MOTT MACDONALD

Proposed Commercial / Retail Development
Brookside Road, Uttoxeter

Flood Risk and Runoff Assessment

24 October 2018

Lidl UK GmbH

Mott MacDonald
4th Floor
Derwent House
150 Arundel Gate
Sheffield S1 2JY
United Kingdom

T +44 (0)114 2761242
mottmac.com

Lidl UK GmbH
19 Worple Road
Wimbledon
SW19 4JS

Proposed Commercial / Retail Development Brookside Road, Uttoxeter

Flood Risk and Runoff Assessment

24 October 2018

Lidl UK GmbH

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	05/04/18	A Precious	F Gennard	P Charlesworth	For Planning
B	24/10/18	A Precious	B Penny	P Charlesworth	For Planning

Document reference: 392669 | R01 | B

Information class: Standard

Contents

1 Introduction

It is proposed to redevelop an area of land to the north of Brookside Road, Uttoxeter for mixed commercial and retail use. This development will need to be assessed to determine if it is at risk from existing sources of flooding or if the development will increase material flood risk outwith the development site.

The Government has placed increasing priority on the need to take full account of the risks associated with flooding at all stages of the planning and development process, to reduce future damage to property and loss of life. The NPPF – Technical guidance (NPPF-TG) identifies how the issue of flooding is dealt with in the drafting of planning policy and the consideration of planning applications.

The purpose of this report is to assist our client and the local Planning Authority to make an informed decision on the flood risks associated with the site redevelopment.

Local Planning Authorities have the powers to control development in accordance with the guidelines contained in NPPF-TG and are expected to apply a risk-based approach to development with the Sequential Test in Table 1. This sets out a sequential characterisation of flood risk in terms of annual probability of river, tidal and coastal flooding.

In accordance with the sequential test in the technical guidance, sites are to be classed as follows:

Table -1: Flood Zones – NPPF-TG Table 1

Flood Zone	Appropriate Uses
Flood Zone 1 - Low Probability – This zone comprises land having less than 1 in 1000 annual probability of river or sea flooding (<0.1%)	All uses of land are appropriate in this zone
Flood Zone 2 - Medium Probability – This zone comprises land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between 1 in 200 and 1 in 10000 annual probability of sea flooding (0.5%-0.1%) in any year	The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this Zone Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test is passed
Flood Zone 3a - High Probability – This zone 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	The water-compatible and less vulnerable uses of land in Table D.2 area appropriate in this zone. The highly vulnerable uses in Table D.2 should not be permitted in this zone. The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this should be designed and constructed to remain operational and safe for users in time of flood.
Flood Zone 3b - Functional Floodplain – This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)	Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to: Remain operational and safe for users in times of flood; Result in no net loss of floodplain storage; Not impede water flows; and Not increase flood risk elsewhere. Essential infrastructure in this zone should pass the Exception Test.

1.1 Reference Documents

The following documents have been referenced in the compilation of this document;

1. Environment Agency on-line flood maps;
2. National Planning Policy Framework;
3. Staffordshire Strategic Flood Risk Assessment;
4. CIRIA SuDS manual (C753);
5. Geo-environmental Report – Opus International ref J-D0954.00_R1_STM.

1.2 Terms of Reference

This document is to accompany a full planning application and separate outline planning application for the redevelopment of the site identified in Section 2.1 only, and is for the sole benefit of the client (Lidl GmbH UK) and should not be used or relied upon by third-parties.

Mott MacDonald has followed accepted procedure in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, we take no liability for and give no warranty against actual flooding of any property (client's or third party) or the consequences of flooding in relation to the performance of the service. This report has been prepared for the purposes of planning approval only and is to assist our client and the local Planning Authority to make an informed decision on the flood risks associated with the site redevelopment.

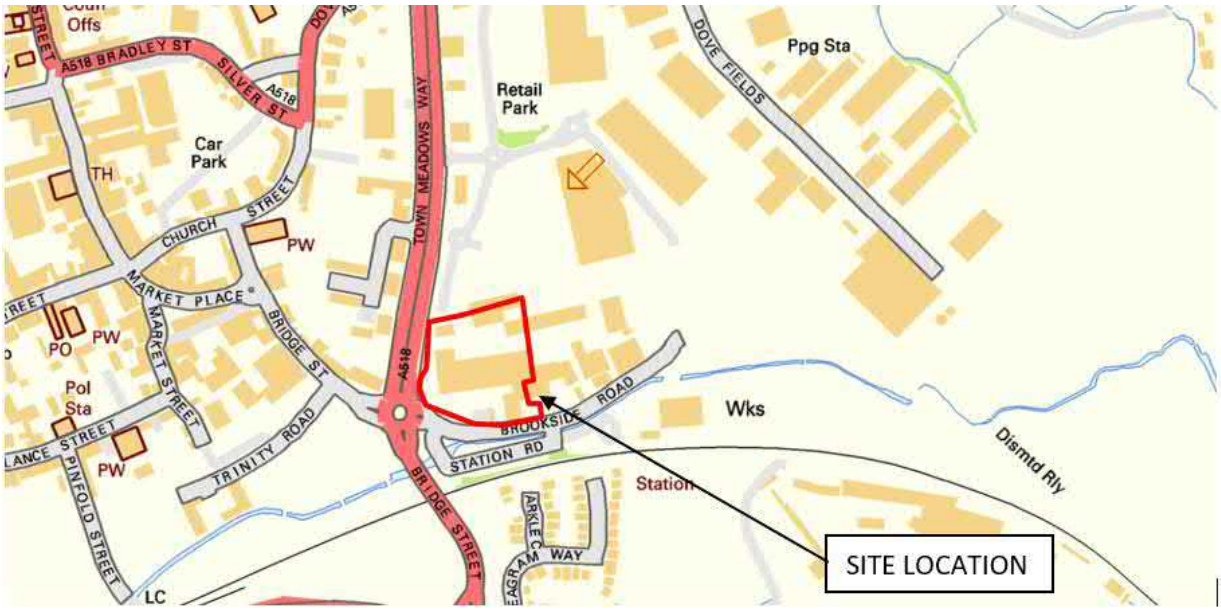
Allowance for the effects of climate change will be made in accordance with government recommendations in place and statistical data available at the time of writing this report. These recommendations may become more onerous and the statistical data may be revised in the future; we will not make any estimate of what changes may result from this. Please be aware that this, and other issues over which the Mott MacDonald has no control, may affect future flood risk at the development and require further work to be undertaken for which we accept no liability.

2 Existing Site

2.1 Site Location

The site is located to the north of Brookfield Road in the eastern part of the settlement of Uttoxeter (see Figure 2.1) approximately 500m east of the town centre and centred on National Grid Reference (NGR) 409614E, 333371N.

Figure 1: Site Location Plan



Source: Ordnance Survey Open Data - Contains Ordnance Survey data © Crown copyright and database right 2014

2.2 Site Description

The total site is approximately 1.67ha in area and comprises an area allocated for a Full Application (1.41ha) and an Outline Application area (0.26ha). The site includes in-use and dis-used commercial and industrial premises with associated hardstanding and some minor landscaping and undeveloped areas.

The main entrance to the site is from Brookside Road which forms part of the southern boundary. The site is bound by existing commercial development to the north and east and Town Meadows Way to the west.

A topographical survey of the site has been undertaken and is included in Appendix A.

The survey shows that the site is relatively flat but that the site is set lower than the carriageway of Town Meadows Way along the western boundary.

The site has a minor fall from west to east falling to a central lower area and then rising again to the eastern boundary. Levels along the western boundary range between 77.5m and 77.3mAOD falling to the central area between 76.7m and 77.0mAOD before rising again to 77.0m and 77.2mAOD in the east.

The Full Application site is entirely developed yielding an impermeable area of 1.443ha, the outline area has a small area of landscaping and yields a total existing impermeable area of 0.18ha.

2.3 Existing Site Drainage

Historical site drainage information has been provided by the landowner and is included in Appendix B. This shows that the majority of the site has existing drainage with part of the site draining to Picknal Brook to the south, part to the open watercourse to the north and the remainder to the 'council drain' which became the adopted combined sewer in Brookside.

As these are historic, these should be judged as illustrative only but can be used for gauging the areas drained and to which location.

Observations on site in the present day indicate that there are 2no. 225mm diameter and a 300mm diameter outfall to Picknall Brook form the development site.

2.4 Existing Land Drainage

The topographical survey and the site observations confirm the existence of a drainage ditch along the northern boundary of the site.

It is understood that this was installed as part of the development of the commercial units north of this area and is therefore an active part of the drainage system in this area.

The ditch outfalls to the active flood zone east of the site and may also act as a secondary flow route for flood water.

2.5 Existing Watercourses

The site is located alongside Picknal Brook from which the access road gets its name.

This is a major tributary of the River Dove which is located 750m to the east of the site.

Both watercourses are EA main river and have been modelled as part of the River Dove catchment in the Staffordshire Strategic Flood Risk Assessment (SSFRA).

Picknal Brook in this area is characterised as highly canalised with near vertical sides to the manmade channel.

An open watercourse is noted to the north of the site, this is riparian and appears to receive runoff from an adopted sewer from the west and discharges to a culverted section to the east of the site.

