

**Flood Risk Assessment
& Drainage Statement**

Proposed Foodstore Development

Old Mill Lane, Barnsley, S71 1LL

**For
Aldi Stores Ltd**

Report ref	Issue	Prepared by	Reviewed by	Date
15004-3E-00-XX-RP-C-9000	Issue 1	J Mitchell	S Thorpe	October 2016

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1.00 Introduction

1.01 This report is commissioned by Aldi Stores Ltd to examine the flood risk and drainage issues associated with the re-development of land off Old Mill Lane, Barnsley, South Yorkshire.

1.02 The objectives of this assessment are to identify any potential risk of flooding to the proposed development and any risks to the adjacent properties as a result of the re-development, in accordance with the requirements of the National Planning Policy Framework (NPPF) and its associated Technical Guidance. It will also assess the surface and foul water drainage proposals to ensure the development does not increase the risk of flooding elsewhere.

1.03 This report is based on information received from the Environment Agency following a request for flood model data in addition to information obtained from the Barnsley Strategic Flood Risk Assessment (SFRA) General Maps and the Environment Agency's (EA) online flood maps. Reference has also been made to two topographical surveys, one undertaken in 2008 and one in 2015, and historical and geotechnical maps of the area.

1.04 This report presents the factual information available during the time of appraisal, interpretation of the data obtained and recommendations relevant to the scope of works. It has been assumed in the production of this report that the site is to be redeveloped for a commercial end use.

1.05 This report has been prepared for the sole use of Aldi Stores Ltd. No other third party may rely upon or reproduce the contents of this report without the written approval of 3e Consulting Engineers. If any unauthorised third party comes into the possession of this report, they rely on it entirely at their own risk and 3e do not owe them any Duty of Care or Skill.

2.00 Site Location, Proposed Development and Topography

2.01 The site is centred on National Grid Reference 435192, 407312 and located approximately 1km north/east of Barnsley Town Centre. The site is currently undeveloped, unsurfaced and accessed via Old Tannery Road off Old Mill Lane (A61). An existing Wickes store and associated car parking is located north of the site, which also uses Old Tannery Road for access. The River Dearne is located just beyond Old tannery Road directly south of the site.

2.02 The proposed development layout is shown in **Appendix A** and shows the proposed foodstore located in the southern corner of the site. Car parking provision is provided to the north/north western part of the site with servicing to the east. The existing access will be maintained onto Old Tannery Road. The development also includes landscaping works.

2.03 The existing site is relatively flat in nature with levels across the site ranging from approximately 45.00m AOD in the north down to approximately 44.50m AOD to the south. The latest 2015 topographical survey shows Old Tannery Road located between the site and the River Dearne to the south west. Levels along the carriageway are set higher than the adjacent topography, effectively forming a berm between the site and the river. The minimum level along the carriageway is 44.98m AOD. The existing topographical survey is shown in **Appendix B**.

2.04 All heights specified on the topographical survey relate to the OSGB 36 datum and have been computed using the OSTN(02) Geoid model.

3.00 Existing Watercourses and Drainage

3.01 The River Dearne is the closest major watercourse to the site, running in a south easterly direction approximately 40m to the south of the site. The watercourse is located within a formalised stone, brick and concrete channel as it passes the site and is classified as Main River.

3.02 The River Dearne flows in an easterly direction for more than 30km, from its source just inside West Yorkshire, through Denby Dale, Clayton West, Darton and Barnsley to its confluence with the River Don and Denaby Main. As it passes the site the River Dearne has a catchment of approximately 120km².

3.03 The Yorkshire Water sewer record plan has been received but this does not show any sewers within close proximity of the site. This is understood to be due to the recent construction of Old Tannery Road and the likely diversion of the existing services. A full drainage connectivity survey should be undertaken to understand the location, depth and condition of all surface, foul and combined drainage networks.

3.04 Given the adjacent development, it is understood that both foul and surface/combined systems are available within the adjacent highways.

3.05 No existing drainage systems are understood to the present within the site.

4.00 Flood Zones & Risk To The Proposed Development

4.01 The site has been assessed for flood risk based on the EA Flood Maps and the Barnsley SFRA. All sources of flooding have been reviewed including fluvial, pluvial, tidal, artificial sources and groundwater.

Fluvial & Tidal Flooding

4.02 An extract of the Environment Agency Indicative Flood map is shown in **Figure 1** below. The proposed development is shown to be located partly within Flood Zone 1 'Low Probability' and partly within Flood Zone 3 'High Probability'. The National Planning Policy Framework states that Flood Zone 3 comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

