANNOT BE OBTAINED ON BENCHING.
18. WHERE A S125 COVER AND FRAME HAS BEEN APPROVED, THIS **MUST NOT** BE COATED IN PLASTIC AND MUST HAVE LIFTING EYES SUITABLY SIZED TO ACCOMMODATE STANDARD LIFTING KEYS. SCREW DOWN COVERS ARE **NOT** ACCEPTABLE.
19. THERE SHOULD BE ENOUGH CLEARANCE TO ACCOMMODATE THE BEDDING FOR BOTH PIPES, APPROX 300mm : IF CROSSOVER IS NEAR THE ROCKER THEN THE CLEARANCE NEEDED MAY BE INCREASED.

KIRKLEES PAVEMENT DESIGN

ROAD LAYER	ALTERNATIVE MATERIAL	SHARED SURFACE/ HOME ZONE	LOCAL RESIDENTIAL STREET	CONNECTOR STREET	INDUSTRIAL ROAD
SURFACE COURSE	10mm stone mastic asphalt surface course			50	50
	SMA 14 surf 40/60				
	0/8mm dense surface course	30	30		
BINDER COURSE	AC 6 dense surf 100/150				
	Concrete block paving on 30mm sand bed red or brindle or similar approved. (Tegula / Yorkstone in conservation area)	80	N/A	N/A	N/A
BASE COURSE	0/20 dense binder course	55	55	55	55
	AC 20 dense bin 100/150				
BASE COURSE	0/32 dense / binder course	85	85	85	150
	AC 32 dense base / bin 100/50				

KIRKLEES PAVEMENT FOUNDATION DESIGN

	SUBBASE ON CAPPING			SUBBASE ONLY
CBR %	CAPPING(mm)	+ SUB BASE(mm)		SUB BASE(mm)
<2.5	Ground improvement will need to be considered to improve the subgrade CBR			
2.5	430	250	OR	420
3	380	230		370
4	320	220		320
5-15	260 -160	200		280 - 210
Greater than 15	150	200*		200*

*Minimum required type 1 subbase thickness to achieve 450mm (from the designed final surface) of non-frost susceptible material

*Recommended minimum:

1. 150mm sub-base + 600mm capping with layer 1 geogrid
2. Where <2m of made ground is present full excavation and replacement with engineered fill is required (usually without geogrids).
3. Where 2m to 5m of made ground is present a minimum 2m depth of excavation is required and replacement with geogrid (minimum 2 no. layers) reinforced engineered fill (proposal requires approval).
4. Where >5m of made ground is present specific ground improvement (proposal requires approval) is required.

KIRKLEES FOOTWAY AND CYCLEWAY PAVEMENT DESIGN

TYPE	CBR	SUB-BASE(mm)	BASE (mm) AC 32 dense base 100 / 150	BINDER COURSE (mm) AC 20 dense base 100 / 150	SURFACE COURSE(mm) AC 6 dense base 100 / 150
Pedestrian only Footway / Cycleway or Footpath	≥ 2.5%	100	0	50	20
Vehicular Footway Crossing or Light-Vehicle footways / cycleways	≥ 2.5%	225	0	50	20
Heavy-Vehicle footways/ Cycleways	≥ 2.5%	320	90	0	25
	≥ 2.5% & ≤ 4%	210	90	0	25

- Rev F SWS outfall amended.

Rev E Land drainage added.

Rev D Gullies added to new site frontage footpath. Tactile paving added.

Rev C Updated to suit latest planning layout. SWS outfall amended to suit clients instructions. White lining added.

Rev B Road 1A amended to suit Kirklees comments

Rev A Plot 6-19 & 24 amended to suit clients instructions. Site entrance radii increased. Highway dimensions added. Visibility displays added to plots 36-41.
- 19.10.22 HH

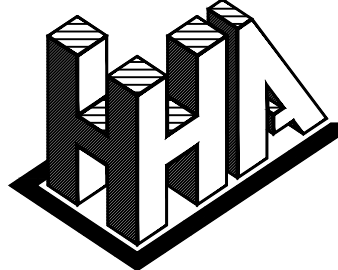
13.10.22 HH

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Client

SB HOMES

Project

LINGARD ROAD, SLAITHWAITE

Detail

MAIN ROAD AND SEWER PLAN

Dwn

Chkd

Date

Scale

Dwg No.

HH

JUN-22

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