3 Sources and Extents of Flood Risk

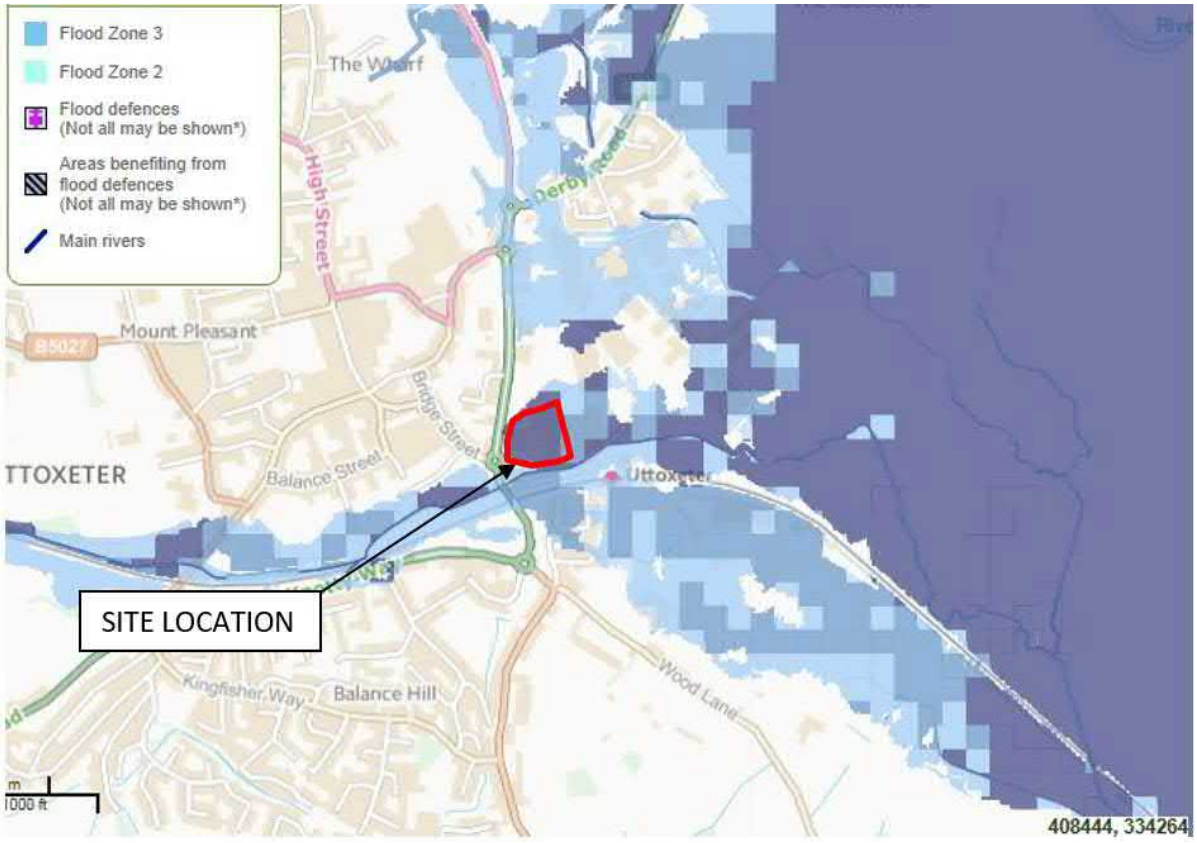
3.1 Natural Drainage

3.1.1 Fluvial Flooding – Main River

With reference to the EA's indicative flood maps, the site is shown to be in all three Flood Zones (1-3), with a larger portion in Flood Zone 3.

An extract from the EA's map is included in Figure 2 for reference.

Figure 2: Environment Agency Indicative Flood Map



Source: Environment Agency What's in Your Backyard © Environment Agency copyright and database rights 2014. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380

3.1.2 Fluvial Flooding – Riparian Watercourse

The open section of the watercourse extends for approximately 200m flowing eastwards boundary starting at the corner of the existing building on the northern boundary.

Inputs to the watercourse are principally the 600mm diameter surface water sewer and historical inputs from the existing development estimated from the historical records to be approximately 600m^2.

This would indicate a peak capacity of approximately 275 l/s (600mm @ 1v:500h and Ks = 1.5mm) + 10l/s from drained area = 285l/s is required in the channel.

The bank-to-bank distance of the very top of the corridor for the watercourse is approximately 11m with the nominal channel within this is around 3m wide.

3.1.3 Pluvial Flooding and Overland flow

With reference to the EA's online mapping, data related to the risk of potential surface water inundation or flooding is also provided.

An extract from this map is shown in Figure 3.

Figure 3: Extract from EA's Online Surface Water Flooding Map

Source: Environment Agency What's in Your Backyard © Environment Agency copyright and database rights 2014. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380

The inundation exercise indicates that the site is likely to be affected by the effects of pluvial flooding. This corresponds to the route of Picknal Brook and to the drainage ditch to the north.

3.1.4 Groundwater Flooding

There are no specific features within the site which indicate the presence of elevated ground water such as marshes or ponds. The adjacent drainage ditch is a relatively good proxy for normal ground water and this indicates a level of up to 2.9m begl when observed during the geotechnical site walkover (ref J-D0954.00_R1_STM produced by Opus International Consultants in July 2012).

It is noted in the SSFRA that this area of Uttoxeter is identified as an area of potential ground water flood risk or inundation, by virtue of the likely underlying ground conditions.

3.1.5 Climate Change

The Environment Agency requires, in accordance with the Government's NPPF-TG document, that there should be no increase in the rate of surface water emanating from a newly developed site above that of any previous development. Furthermore, it is the joint aim of the Environment Agency and Local Planning Authorities, to actively encourage a reduction in the discharge of storm water as a condition of approval for new developments. In addition, all drainage systems should be sized to accommodate the runoff arising from a 1 in 100-year rainfall event and should include a further allowance to account for the future effects of climate change. Table 2 below, shows the anticipated increases in rainfall intensities and river flows with time, and has been reproduced in part from Table 4 of NPPF-TG.

Table 2: Recommended National Precautionary Sensitivity Ranges for Peak Rainfall Intensities and Peak River Flows

Type	Applies across all of England	2015 to 2039	2040 to 2069	2070 to 2115
River Humber Basin	Upper End	20%	30%	50%
	Central	10%	15%	20%
Rainfall	Upper End	10%	20%	40%
	Central	5%	10%	20%

Source: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

In this instance, with a residential development having a design life of around 75-100 years, the overriding criteria will be the 20% increase in rainfall intensity and 20% for river flows. It is noted that SCC guidance indicates 30% as the critical climate change allowance, thus this will be applied.

3.2 Artificial Drainage

3.2.1 Adopted Drainage

Sewer records obtained from Severn Trent Water (STW) are included in Appendix B for reference.

The records show an extensive network of both foul and surface water drainage serving areas to the west of the site with two large diameter sewers running west to east along Brookside Road.

These appear to combine to the east of the site, potentially with some form of overflow to Picknal Brook, before continuing as a single foul sewer to the east.

3.2.2 Private Drainage Systems

Although no formal drainage investigation has taken place, the topographical survey has identified that there is extensive visual evidence of a drainage system for both rainwater and foul from the site. All hardstanding and roof areas are considered to be positively drained at present.

The total existing impermeable area is estimated to be 1.58ha and would yield a runoff of approximately 220l/s for the 50mm/hr event.

3.2.3 Highway Drainage

Site observations indicate that Brookside Road is served by a positive drainage system although it is not known if this remains as a separate highway drainage system or if it discharges to the adopted assets locally.

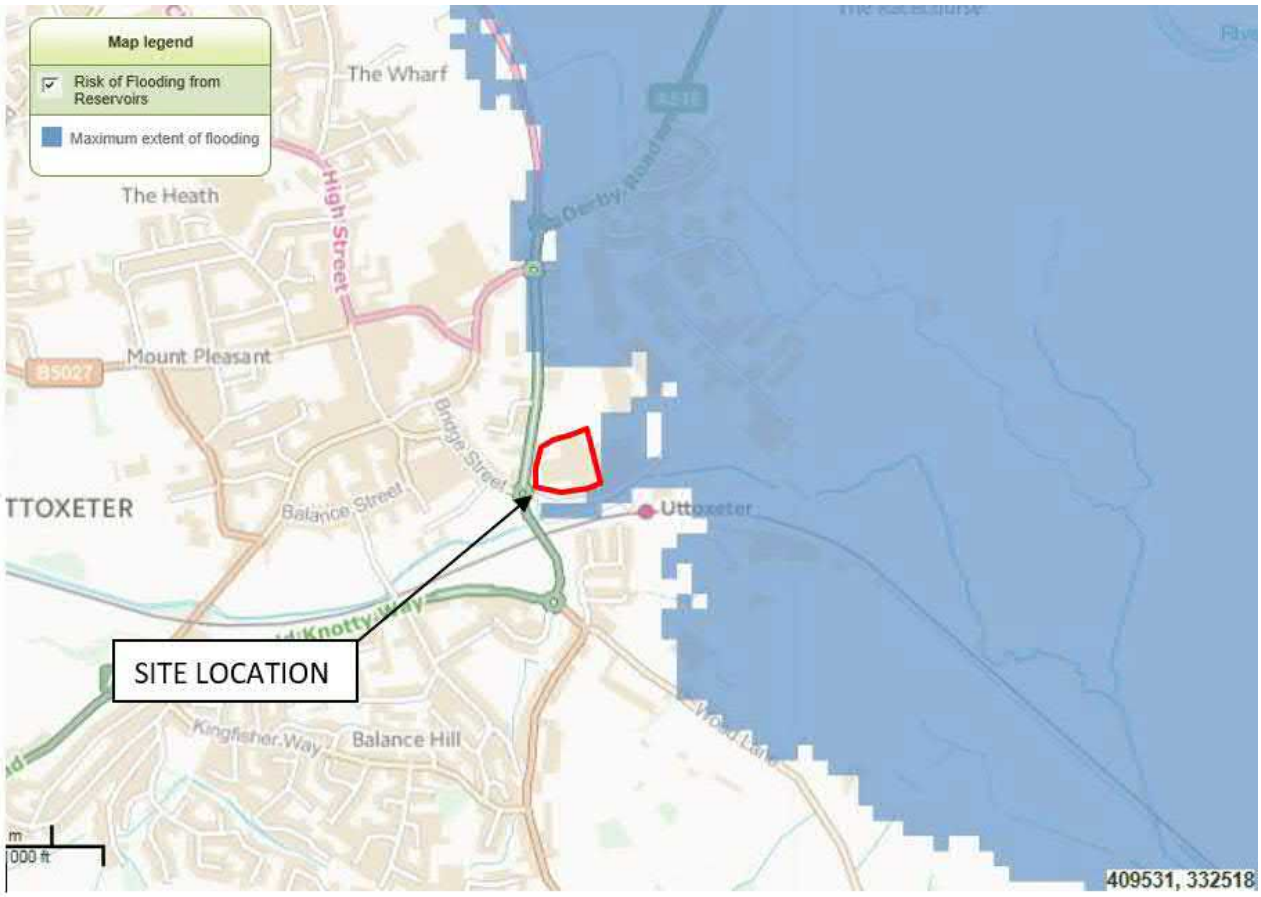
Often, in similar scenarios, highway drainage is directed to the nearest watercourse such as Picknal Brook.