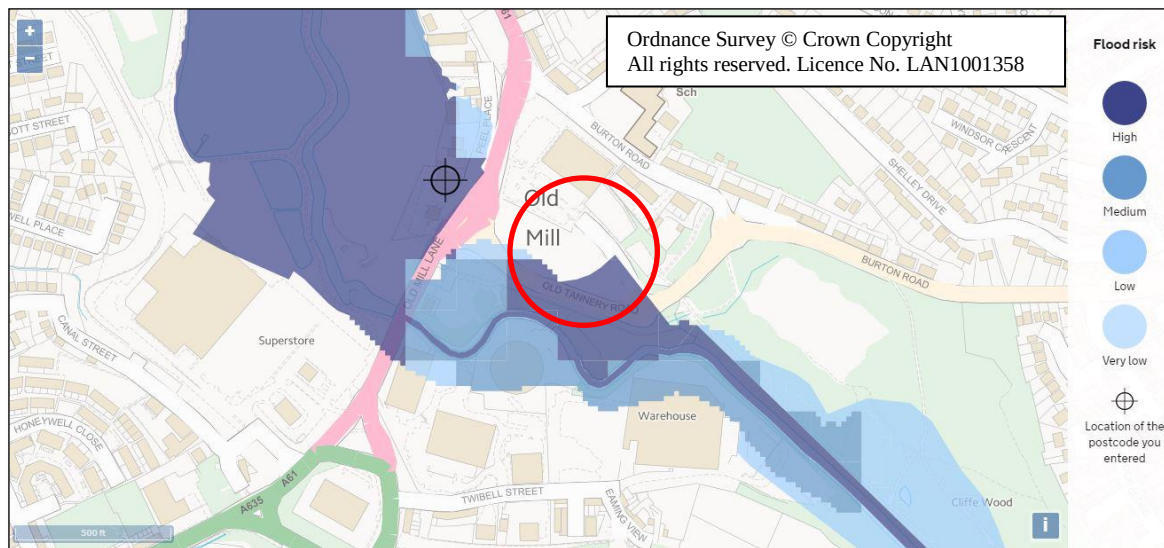


Figure 1 – Extract of EA Flood Map

4.03 The nearest source of fluvial flooding is predicted within the River Dearne immediately to the south of the site. The fluvial flooding is predicted to originate from out of bank flows downstream of the Old Mill Lane bridge as a result of out of bank flows due to insufficient capacity in the main river channels. The flood map indicates that there are no overland flows from upstream of the Old Mill Lane bridge. This is also confirmed within the SFRA flood maps.

4.04 It is, however, understood that these flood maps are based upon historic survey information dated before the Old Tannery Road was built in November 2013. A study of a much more recent topographical survey suggests that these fluvial floodwaters would not affect the site due to the embankment formed as part of the highway construction.

4.05 On behalf of Aldi Stores Ltd, 3E Consulting Engineers have obtained the relevant 'Product 4' information from the EA in relation to this site and the River Dearne. Two sets of modelled data were received in the form of the *2004 FRM River Don defended Scenario* and the *2010 Upper Dearne Undefended Scenario*. Although the 2004 model has a node located directly adjacent the site it was decided that the more recent and more onerous 2010 model should be used for this assessment. Shown below in Figure 2 is an extract of the EA node location plan.

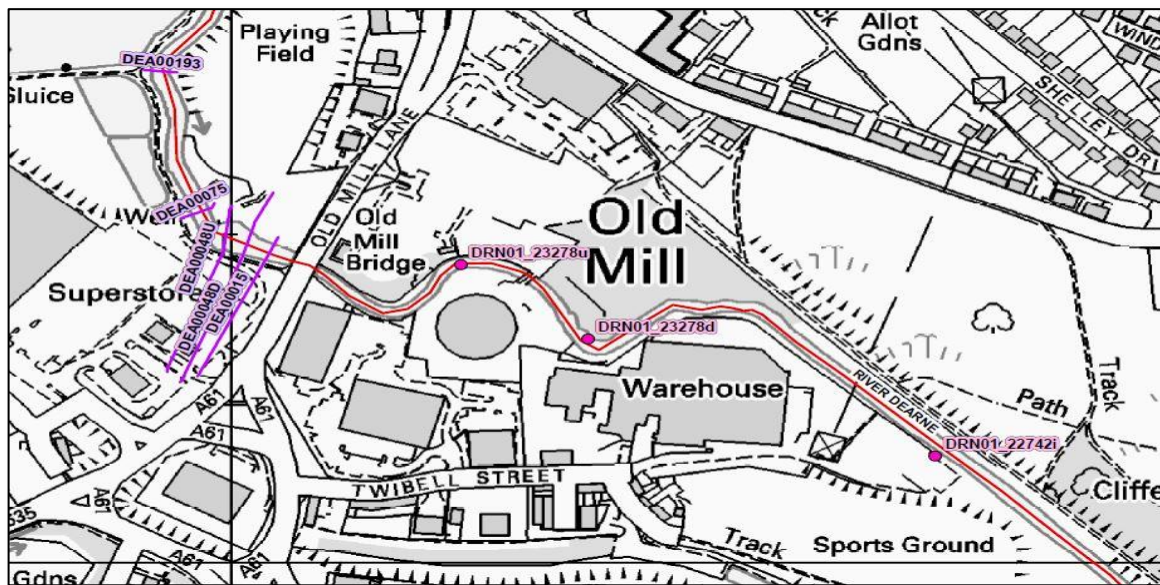


Figure 2 – EA Node Location Plan

4.06 To undertake this assessment the highlighted levels show below in Figure 3 have been used from Node DEA00015. This node is located approximately 100m south/west of the site, upstream of where Old Mill Lane (A61) crosses the River Dearne. It is considered that these levels will provide a worst case scenario as the DEA00015 flood levels are likely to be much greater at this location than they would adjacent the site. No hydraulic gradient has been applied along the length of the River Dearne to the point at which the site is located.