3.2.4 Reservoir Flooding

The site is indicated to be adjacent to an area potentially at risk of reservoir flooding.

This flood mapping includes areas that may be affected should a catastrophic failure of a local reservoir occur.

Figure 4: Extract from EA's Online Reservoir Flood Risk Map



Source: Environment Agency What's in Your Backyard © Environment Agency copyright and database rights 2014. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380

3.2.5 Development Drainage

The proposed development details are included in Appendix D, and shows three proposed commercial/retail units on the site, generally located on the eastern boundary with a shared car park to the west. It is noted that the unit to the south (noted as drive-thru) is an outline

application but is included herein and the flood risk and drainage strategy are interlinked with the full application site.

This arrangement will yield a total post-development impermeable area of 1.443ha comprising roof, car park and access road.

Using the Lloyd-Davies method for direct run-off, a 32mm/hr intensity event (=M5-30) would generate a typical peak runoff rate in the order of 128l/s from this area.

If left unrestricted, this concentrated outflow rate could pose a flood risk to adjacent developments.

4 Flood Risk Assessment

4.1 Natural Drainage

4.1.1 Fluvial Flooding – Main River

With reference to the EA's published flood maps (see Figure 2 in 3.1.1) the site can be shown to be within the influence of the flood envelope associated with Picknal Brook.

The EA's model identifies numerous nodes along the boundary of the site (2616 to 2583) and the watercourse and the corresponding modelled flood levels for events up to and including the 1 in 1000-year (0.1%AEP) event.

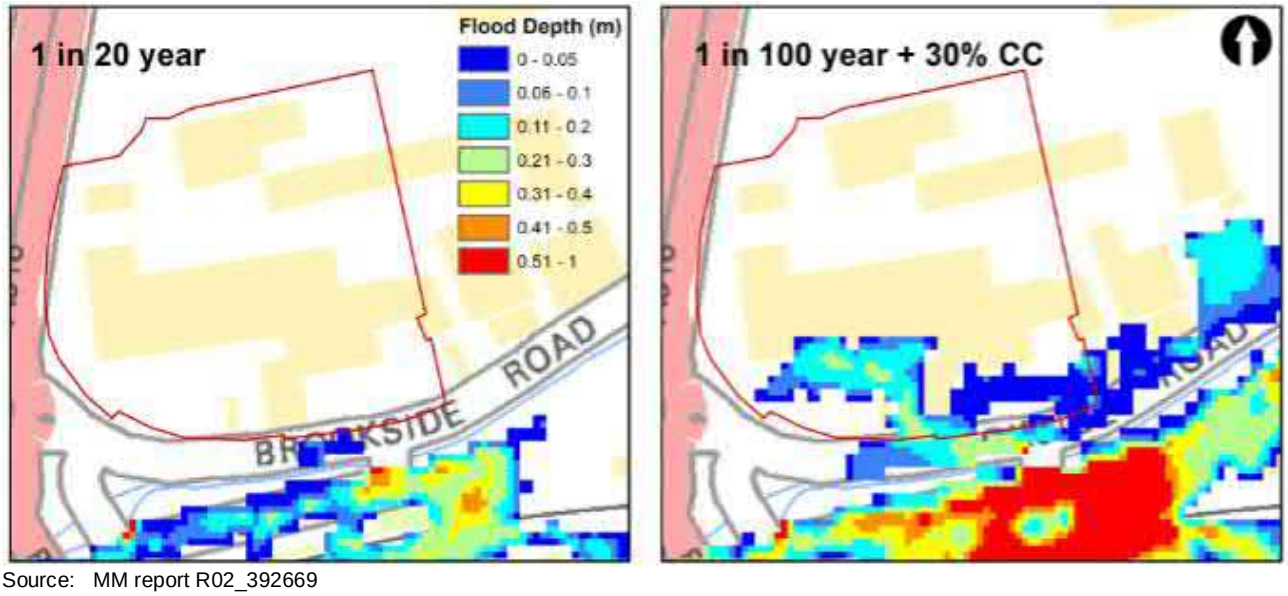
Mott MacDonald has licensed this model data with the intent of increasing the resolution of the model locally in order to more accurately determine flood risk for the development site.

By extending the model using site topographical data, LiDAR and detailed assessment of the hydrology of the watercourse, a new site-specific flood envelope has been derived for the development site. It can be seen from the outputs that the extent is considerably smaller than the published mapping.

The full hydraulic modelling report is issued under separate cover with reference R02_392669 (included as Appendix E) and should be referred to for detailed information. This report summarises the main outputs from the model which are relevant to the flood risk of the site.

The baseline flood envelope has been defined for the site using the latest topographical data. The outputs from this are shown in Figure 5 below.

Figure 5: Extracts from Baseline Modelling



Source: MM report R02_392669

The maps clearly show that the lower western part of the site is at risk of flooding for the 1%+CC AEP event but that the flood envelope is significantly smaller than indicated on the EA's online mapping.

Outputs from the model also indicate that the flooding on the site is shallow over a larger area.

4.1.2 Fluvial Flooding – Riparian Watercourse

The estimated peak flow capacity in the channel from the identified inputs is estimated to be 285l/s in the nominal channel.

Given that the watercourse lies within a larger vegetated corridor measuring approximately 11m from edge-to-edge, there is a significant amount of secondary conveyance within the corridor to enable the 285l/s to pass forward should the nominal channel become blocked.

In addition to this, the proposed building on that boundary is set a minimum of 150mm above the local land level and has an access strip sloping away from the building to the shared boundary, this will increase further the overland flow capacity along this boundary.

To the east of the site the channel returns to a culverted section. The screen over the culvert may be a blockage risk and so a failure route form the channel will need to be established. The minimum bank edge level is recoded at 76.54mAOD approximately 100m to the east of the site, this would therefore be the spill point form the open channel in the event of a full blockage of the screen.

It is also noted that the watercourse will remain in the ownership of the land owner and thus a degree of control over the condition and management of the channel can be exercised.

Given the above, it is considered that the proposed development is at very low risk of flooding from this source and that the residual secondary conveyance capacity is well in excess of the anticipated peak flow rate required in the channel.

4.1.3 Pluvial Flooding

The EA's inundation assessment indicates an indicative risk associated with both Picknal Brook and the existing drainage ditch to the north of the site. This is typically the case for watercourses which are identified as local low spots in topography.

It is noted that there are other significant pluvial flood risk identified on this plan which corresponds with the topography of the site noted previously.

Given the above, it is considered that the pluvial flood risk and fluvial flood risk are ostensibly the same flood event type albeit to different magnitudes of return period. As such mitigation of the fluvial flood risk, in conjunction with a surface water management plan is will provide mitigation for the pluvial flood risk by default.

4.1.4 Groundwater Flooding

The risk of ground water flooding noted in the updated 2013 SFRA published by East Staffordshire Borough Council is principally derived from the British Geological Survey data which indicates the likely presence of impermeable strata under the development site area above and stratum of permeable sands and gravels.

This is in lieu of site specific geotechnical investigation.

Reference is made to previously issued Geo-Environmental Investigation Report J-D0954.00_R1_STM produced by Opus International Consultants in July 2012.

Intrusive ground investigation was undertaken on the site and where observed, ground water levels were taken. Section 9.6 of the report comments on the suitability of soakaways for use and the site and notes that:

A drain is shown within the southern area of the site on the historical plans and on current ordnance survey sheets, groundwater levels were recorded at between 2.84m (begl) and 2.91m (begl) in WS206, within the southern area of the site. Given the relatively high groundwater levels in this area of the site, land drainage may need to be incorporated into the drainage design and the relevant authorities should be consulted regarding works within the southern area of the site.

The measured water depths of 2.84 and 2.91m below ground level, while relatively high for the use of infiltration-based drainage systems, is deep in comparison to levels that would represent a risk to development on this site.

4.1.5 Climate Change

With reference to section 3.1.5, drainage systems will be designed for 30% increase in climate change and tested for 40% events.

Fluvial flooding will be assessed using 20% and 30% increases in fluvial flows.

4.2 Artificial Systems

4.2.1 Adopted Drainage

The drainage on site is private with a presumed adopted connection along the southern boundary into Picknal Brook for surface water with foul connection to the adopted assets in Brookside.

The full extent of the upstream catchment is not identified on the sewer records; however, a 300mm diameter sewer is capable of conveying a relatively significant volume of water. Should the sewer become blocked water may potentially manifest at the surface of the site.

The 300mm sewer has the potential to convey 680l/s at full bore (K_s = 1.5 @ 1v:190h). These flow rates and associated volumes are significant and should be considered as a flood risk to the site.

The 525mm diameter sewer is not considered to be a risk to the site as it is located on the opposite side of the watercourse.

4.2.2 Private Drainage

At the time of writing a utilities survey has not been undertaken, however, the topographical survey shows a number of manholes, gullies and rain water pipes across the site indicating that there is some form of private drainage system serving the current development. These are predominantly in the south west of the site in the industrial development.

As any existing drainage is to be abandoned as part of the redevelopment of the site the flood risk from this element will also be removed.

Existing connection points to the Picknal Brook may be retained for use for proposed outfalls.

4.2.3 Highway Drainage

The existing road network on Brookside Road is served by a gully system which is likely to be reconfigured as part of the proposed development and therefore does not pose a significant flooding risk to the site.

Town Meadows Way to the west and Brookside Road to the south lie slightly higher than the site boundary and could therefore propose a flood risk should the system become blocked. However, the carriageway of the road will act as secondary conveyance and channel water away from the development site.

4.2.4 Reservoir

Figure 4 indicates that the site is adjacent to an area potentially at risk of reservoir flooding should catastrophic failure of a dam occur.

Although an identified flood risk, the probability of this occurring is very low. The residual effect of an incident can be reduced by adopting resilient construction methods (see Section 7).

4.2.5 Development Drainage

It is proposed that the site is redeveloped to provide three purpose-built units for commercial/retail type uses.

It will be necessary to provide a suitably designed storm water drainage system to collect, convey and attenuate the additional runoff generated by the development of this site. The net result should be that there is no net increase in flood risk to either downstream properties or assets as a result of the development.

This will be demonstrated by the developing drainage strategy of the site. This strategy should also include measures to improve run-off quality whilst maximising bio-diversity and amenity to provide a sustainable drainage system as noted in NPPF-TG.

Foul flows from the development should be drained through an entirely separate system designed to adoptable standards to minimise the risk of foul flooding occurring as a result of the development.

Picknal Brook along the southern edge of the site is at a lower level to the proposed development and therefore should be viable for a surface water gravity connection.

5 Sequential Test

5.1 Application

The Sequential Test is designed to direct development towards areas of lower flood risk, however, where suitable sites do not exist in Flood Zone 1 sites in Flood Zone 2 and then 3 may be considered.

The site is currently classed, using the EA's online mapping, as being partly in Flood Zone 3 and Flood Zone 2, and having a greater than a 1% annual probability of flooding from fluvial sources.

It is noted that the development vulnerability classification will not be altered by the development of this site, with commercial/industrial and commercial/retail both classified as 'Less Vulnerable' in accordance with NPPF Table 2.

With reference to Table 3[1] of the NPPF Flood and Coastal Change 'Less Vulnerable' development in Flood Zone 2 and 3 are deemed suitable without further testing.

As there is no proposed change in flood risk classification, the site is already developed and classified as brownfield the development is deemed to be suitable for this location.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/575184/Table_3_-_Flood_risk_vulnerability_and_flood_zone__compatibility_.pdf

6 Exception Test

6.1 Introduction

The Exception test is applied under guidance in NPPF-TG when the Sequential Test has been passed.

Reference is made to Table 3 of the NPPF guidance and the Flood Risk Vulnerability Classification therein[2].

In this case, the Less Vulnerable classification is deemed to be appropriate for Flood Zone 3a.

However, for completeness we have included the elements of the Exception Test to demonstrate that the development of this site is appropriate.

The test takes three parts, each one addressed below. The site should;

- Be developed on brownfield land;
- Provide wider sustainability benefits;
- Be safe to operate.

6.2 Previously Developed Land

The site is a clearly re-development of existing extensively developed land.

6.3 Wider Sustainability Benefits

The site is to be converted in the main from light industrial use to commercial retail. This is in keeping with the general shift in the whole area from light industrial.

The replacement of industrial units, some of which are derelict, with more economically valuable retail units will provide local impetus to the local economy by way of increasing the number of job opportunities locally.

The development of the site and the proposed mitigation along Brookside Road (see Section 8 of this report) will provide much needed amenity benefit to the river, opening up Brookside for pedestrians. The development of the site will also reduce the impermeable density of the site and introduce a drainage attenuation system. Both elements will significantly and positively impact on the runoff profile from the site and ultimately on the local flood risk profile.

In addition to this, the proposed drainage system will remove surface water inputs form the existing developed site to the combined sewer in Brookside. This will have a significant positive impact on the flood risk associated with a surcharge of the combined sewer and also the volume of clean water being treated at the downstream water treatment works. Both are positive benefits to sustainability and public health.

6.4 Safe Operation

The proposed layout plan has been developed to accommodate both the provision of flood mitigation along Brookside Road and the operation of the site during such operation.

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575184/Table_3_-_Flood_risk_vulnerability_and_flood_zone__compatibility_.pdf

The hydraulic model shows that Brookside Road is at risk of flooding from Picknall Brook and as such cannot be the only egress route from the site.

The proposed level strategy for the site provides units which are outside the flood envelope of the 1%+CC event and a dry access/egress above this level for pedestrians and customers.

The large car park area is designed to act as a temporary surface storage area for fluvial flood water to a maximum depth of 40mm for approximately 6-hours.

Outputs from the proposed hydraulic model clearly show that this access is ‘safe’ and also dry for these extreme events.

It is recommended that a Flood Evacuation Plan (FEP) is developed as part of the detailed design of the site which will identify key roles and responsibilities during a flood event and describe in detail how a flood event might propagate and how to mitigate the impact whilst evacuating the site safely.

6.5 Summary

Although the development is shown to be within Flood Zone 2 and 3, the proposals show that the site can be safely developed and used for its proposed lifetime without creating a flood risk.

Therefore, the re-development can be shown to pass the Exception Test.

7 Storm Water Management

7.1 Control of Surface Water Run-off

It should be acknowledged that the satisfactory collection, control and discharge of storm water is now a principal planning and design consideration.

Part H of the Building Regulations 2015 recommends that surface water run-off shall discharge to one of the following, listed in order of priority:

- an adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable,
- a watercourse, or, where that is not reasonably practicable,
- a surface water sewer.

It is necessary to identify the most appropriate methods of controlling and discharging surface water for this site. The design should also seek to improve the local run-off profile by using systems that can either attenuate run-off and reduce peak flow rates or positively impact on the existing flood profile.

7.1.1.1 Infiltration Based Systems

From the British Geological Society maps it can be seen that the superficial deposits are primarily alluvium which consists of clay, silt, sand and gravel. The bedrock is described as Mercia Mudstone.

Given these observations, it is considered that in the main, the site is likely to be unsuitable for infiltration-based systems given the clayey overlying deposits and the impermeable lower strata.

7.1.1.2 Watercourse

Historical records show that the site has several existing discharges to both Picknall Brook and the Combined sewer (council sewer) in Brookside.

It is therefore proposed to utilise these existing connections, potentially combining them in to a single outfall to Picknall Brook.

It is worth noting that the existing surface water connections to the Combined Sewer will be extinguished as part of the development and therefore will have a significant positive impact on flood risk in that asset.

7.1.1.3 Adopted Sewers

The drainage on site is private with a presumed adopted connection along the southern boundary into Picknal Brook for surface water and the existing foul sewer for foul. As such the use of an existing adopted drainage system has been discounted for this site.

7.2 Allowable Site Discharge

The historical drainage records indicate that approximately 8635m^2 of the 1.58ha currently developed site area discharges to drainage systems that outfall to Picknall Brook with a further 7165m^2 discharging directly to systems that outfall to the combined sewer in Brookside.

The total peak discharge from the existing impermeable areas on the site is estimated to be in the region of 140l/s (@32mm/hr) of which approximately 73l/s is connected to Picknall Brook and 67l/s to the combined sewer.

It is proposed to remove entirely the surface water connection to the combined sewer and limit discharge from the developed site to that of the existing discharge rate to Picknall Brook

7.3 Site Attenuation

The provision of suitable attenuation on site to mitigate the flood risk resulting from the development of the site will be a key factor in the evolution of the site development layout.

The provision of large volumes of attenuation, as is likely in this case, can be achieved by a number of methods; however, not all systems can be assessed in direct comparison.

One of the aims of the NPPF is to provide not only flood risk mitigation but also to maximise additional gains such as improvements in runoff quality and provision of amenity and bio-diversity. Systems incorporating these features are often termed Sustainable Drainage Systems (SuDS) and it is the requirement of NPPF that these are considered as the primary means of collection, control and disposal for storm water as close to source as possible.

The volume of attenuation required for the development may be estimated using design software. As this is for outline planning and to inform the developing layout and drainage strategy an example system will be evaluated.

For the purposes of the assessment a single open pond/tank with a flow control device has been used as infiltration is unlikely to be viable on this site. The software uses the FSR[3] characteristics of M5-60=19.0mm and ratio R=0.395.

Table -3 - Summary of Anticipated Attenuation Volumes

Developed Impermeable Area	Anticipated Unrestricted Run-Off	Flow Restriction	Attenuation (1 in 100 +30%)
ha	ls^{-1}	ls^{-1}	m^3
1.443	140	76	400

This assessment is for the whole impermeable area discharging into a single system such as a pond or tank type system to give an indicative volume only.