RFI: 32716 - Model results
Model: 2010 Upper Dearne
Undefended Scenario

Cross Section Reference Name	Return Period															
	Max Stage - Level (mAOD)								Max Flow - cubic m/sec							
	5yr	10yr	25yr	50yr	75yr	100yr	100yr+CC	1000yr	5yr	10yr	25yr	50yr	75yr	100yr	100yr+CC	1000yr
DEA00015	43.33	43.52	43.85	44.16	44.35	44.52	44.85	46.11	45.89	52.20	64.01	75.33	82.67	90.60	108.15	170.65
DEA00048D	43.48	43.68	44.05	44.38	44.59	44.76	45.12	46.39	42.73	47.82	56.18	63.50	67.85	72.50	82.23	94.71
DEA00048U	44.94	45.03	45.16	45.27	45.33	45.39	45.52	46.45	42.73	47.82	56.18	63.50	67.85	72.50	82.23	94.71
DEA00075	45.10	45.18	45.32	45.43	45.49	45.55	45.67	46.49	42.58	47.51	55.49	62.35	66.22	70.19	77.99	85.54
DEA00193	45.17	45.26	45.42	45.54	45.61	45.69	45.83	46.55	37.46	39.96	46.57	52.27	53.78	55.00	56.84	57.32
DEA00321	45.27	45.38	45.56	45.69	45.76	45.82	45.94	46.57	30.21	31.44	34.10	37.04	39.11	41.96	48.14	57.76
DEA00460	45.33	45.44	45.61	45.75	45.82	45.89	46.02	46.60	42.23	45.01	51.17	56.59	60.03	64.52	73.34	91.05

Node Point Name	Return Period											
	Max Stage - Level (mAOD)						Max Flow - cubic m/second					
	25yr	50yr	75yr	100yr	150yr	200yr	25yr	50yr	75yr	100yr	150yr	200yr
DRN01_23278u	43.21	43.41	43.49	43.53	43.70	43.75	49.25	56.12	58.95	60.30	66.63	68.80
DRN01_23278d	43.17	43.36	43.43	43.47	43.63	43.68	49.25	56.12	58.95	60.30	66.63	68.80
DRN01_22742i	41.57	41.79	41.87	41.90	42.08	42.13	49.25	56.12	58.95	60.30	66.63	68.80

Figure 3 – EA River Dearne Model Results

4.07 The above flood levels have been projected onto both the 2008 and the 2015 topographical surveys with the results shown on the sketch within **Appendix C**.

4.08 Insets 1 and 2 on the sketch show the 1 in 25 year and 1 in 100 year plus climate change flood levels projected onto the existing 2008 survey information. This information indicates that the site is at risk of flooding and would be considered to be located within Flood Zone 3. The 1 in 25 year flood level does not encroach into the site, indicating the development would not be located within Flood Zone 3b (functional flood plain).

4.09 It has been confirmed by Barnsley Council that Old Tannery Road was complete in November 2013, approximately 3 years after the latest flood modelling was carried out. It is therefore clear that this historical survey information forms the basis of the EA Flood Map, locating the site within Flood Zone 3.

4.10 Inset 3 on the sketch shows the approximate extents of Flood Zone 3 (taken as the 1 in 100 year plus climate change flood event) projected onto the existing 2015 survey information.

4.11 This sketch indicates that Old Tannery Road is completely elevated above the predicted 1 in 100 year plus climate change flood level and it, therefore, acts as a flood embankment along the southern boundary. To the east of the site, adjacent to the site entrance, surveyed ground levels approach the 1 in 100 year plus climate change level of 44.85m AOD, however, the ground levels do not permit floodwaters to enter the site.

4.12 This assessment is based on a worst case flood level of 44.85m, whereby no hydraulic gradient has been applied along the River Dearne, downstream of node DEA00015. It is considered that the 1 in 100 year plus climate change maximum water level adjacent to the site will be lower than the modelled level and the flood extents will be far less than that shown on the sketch.

4.13 It is therefore concluded that the site is not at risk of flooding from the 1 in 100 year plus climate change event and is therefore not located within Flood Zone 3. However, the site is still considered to be at risk during extreme flood events, greater than the modelled 1 in 100 year plus climate change event.

4.14 The site is therefore considered to have a 'Medium Risk' of fluvial flooding. In order to mitigate the risks to the development from pluvial flooding, finished floor levels should be set a minimum of 300mm above the predicted 1 in 100 year plus climate change flood level of 44.850m AOD.

Pluvial Flooding

4.15 The site may be vulnerable to pluvial flooding from the existing drainage systems adjacent to and within the site. Although no sewers are highlighted nearby on the sewer record plan, it is likely that both foul and surface water/combined sewers are present within the adjunct highway. The site may also be at risk of surface water run-off from the adjacent highways and other impermeable areas.

4.16 The Environment Agency, working with Lead Local Flood Authorities (LLFA's) have produced a series of updated Flood Maps for Surface Water (uFMfSW). These updated flood maps are based upon the latest modelling techniques and flood data and supersede the

previous nationally produced surface water mapping products. **Figure 4**, below, indicates the location of this predicted surface water flooding.