7.4 Sustainable Drainage Systems (SuDS) and Water Quality

The most appropriate attenuation system should satisfy three main characteristics, firstly, provide the required volume of storage, secondly, minimise the loss of developable land and thirdly, where possible provide local amenity.

A summary of the various types of attenuation is included Table 4.

EA guidance applies a sustainability hierarchy to the various types of SuDS systems, this is summarised overleaf;

3 Flood Studies Report 1975

Table 4 - SuDS Hierarchy

	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
Most Sustainable	Living roof	√	√	√
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	√	√	√
	Filter strips and swales	√	√	√
	Infiltration devices - soakaways - infiltration trenches and basins	√	√	√
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paviors	√	√	
Least Sustainable	Tanked systems - over-sized pipes/tanks - Cellular Storage	√		

Systems at the top of the hierarchy provide a combination of attenuation, treatment and ecology and are deemed the most sustainable options. There are always specific scenarios where some systems are more suitable than others and at this stage it is not possible to guide the development towards a particular strategy. However, included below are summaries of some of the main types of SuDS systems that may be applied to the development outlining the main benefits and constraints to their application.

In addition to the above hierarchy, the CIRIA SuDS Manual C697 identifies the number of treatment trains or SuDS devices through which flow should pass from various point sources of runoff. This is designed to ensure that the receiving watercourses are not put at risk of pollution by new development.

Table 5.6 in the SuDS Manual identifies the number of treatment trains as a function of runoff source and receiving water sensitivity. This site lies within a medium sensitive catchment and therefore would require two treatment trains:

Table 5 - Watercourse Sensitivity and Treatment Trains

	Receiving Watercourse Sensitivity		
Runoff Catchment Characteristic	Low	Medium	High
Roof only	1	1	1
Residential roads Parking areas Commercial zones	2	2	3
Refuse collection Industrial areas Loading bays Lorry parks Highways	3	3	4
CIRIA SuDS Manual C697 Table 5.6			

7.4.1 Living or Green Roofs

Larger areas of roof may be designated as living or green roofs to provide both point water treatment and significant enhancement of local bio-diversity. The assessed gains are such that these systems are the preferred EA option for the provision of SuDS.

If considered at the outset of the design of a unit, a green roof can be integrated within the provision of a roof terrace area to multiply the benefits, alternatively, a maintained roof can be installed that may require specialised access.

There are numerous proprietary systems available on the market to suit various specific applications and it is recommended that if these systems are being considered discussion with several suppliers is instigated as soon as possible.

While a useful system, the application of green roofs is not considered viable in this instance as the roofs of the units will likely have significant amounts of plant located on the roof which would impact its viability.

7.4.2 Ponds and Basins

The nature of these systems is such that the run-off from the development can be treated by biological action and stilling to significantly improve the quality of water discharged from the system.

Basins also provide large areas of open space that can be developed for recreational uses or as new habitat for wildlife.

Both systems do, however, take up developable land and have residual maintenance and liability issues attached to their implementation.

In this case the proposed development density on the site does not leave sufficient areas for a pond to be used as the primary means of surface water storage.

However, the use of landscaped areas as emergency and temporary attenuation for more extreme events is considered to be viable.

7.4.3 Filter Strips and Swales

Often used adjacent to roads and footpaths, swales and filter strips can be used to collect water directly from linear features, percolate some of the flow, attenuate and then discharge the flow to either a traditional system or a secondary SuDS device.

The use of these systems is more suited to linear applications such as roads as the typical cross section is relatively small and longer runs are required to provide attenuation volume.

Filter strips will be smaller in plan area than a swale although the swale can be landscaped to be incorporated in to the verge of the carriageway, combining two functions.

Land take can be relatively small in comparison to other systems and both types perform well in improving water quality. They are also ideally suited for disposal of water via secondary infiltration.

These systems may be suitable for the collection of runoff from car parks but would be limited in the suitability of collection of roof runoff. As a large volume of attenuation is required, the use of swales may be more suitable for collection and conveyance.

7.4.4 Permeable Paving

Larger areas of block paved hardstanding can easily be converted to provide significant volumes of storage. These systems also encourage biological treatment of flow and extraction of oils and heavy metals from the run-off.

Land take is reduced as storage is located under car parks and access roads. However, maintenance is potentially a long-term issue and the possibility of the paving being damaged, dug up and not properly reinstated or not regularly swept could lead to compromising the future capacity of the system.

This system will negate the need for a separate collection system such as kerbs and gullies. It will also assist in reducing the flood profile of the site by significantly attenuating the run-off from the development within the sub base material.

There is no specific amenity provided by the system other than enabling other areas to be utilised for development rather than potentially sterilizing areas with an easement for a sewer or stand-off for a basin.

These systems may be incorporated into normal car-parking areas and driveways but may not be suitable for areas accessed by larger vehicles. It is also possible to provide plot-by-plot systems connecting in to a site wide system.

There is scope for the parking areas to be used as attenuation via permeable paving on the surface and permeable sub-base beneath. Not only would this enable more efficient use of the parking area but remove the requirement of a separate attenuation feature and will help to limit the overall depth of the drainage system, ensuring a gravity connection to the watercourse is achievable.

7.4.5 Cellular Storage

Large volumes of storage can be provided under grassed and lightly trafficked areas by using proprietary plastic cellular systems. This will maximise the developable area of the site.

There is no specific mechanism within the system designed to treat flow but extended detention times will allow sedimentation reducing the suspended solids within the discharge.

There is no creation of amenity by the installation of these types of systems, indeed by maintaining access to the system small areas may need to be reserved.

If the developable footprint is tight then these systems may be advantageous, however, to ensure adoptability it is recommended that the use of these systems is discussed with the adopting authority as they are not always preferred.

In this case, geocellular attenuation could be used to supplement the permeable sub-base system noted above.

7.4.6 Tank or Culvert Storage

Hard engineered tank storage systems have traditionally been used for attenuation structures for the past decade and are often specified where large volumes of storage are required (>200m^3) and available space is an issue.

These systems have no inherent water treatment properties except potential sedimentation of the attenuated flow and offer no additional amenity benefits. In some cases, the easement to the tank or culvert is such that a significant portion of land area is sterilized from development as are certain types of landscape planting.

There are also significant costs associated with these systems in production, transportation and installation. However, once installed the long-term maintenance requirement of the system is relatively low.

With a proven record of successful installation, tanks and culverts are regularly adopted by water authorities across the country, albeit with a large associated easement that will sterilise that portion of the site.

The use of a tank or culvert would require standard cover depths to the attenuation (approx. 1.2m) which would result in an overly deep outfall to Picknal Brook. As other more sustainable attenuation features are applicable the use of tanks is not recommended.

7.4.7 Surface Storage

The use of roads, public areas and even landscaped areas as additional storage for an extreme rainfall event is becoming a widely accepted form of attenuation.

Water spilling from drainage systems can be collected via roads and kerbs and channelled to lower lying areas where it would be stored until the capacity in the existing system returns.

These systems have the advantage of requiring little additional infrastructure merely detailing of the proposed roads and grassed areas.

As these systems will only be used in extreme events when the adopted drainage system is exceeded (>1 in 30 years), they provide a very efficient way of catering for these events rather than providing permanent capacity.

There is no inherent water treatment capability in this system nor any particular increase in amenity, however, the costs associated with this provision are relatively small.

If permeable paving is used, this would enable the safe mobilisation of surface storage on the permeable paving area during extreme events.

7.4.8 Over Sized Pipework

It is often possible to provide the required volume of storage within the existing collection pipework of the proposed system. This may be incorporated by using oversized pipework designed to act as inline storage.

As the diameter of larger pipes readily available is limited the applicability of these types of systems is more suited to <200m^3 of attenuation. Above this volume the length of pipe required is excessive and difficult to suitably fit into a normal site layout.

There is no intrinsic amenity provided by the use of this system neither is there any specific level of run-off treatment over and above that of a standard pipe and gully system.

However, due to their traditional nature, the adoption of these types of systems by water authorities is straightforward and does not require any specialist input. The pipes are generally available direct from suppliers with little or no lead in time and the satisfactory long-term performance of these systems is well documented.

In this case as there are serval other more sustainable options available this is not recommended for use on this site.

7.5 Summary

The application of SuDS based systems needs to be considered as the primary measure for dealing with surface water for any proposals, these systems are the only ones that provide the required level of treatment.

The large car park area serving the units is an ideal multi-function feature that could be used for collection, conveyance and attenuation.

This type of system would also facilitate a shallow connection to Picknal Brook that would reduce the likelihood of surcharge on the outfall affecting the operation of the drainage system during high river levels.

Permeable sub-bases also negate the need for an oil separator by providing in-situ treatment of runoff form the parking area.

Given the likelihood of the full planning application part of the site and the outline progressing at different times, the use of a permeable sub-base system will allow the attenuation features to be installed separately.

7.6 Design Example

To give some idea of the size of attenuation features that may be required and thus begin the process of integration, it is possible to provisionally size a typical feature at this stage based upon the assumptions discussed previously.

As noted above, the attenuation for the full allocation site and the outline application will be split with regard to flow control and attenuation but can share a common outfall to Picknall Brook. The offsite discharge will be split pro-rata.

Table 6: Summary of Attenuation Options

Location	Impermeable Area (ha)	Flow Restriction (l/s)	Attenuation Volume	Key dimensions
Full Application	1.266	56.0	235m^3	Permeable Paving Area = 5175m^2 Working Depth = 0.20 to 0.40m
Outline Application	0.180	20.0	50m^3	Permeable Paving Area = 725m^2 Working Depth = 0.250m

Source: MMD 2018

Outputs from this indicative design are included in Appendix F for reference with a typical drainage masterplan included in Appendix G.