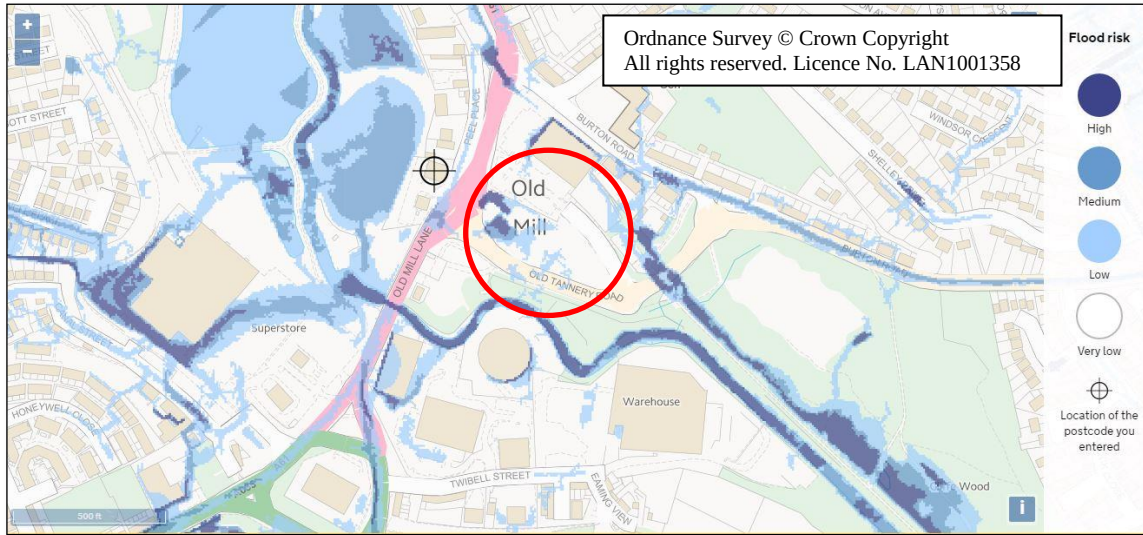


Figure 4 – Extract of EA Flood Maps for Surface Water

4.17 The surface water flood map shows a small section of the site which is considered to be at 'High' risk of surface water flooding with other small areas of 'Low' risk. The predicted floodwaters appear to enter the site from the adopted Old Mill Lane or from the adjacent retail store car park with the resultant waters ponding within the site.

4.18 Further study of the Flood Map for Surface Water indicate that this flooding is likely to be at depths of less than 300mm and velocities of less than 0.25 m/sec. However, some localised areas of deeper and faster flowing run-off may be experienced. This prediction is predominantly based upon large scale aerial surveys of the local topography, however, this quite accurately reflects the levels and gradients witnessed on site and those shown on the topographical survey.

4.19 The surface water flood maps indicate that the majority of pluvial floodwaters will pond within the north western part of the site. In order to mitigate the risks to the development caused by fluvial flooding, finished floor levels should be set a minimum of 150mm above the existing topographical survey levels within this area. This should ensure

that any future flood events are prevented from entering the building and are directed towards the surface water drainage and attenuation facilities.

4.20 It is, therefore, considered that the site has a medium risk of surface water flooding but that this risk can be managed through good design and careful consideration of the external levels. A minimum finished floor level of 45.150m AOD should be provided.

Flooding from Artificial Sources

4.21 The EA flood maps have been reviewed to determine the risk of flooding from artificial sources such as reservoirs, canals or flood defences etc. These maps will show any areas of potential risk of flooding due to failure of such structures.

4.22 The flood maps show there is no risk of flooding to the proposed development site from artificial sources.

Ground Water Flooding

4.23 Another potential risk of flooding to be considered is from rising groundwater within the underlying strata. A Phase 1 geo-environmental assessment was completed by 3e Consulting Engineers in January 201 with intrusive investigations currently ongoing. The investigations confirm that ground conditions generally comprise made ground underlain by alluvial soils. These soft cohesive soils were identified to vary greatly across the site and are further underlain by moderately strong siltstone. Shallow groundwater, between 0.59m and 1.24m bgl, was also encountered across the site.

4.24 Given the relatively flat nature of the site and surrounding area, and the type of development proposed, we do not consider this to be a significant risk. However, further consideration will be given to groundwater flooding following at the detailed design stage.

5.00 Surface & Foul Water Drainage

5.01 The proposed surface water drainage system should seek to meet the requirements of the NPPF. Additionally, the current Building Regulations now requires disposal of new development surface water run off to discharge by infiltration (to ground), to watercourse or to surface water sewer in that order of priority.

5.02 Sustainable Urban Drainage Systems (SUDS) should also be used wherever possible to mimic as far as practicable the natural run off regime, improve water quality, reduce run-off volume and attenuate peak flows. These should be designed in accordance with the current guidance, Ciria C753 'The SuDs Manual'.

5.03 The intrusive investigations undertaken by 3e Consulting Engineers suggest the site is underlain made ground over deep cohesive soils. A shallow water table was also recorded across the site. Given the anticipated low permeability of the above strata and the high water table, soakaways are unlikely to be suitable and will not be considered for the disposal of surface water.

5.04 The River Dearne is located approximately 40m to the south of the site and flows in a large formalised channel. However, no existing connectivity has been established between the site and the watercourse. The location of the existing highways, third party land and flood risk issues would prevent a new connection being made.

5.05 Given the above hierarchy, surface water flows should therefore be taken to the nearest combined or surface water sewer. Although no adoptable sewers are recorded within the adjacent highways, it is anticipated that drainage systems are available within the adjacent highways and the run-off from the proposed development should, therefore, be directed to these assets.

5.06 Should no system be readily available adjacent to the site then a lateral drain may be requisitioned to the site boundary. This should be discussed with the Yorkshire Water prior to the detailed design stage.

5.07 Given the lack of existing connections from the site, and its un-developed nature, surface water flows from the proposed development should be reduced to the existing greenfield run-off rate. The greenfield run-off rate should be calculated based on 5.0 l/sec/ha and the total site area of 1.05 ha. This would result in a proposed discharge rate from the site of 5.25 l/sec.

5.08 Flows from the development should be restricted to this maximum discharge rate using a suitable flow control device with surface water attenuation provided below ground to accommodate these flow rates.

5.09 At this stage no information is available on the location or depth of the existing sewer network. However, given the levels of the site relative to the adjacent highways, a surface water pump station may be required.

5.10 All proposed surface water systems should be designed to accommodate the worst case 1 in 30 year storm event without flooding. Furthermore, the worst case 1 in 100 year plus climate change storm event should also be retained on site in an area that will not cause flooding to any existing or proposed buildings. In accordance with the updated NPPF Technical Guidance, a climate change uplift of 40% should be applied to all rainfall estimates.

5.11 In line with current planning requirements and CIRIA guidance, the use of Sustainable Urban Drainage (SUDs) techniques to assist in the treatment of surface water at source should be considered within developments. A detailed drainage design has not yet been undertaken but the use of SUDs will be evaluated when preparing the detailed design of the proposed drainage system.

5.12 Foul water flows should also be directed to the nearest adopted foul water sewer which is understood to be located within the adjacent highway. Again, should no system be readily available adjacent to the site then a lateral drain may be requisitioned to the site boundary. Given the levels of the site relative to the adjacent highways, a foul water pump station may also be required.

6.00 Conclusions & Recommendations

6.01 The site has been reviewed in relation to all potential sources of flooding and it is considered the proposed development is generally at low to medium risk of flooding.

6.02 The site is shown to be located partly within Flood Zone 3 'High Probability'. However, this assessment is understood to be based on old topographical survey data and does not take into account the construction of local infrastructure which protects the site from flooding up to the 1 in 100 year plus climate change event. Taking the above into consideration the site is considered to have a 'Medium Probability' risk of flooding. The proposed development is classified as a 'Less Vulnerable' development in accordance with Table 2 of the NPPF Technical Guidance document and as such is noted as an 'Appropriate' development (in accordance with Table 3 of the guidance).

6.03 The development is also considered to have a medium risk of pluvial or surface water flooding, however, this risk can be managed through good design and careful consideration of the finished floor level and external levels. Finished floor levels should be set a minimum of 150mm above the existing topographical survey levels within this area. A minimum finished floor level of 45.150m AOD should, therefore, be provided.

6.04 External levels should also be shaped within the site to ensure that overland flows are directed away from any proposed or existing buildings and towards the surface water drainage and attenuation facilities.

6.05 Given the anticipated low permeability of the above strata and the high water table, soakaways are unlikely to be suitable and will not be considered for the disposal of surface water. No existing connectivity has been established between the site and the nearby River Dearne and, in addition, the location of the existing highways, third party land and flood risk issues would prevent a new connection being made.

6.06 Surface water flows should therefore be taken to the nearest combined or surface water sewer. It is anticipated that drainage systems are available within the adjacent highways and the run-off from the proposed development should, therefore, be directed to these assets.

6.07 Surface water flows from the proposed development should be reduced to the existing greenfield run-off rate of 5.0 l/sec/ha. Based on a site area of 1.05 ha this would result in a proposed discharge rate from the site of 5.25 l/sec. Flows from the development should be restricted to this maximum discharge rate using a suitable flow control device with surface water attenuation provided below ground to accommodate these flow rates.