The 30% climate change scenario is also included which shows that the 60-minute storm slightly has a peak offsite discharge (after each flow control) of (50.2+20.4) = 70.6l/s the 60-minute storm yields surface flooding in the car park of just under 1.5m^3, which over the lower area of the site (approximately 760m^2) equates to a maximum temporary flooding depth of 2mm, which is considered acceptable.

7.6.1 Joint-Probability Events

As the site drainage system outfalls to Picknall Brook it is necessary to consider the performance of the drainage system when the brook is in flood.

HR Wallingford have produced a joint-probability tool[4] for gauging the combined probability of fluvial and pluvial events based on their respective time-to-peak (T_p).

In this case the watercourse has T_p = 10 hours and the drainage system approximately 1 hour. The output from the tool is included in Figure 6 below.

Figure 6: Extract from Joint-Probability Tool

< Back

JOINT PROBABILITY ANALYSIS
River - Drainage Combination

Enter the river and drainage critical durations in the cells below

River critical duration (hours)	10
Drainage critical duration (hours)	1
Ratio	10
Level of dependency (CF100)	
Modestly correlated	75

Ratio Range	CF100 Range		Default Value	
0 < Ratio ≤ 0.1 Ratio ≥ 10	50	100	**75**	Modestly correlated
0.1 < Ratio ≤ 0.3 3 ≤ Ratio < 10	100	250	**175**	Well correlated
0.3 < Ratio ≤ 1 1 ≤ Ratio < 3	250	400	**325**	Strongly correlated

River return period (years) \ Drainage return period (years)	1	2	5	10	20	50	100	200
1	19.1	31.0	59.0	95.9	156.0	296.7	482.5	784.6
2	31.0	50.4	95.9	156.0	253.7	482.5	784.6	1276.0
5	59.0	95.9	182.5	296.7	482.5	917.6	1492.2	2426.6
10	95.9	156.0	296.7	482.5	784.6	1492.2	2426.6	3946.1
20	156.0	253.7	482.5	784.6	1276.0	2426.6	3946.1	6417.1
50	296.7	482.5	917.6	1492.2	2426.6	4614.8	7504.5	12203.6
100	482.5	784.6	1492.2	2426.6	3946.1	7504.5	12203.6	19845.4
200	784.6	1276.0	2426.6	3946.1	6417.1	12203.6	19845.4	32272.3

Joint return period (years)

The default river and drainage return periods above can be changed by typing new values in the blue cells

Source: JPT outputs MML 2018

[4] http://gamma.hrwallingford.co.uk/UKStormwaterDrainage/exceltools/Joint_Probability_Assessment_locked.xls

The tool identifies significantly low probabilities for fluvial return periods above 1 in 5-years for all pluvial events and likewise for the 1 in 5-year pluvial events.

The drainage system has been tested for a 1 in 5-year and 1 in-10-year against the 1 in 50-year fluvial event (flood level 77.52mAOD) which gives a joint probability of around 1 in 900-years and 1 in 1400-years respectively.

Outputs from this assessment show no increase in flooding on the site with the shallow attenuation system enabling continued output from the site system for all events. Model outputs are included in Appendix F for reference.

7.7 Flood Routing

The performance of the system during extreme events (>1 in 100 years) should also be considered at this stage.

The routing of potential storm water run-off, should the capacity of the proposed site drainage system be exceeded, needs to be built into the layout of the site such that the residual risk of flooding from this element can be easily mitigated.

The likely route, is towards the lower Picknal Brook and the carriageway of Brookside Road. The proposed levels on the site will direct water away from the development and towards the watercourse.

Brookside Road can be utilised as additional surface attenuation in this extreme circumstance with a second emergency access being located off Town Meadows Way but the principal mitigation strategy will be to maintain the drainage system in working order.

7.8 Foul Drainage

Foul drainage from the site should be discharged via a new connection towards the adopted assets shown either in Brookside Road.

This connection would need to be approved by the local water company via a Developer's Enquiry at the detailed design stage and it is recommended that this is instigated as soon as possible.

It also needs to be confirmed that the local water company have adequate treatment capacity available to accept the increased foul flow from the developed site.

8 Flood Risk Mitigation

8.1 Fluvial Flooding

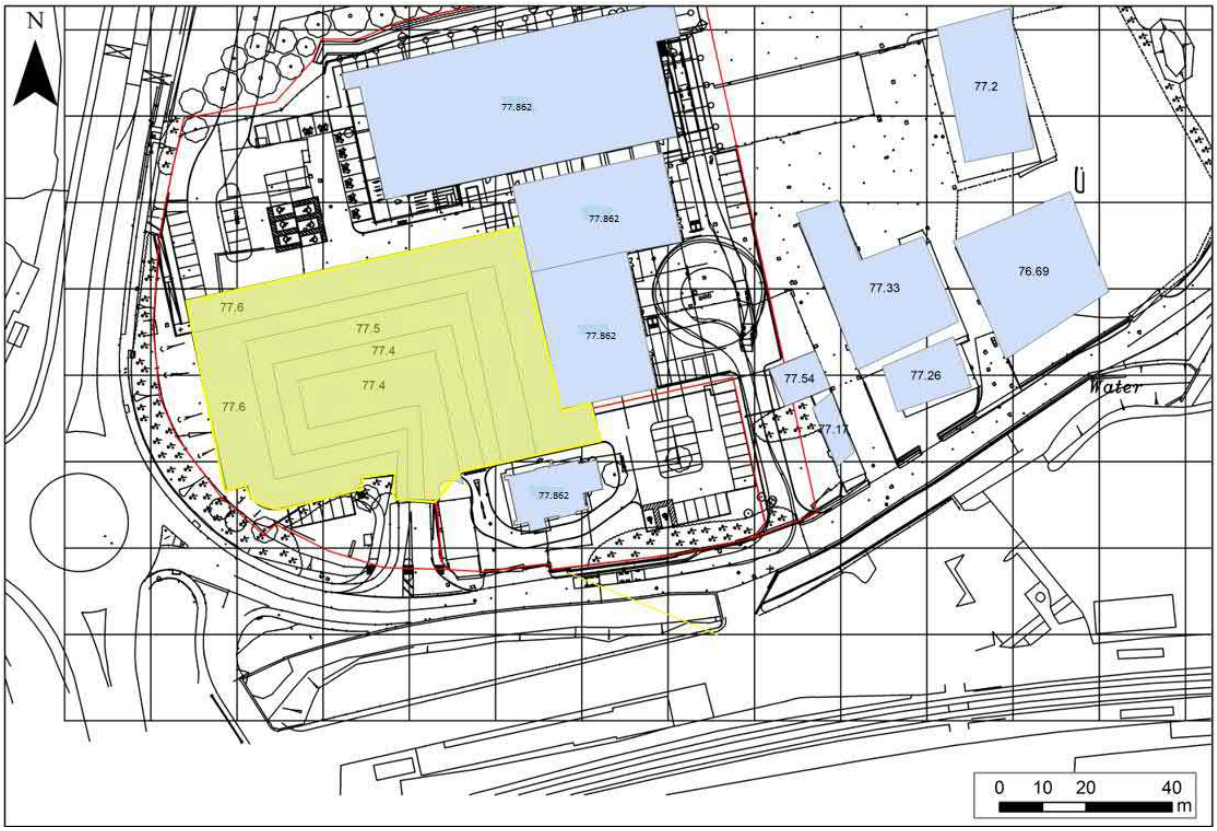
The anticipated on-site peak flood level for the 1 in 100-year plus 30% climate change event is 77.552mAOD. It is recommended that 'Less Vulnerable' retail/commercial units are set with a minimum freeboard of 300mm above the design storm event.

It is proposed that revised ground levels are used to engineer the flood extent on the site to maximise the development footprint of the site while controlling flood risk locally.

The levels of the large car park area can be used to provide surface storage during an extreme flood event in the channel. This area is shown to flood on the baseline model and will be effectively recreated.

Minimum finished floor levels of the units of 77.852mAOD will be provided with an external pedestrian access route set to 77.652mAOD. Car park levels will slope to a central lower area at 77.40mAOD. A flood flow path, emanating upstream of the existing bridge will be facilitated linking the channel of Brookside Road and the lower part of the car park using the landscaping around the proposed outline planning area. Levels in this area will be set lower than the adjacent carriageway to act as the first point of inundation on the site. Flow will pass from this area, across the existing site access at a level of 77.40mAOD, to the car park which will then act as surface storage. These are shown on the plan in Figure 7 below.

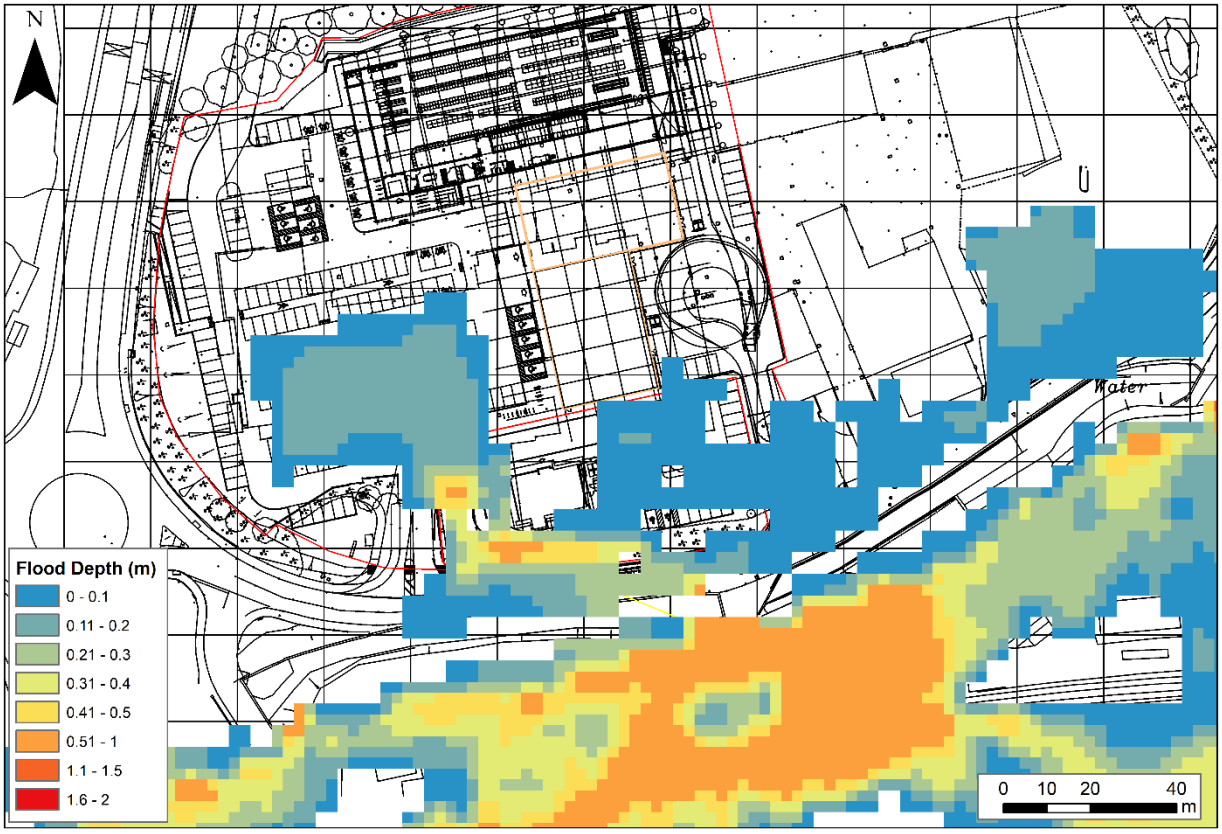
Figure 7: Proposed Level Strategy



Source: MMD 2018 – Car Park area denoted in Yellow

The resultant flood depths, extracted from the site hydraulic model are shown in Figure 8. This clearly shows how the flood path will propagate to the car park area via the landscaping and the existing site access.

Figure 8: Proposed Modelled Flood Depths



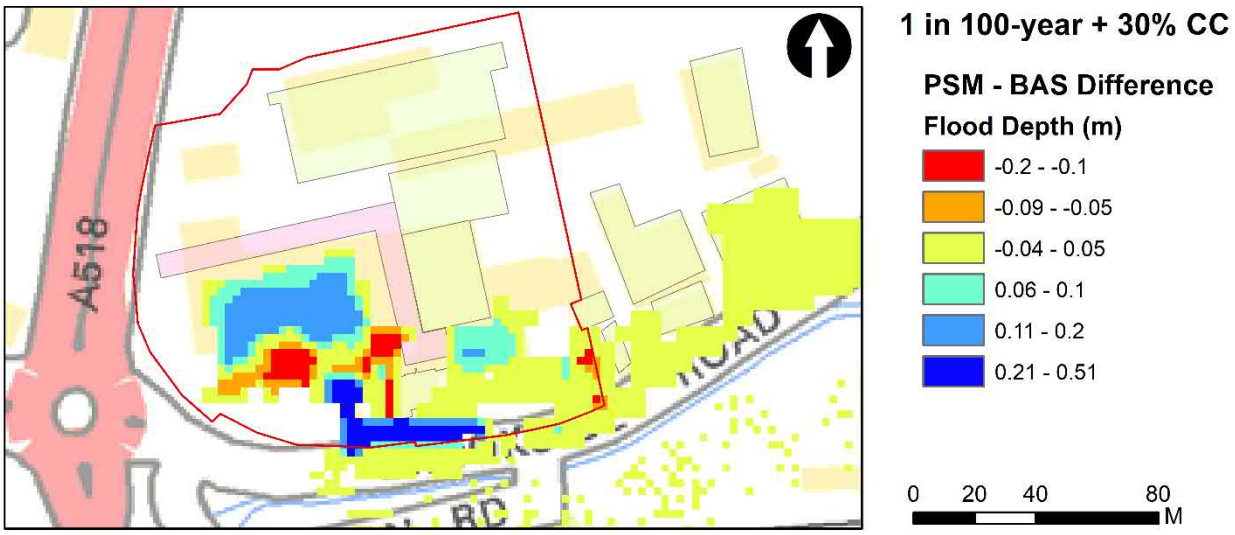
Source: MMD 2018

The proposed layout has been developed to integrate these flood mitigation and SuDS measures as a key feature of the layout. This is included in Appendix G for reference.

This layout has been tested within the baseline model to demonstrate the control of flood risk as a result of the works. More detailed outputs are included in the separately issued modelling report (ref R02_392669).

The extract from the model included in Figure 9, shows that the flood volume displaced by the development is controlled within the flood mitigation areas in the car park area combined with the other resilience features along Brookside Road will further help the area to recover from flood events that would have previously impacted properties and businesses. Flood depths downstream of the site are reduced for the 1 in 100-year+30%CC event

Figure 9: Pre and Post-development flood depth comparison

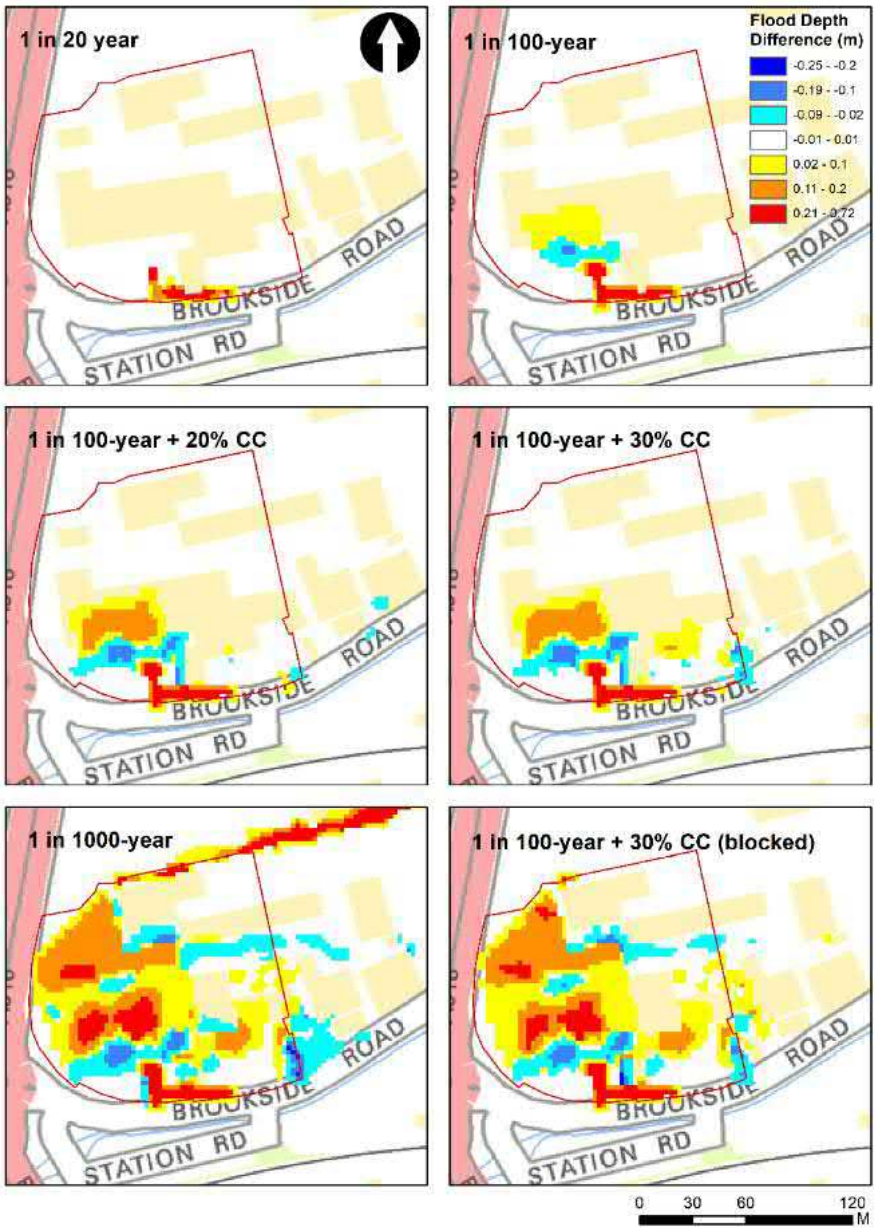


Source: MM report R02_392669

Figure 10 below shows the flood depth difference for the post-development scenario for the range of modelled return periods.

The outputs show the increase in flood level in the parking area and the reduction in flood level downstream of the site.

Figure 10: Flood Depth Difference (m) due to proposed scheme



Source: MML 2018

8.2 Pluvial Flooding

As shown in Figure 3 the site is currently at risk of pluvial flooding.