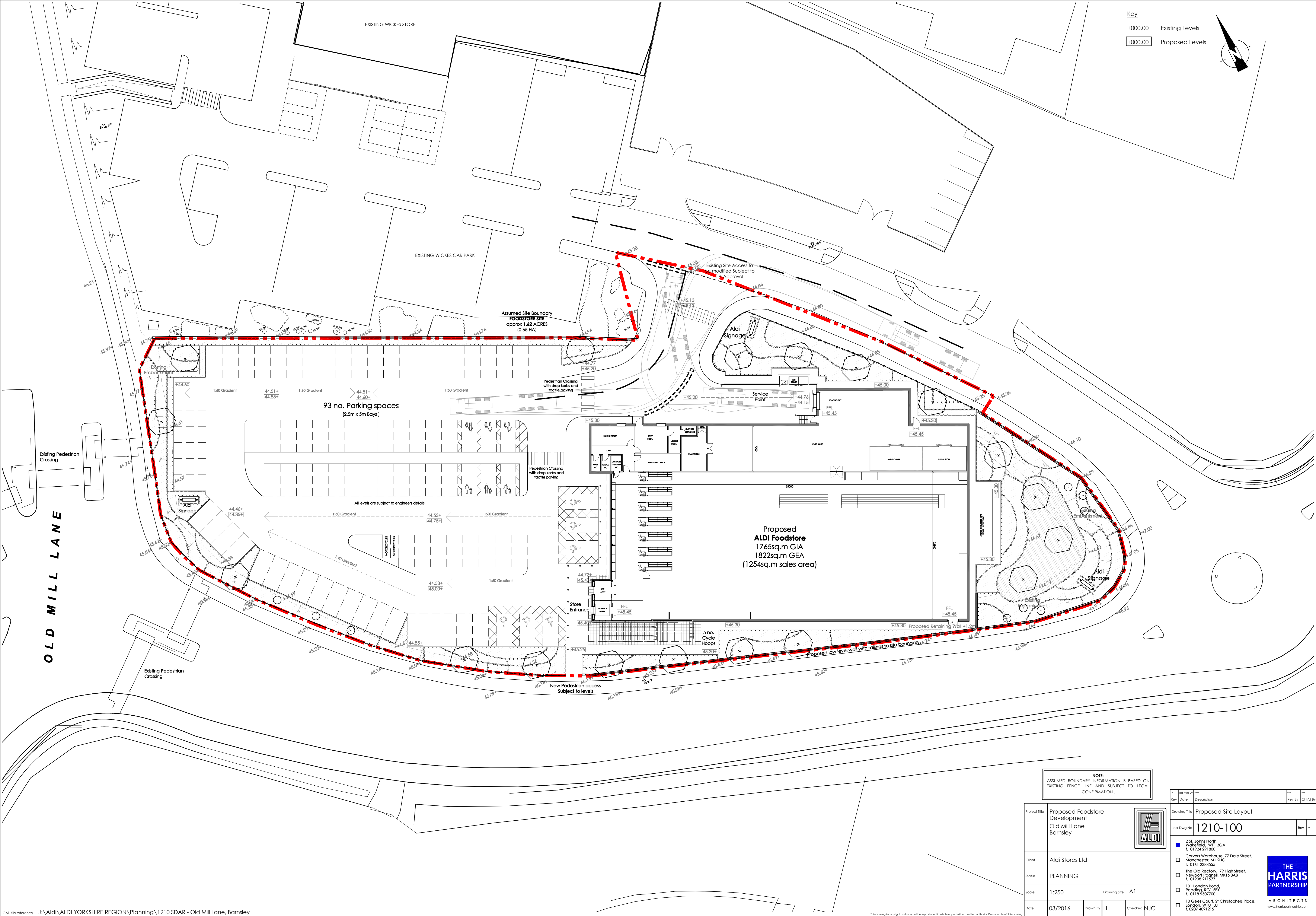
6.08 Foul water flows should also be directed to the nearest adopted foul water sewer which is understood to be located within the adjacent highway. Should no system be readily available adjacent to the site then a lateral drain may be requisitioned to the site boundary

6.09 SUDs techniques should be provided, where possible, to treat the surface water run-off from the site at source, prior to any discharge off site.

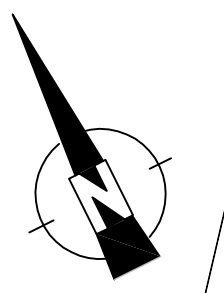
6.10 Given the levels of the site relative to the adjacent highways, both surface and foul water pumping station may be required.

APPENDIX A

Proposed Development Layout

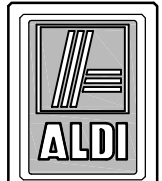


Key
+000.00 Existing Levels
+000.00 Proposed Levels



NOTE:
ASSUMED BOUNDARY INFORMATION IS BASED ON EXISTING FENCE LINE AND SUBJECT TO LEGAL CONFIRMATION.

Project Title	Proposed Foodstore Development Old Mill Lane Barnsley		
Client	Aldi Stores Ltd		
Status	PLANNING		
Scale	1:250	Drawing Size	A1
Date	03/2016	Drawn By	LH
		Checked	NJC



Job No	1210-100	Rev	-
2 St. Johns North, Wakefield, WF1 3QA t. 01924 291800			
Carvers Warehouse, 77 Dale Street, Manchester, M1 2HG t. 0161 2386555			
The Old Rectory, 79 High Street, Newport Pagnell, MK16 8AB t. 01908 211577			
101 London Road, Reading, RG1 5BT t. 0118 9507700			
10 Gess Court, St Christophers Place, London, W1U 1JJ t. 0207 4091215			

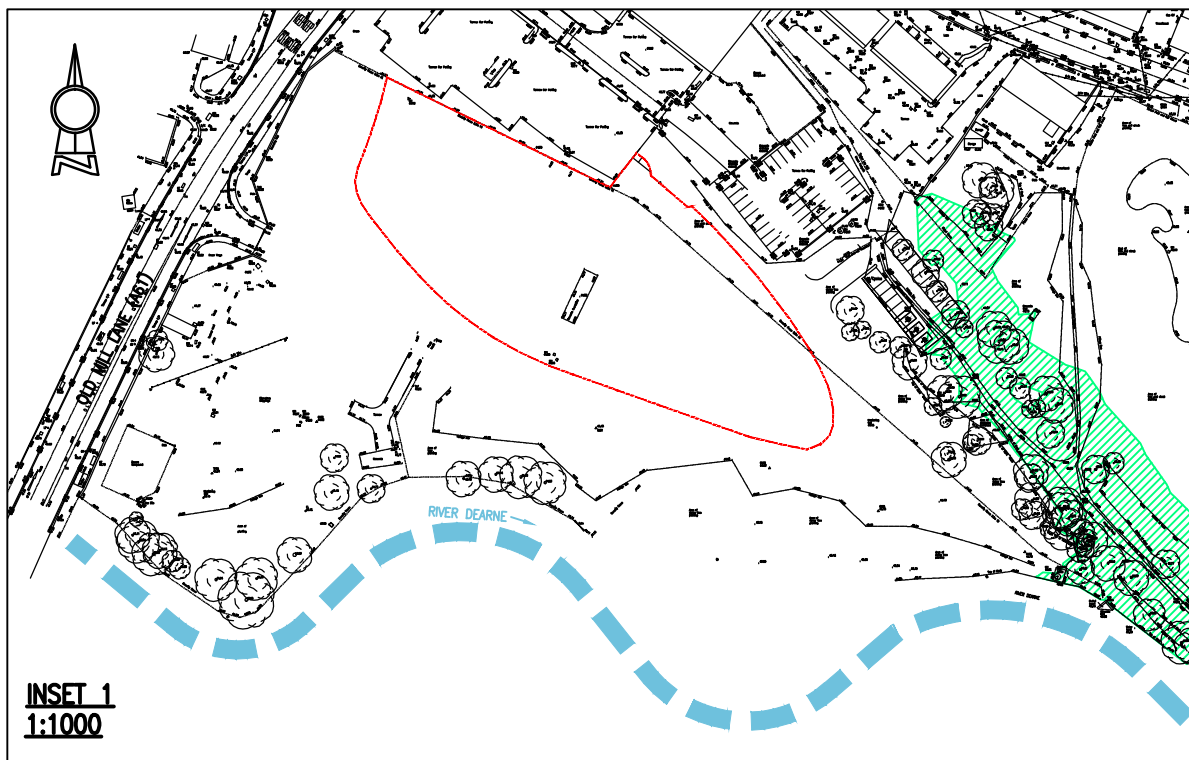


APPENDIX B
Topographical Survey

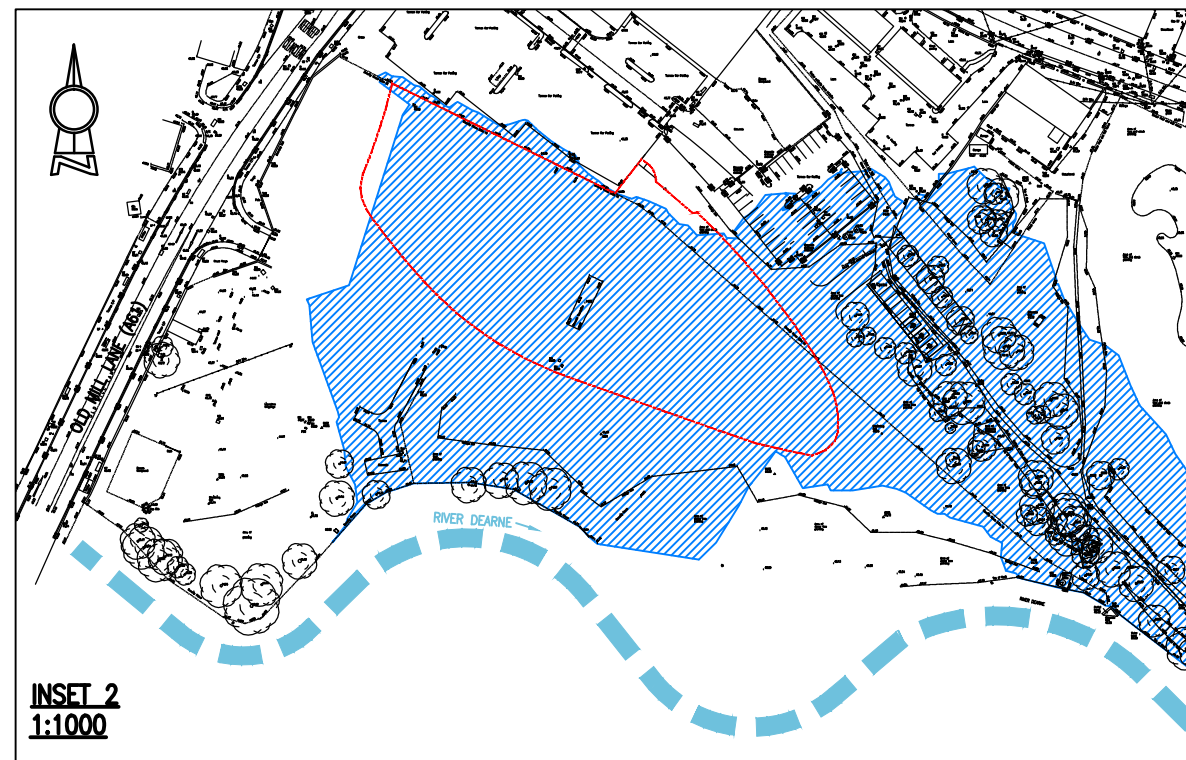
APPENDIX C

Indicative Flood Outline Sketch

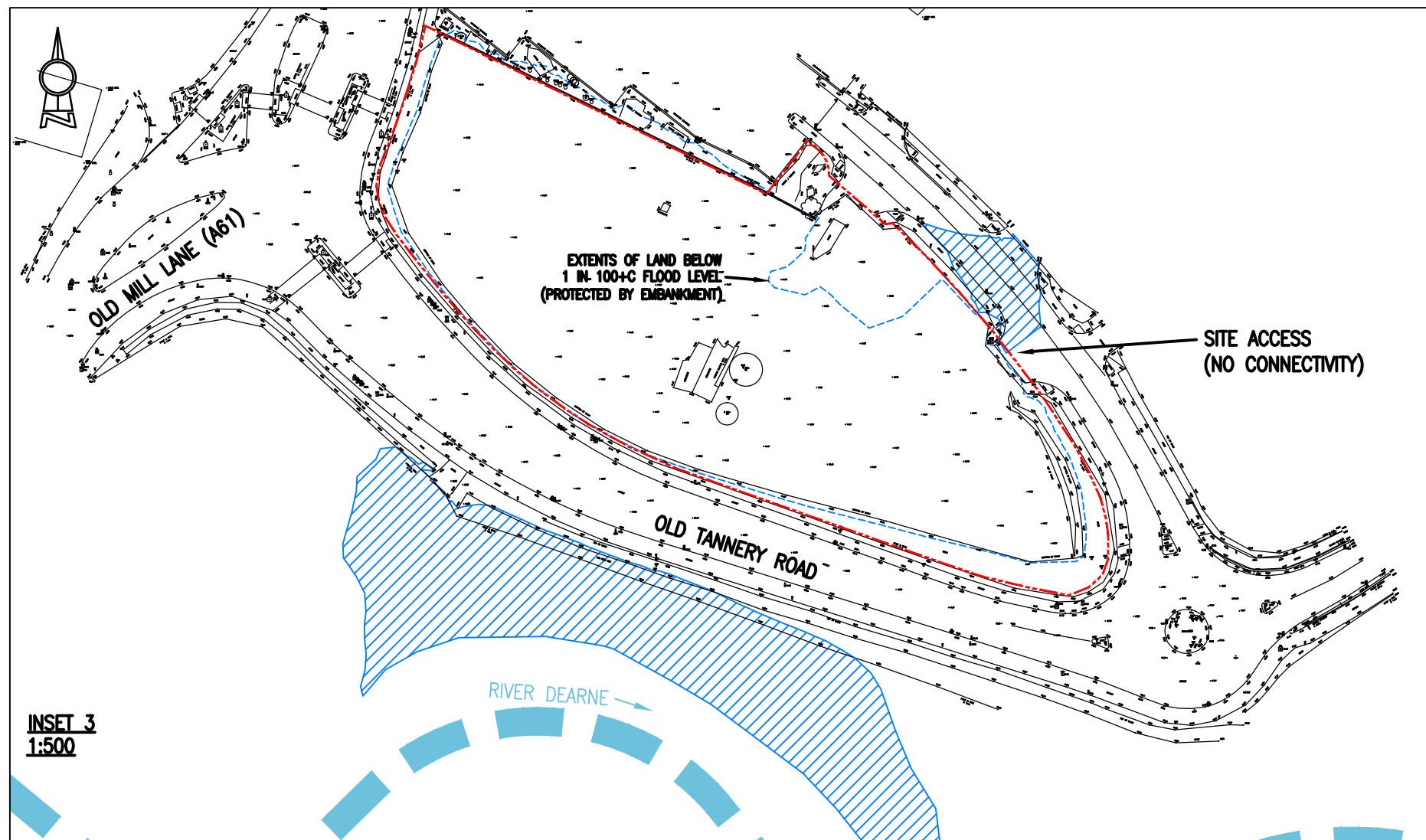
A1



25 YEAR FLOOD OUTLINE ON SURVEY DATED 2008
(FLOOD ZONE 3b - FUNCTIONAL FLOOD PLAIN)



100 YEAR + CC FLOOD OUTLINE ON SURVEY DATED 2008
(FLOOD ZONE 3a)



100 YEAR + CC FLOOD OUTLINE ON SURVEY DATED 2015
(FLOOD ZONE 3a)

DO NOT SCALE.

Only PDF/DWF issues of this drawing are controlled. All other formats (eg. DWG AutoCAD FILES) are UN-controlled and are used at your own risk.

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Contractors should refer to the residual risks contained in the CDM Pre Construction Information before carrying out any site operations and should not issue parts of this drawing without including the CDM notes and references. This information will include details of the SIGNIFICANT risks which 3E have considered beyond that which a competent contractor should be aware.

KEY

- PROPOSED SITE BOUNDARY.
- INDICATIVE ROUTE OF RIVER DEARNE.
- 1 IN 25 YEAR, FLOOD ZONE 3b FUNCTIONAL FLOOD PLAIN OUTLINE.
OUTLINE REPRESENTS THE AREA OF FLOODED LAND UP TO A LEVEL OF 43.85m.
MAXIMUM WATER LEVEL PROVIDED FROM EA MODEL: 2010 UPPER DEARNE.
- 1 IN 100 YEAR +CC, FLOOD ZONE 3a OUTLINE.
OUTLINE REPRESENTS THE AREA OF FLOODED LAND UP TO A LEVEL OF 44.85m.
MAXIMUM WATER LEVEL PROVIDED FROM EA MODEL: 2010 UPPER DEARNE.

28.07.15	INITIAL ISSUE.	ST	P1
Date	Revisions	Drawn	Rev.
3E 4 calder close calder park wakefield WF4 3BA t 01924 240420 f 01924 240421 www.3econsl.com			
Client	Aldi Stores Ltd [South]		
Project	Aldi, Old Mill Lane, Barnsley		
Title	Flood Outlines		
Scale	AS SHOWN	Drawn	ST
Checked	JM	Date	JUL 15
Drawing Status	Preliminary		
Job No.	15004	Drawing No.	CSK01
Revision	P1		