The development of the site will mitigate this risk by providing positive drainage within the boundary of the developed area, rainfall will be intercepted by the new system and collected and attenuated before being discharge to the existing watercourse. This will have the effect of reducing the uncontrolled runoff entering the watercourse and thus reducing the peak flow and flood risk.

Calculations demonstrating the proposed provision of attenuation on the site are included in Appendix F.

8.3 Access and Egress

During extreme events there is a potential that access to the site will be restricted as a result of Brookside Road being allowed to flood as part of the flood mitigation strategy. As such a secondary access will therefore need to be provided to Town Meadows Way, in order to allow pedestrians to egress the site. This will have a minimum level of 77.652mAOD and will therefore be located above the 1%AEP + 30% CC peak flood level on the site.

It is noted that flood depths on the site will be limited to depths of 200mm, which is traversable by vehicles and emergency services.

The integration of this feature is included on the proposed site plan included in Appendix G and as shown in Figure 7

In addition, a Flood Emergency Access Plan will need to be developed and provided to the occupants of each unit (similar to a Fire Evacuation Plan) with the sites included on the EA's flood watch list.

8.4 Overland Flow

The flood mitigation flow route on the site will be mobilised in reverse to act as an emergency flow route from the site drainage to the watercourse during extreme local rainfall events, with the landscaped area adjacent to the outline planning area providing additional, temporary surface storage.

8.5 Storm Water Management

A SuDS based drainage system will be required on this site in order to meet the requirements of CIRIA C753, NPPF-TG and water quality guidance.

An indicative scheme is shown on the drainage masterplan included in Appendix G based on design elements provisionally sized in Appendix F.

In summary, it is recommended that permeable paving and permeable sub-base is used to provide, collection, conveyance and attenuation on the site for both the full and outline application parts of the site.

Flow rates from the site will be limited to 76l/s which is 50% of the estimated existing peak discharge rate from the pre-development scenario and will therefore provide a significant reduction in flow leaving the site

It should be noted that the time-to-peak of the sustainable site drainage system will be an order of magnitude away from the peak river levels in Picknal Brook. The joint-probability assessment of the two systems returns probabilities of up to 1 in 900-years for the fluvial 2%AEP and the pluvial 20%AEP. In any event, the modelling shows that the site drainage system will be able to operate against a channel flood level of 77.52mAOD.

This approach will ensure that the development drainage system will remain operational during an extreme event and therefore not contribute to the fluvial flood extent.

8.6 Safe Failure Planning

If considered early in the development process, mitigation can be built in to the layout to prevent overland flows from the site either entering habitable areas or leaving the site in an uncontrolled manner with very little cost impact.

The development of the site levels to provide a route for flood water to enter the site enables this to be mobilised in reverse as a safe failure route for the proposed site drainage systems.

Testing of the storm water management system for the 40% climate change scenario indicates acceptable increases in offsite discharge (for the 15-minute storm only) and manageable and safe inundation depths on the car park area (up to 40mm).

8.7 Flood Resilience and Resistance

The development of the layout should always consider that the buildings on the site are potentially at risk from an extreme rainfall event greater than the current design requirements, and as such the incorporation of flood resilience and resistance measures is recommended for consideration at this stage.

Relatively simple measures such as raising utility entry points, using first floor or ceiling down electrical circuits and sloping landscaping away from properties can be easily and economically incorporated into the development of the site.

The development should also consider the use of flood resistant construction in the building of the new units. This would include the use of solid floors, sealed door and window cavities, locating IT infrastructure at high level and utility shut-off points.

More information can be found in the Communities and Local Government publication ' Improving the Flood Performance of New Buildings'[5].

[5] http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

9 Conclusions and Recommendations

An initial assessment of the data indicates the site to be in all three Flood Zones (1-3), with a larger portion in Flood Zone 3 with pluvial inundation occurring on the southern boundary.

The existing and proposed development share the same 'Less Vulnerable' flood risk classification and so no Sequential Test is required.

A detailed hydraulic model incorporating updated local topography, hydrology and LiDAR data was developed. This has identified the baseline flood enevlope of the site and has enabled the provision of a flood mitigation option that maximise the site commercial development space whilst mitigating flood risk within the site boundaries.

The proposed external level strategy, illustrated in Figure 7, should be implemented on the site to protect both the proposed units and provide safe access and egress from the site. This provides a minimum finished floor level for the proposed units of **77.852mAOD** and a minimum pedestrian egress level of 77.652mAOD.

The mitigation proposals will manage out of channel from Picknal Brook via a controlled flood route on the proposed car park area which will accommodate displaced flood water caused by the elevation of the proposed units.

Storm water generated by the development itself will need to be managed to avoid creating a flood risk to the development and adjacent sites.

It is unlikely that infiltration-based systems will be suitable for this site given the anticipated ground conditions and the relatively impermeable underlying bedrock.

It is estimated that the existing developed area will generate a peak runoff of 140l/s and as a result the proposed allowable site discharge will be 76l/s or a 45% reduction in the peak runoff for all events up to and including the 1%AEP+CC event.

Based upon the proposed development layout, it is recommended to drain the site into two surface water systems, one for the Full Application site and one for the Outline Application area. The allowable site discharge will also be split between the two applications and will incorporate attenuation methods highlighted in Table 6.

The proposed layout lends itself to the use of permeable surfacing and sub-base under the large car park area. This will provide collection, conveyance and attenuation as well as in-situ water quality improvements and to facilitate a shallow outlet from the site. The proposed drainage masterplan illustrating this is included in Appendix G.

Foul drainage from the site should be discharged using a new offsite connection towards the adopted assets shown in Brookside Road. This connection would need to be approved by the local water company via a Developer's Enquiry at the detailed design stage and it is recommended that this is instigated as soon as possible.

During peak flood events, access to the site along Brookside Road will be temporarily unavailable. A secondary pedestrian access should therefore be provided from the site to Town Meadows Way. A Flood Evacuation Plan should be implemented that details a plan of action should the watercourse flood from its banks. This would include closing the main site access road to traffic, safe evacuation of the car park and the relay of information to customers and staff on the development site.

Based on the proposed mitigation levels, it would not be necessary to evacuate or close the units for the 1%AEP + CC event. Areas of the site remain in Flood Zone 2 however, so internal property flooding may still occur for a 0.1% AEP + CC event.

Appendices

A. Topographical Survey

A.1 Green Hatch drawings ref 15541a_OGL sheet 1 - 3

N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
TC1	409479.153	333388.338	78.229
TC2	409470.973	333301.127	81.731
TC3	409534.831	333282.266	77.728
TC4	409542.700	333327.916	77.440
TC5	409501.057	333311.650	77.624
TC6	409485.963	333340.307	77.680
TC7	409485.307	333370.726	77.555
TC8	409535.298	333370.737	77.465
TC9	409597.293	333376.996	77.384
TC10	409625.828	333376.980	77.266
TC11	409652.281	333392.143	77.029
TC12	409649.822	333425.765	76.963
TC30	409624.211	333295.364	77.317
TC31	409682.460	333331.189	76.872
TC32	409729.979	333362.786	76.625

Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated 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 scale factor 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.

Legend:

Buildings / walls
Kerb line
Edge of surface
Catchpit / Gratching
Line Marking
Centre Line
Barrier
Hand rail
Hedge
Overhead Powerline
Chamber
Woodland
Station and Name
Station Level
Tree / Bush / Sapling
Area of Undergrowth
Gate
Inspection chamber
Manhole
Crown
Unable to lift
Gully
Back Gully
Tree canopy level
Tree girth
Multi girth
Eaves level
Ridge level
Flat roof level
Concrete paving slabs
Block paved
Tac tile paving
Road name board
Retaining wall

Fence types:
Interwoven
Iron Railings
Wire Mesh
Post & Rail
Post & Wire
Chain Link
Wooden Panels
Concrete Panels
Steel Palisade
Electric
British Telecom
Fire Hydrant
Stop tap
Stop valve
Wash Out
Water Meter
Service Marker
Rodding eye
Lamp Post
Sign Post
Electricity Post
Telegraph Post
Bollard
Water level
Height
Internal floor level
Threshold level
Cote
Earth cut

Rev	Date	Description	Drawn	Ch. Ref

greenhatch group
Topographical Surveys
Site Engineering
Measured Building Surveys
3D Laser Scanning
Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk

CLIENT
M J Barrett Developments

PROJECT
Brookside Business Park Uttoxeter

TITLE
Topographical Survey

SCALE	DATE	DRAWN	QUALITY REF
1: 200	10.03.12	TC	D0865

Level datum	OS (GPS verified)
Grid orientation	OS (GPS verified)
Job number	15541
Drawing No.	15541a_OGL
Rev.	0

Comments
This plan should only be used for its original purpose. GreenHatch Ltd accepts no responsibility for this plan if supplied to any party other than the original client.
All dimensions should be checked on site prior to design and construction.
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

DO NOT SCALE

N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
TC1	409479.153	333388.338	78.229
TC2	409470.973	333301.127	81.731
TC3	409534.831	333282.266	77.728
TC4	409542.700	333327.916	77.440
TC5	409501.057	333311.650	77.624
TC6	409485.963	333340.307	77.680
TC7	409485.307	333370.726	77.555
TC8	409535.298	333370.737	77.465
TC9	409597.293	333376.996	77.384
TC10	409625.828	333376.980	77.266
TC11	409652.281	333392.143	77.029
TC12	409649.822	333425.765	76.963
TC30	409624.211	333295.364	77.317
TC31	409682.460	333331.189	76.872
TC32	409729.979	333362.786	76.625

Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated 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 scale factor 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.

Legend:

Buildings / walls
Kerb line
Edge of surface
Canopy / Overhang
Line Marking
Centre Line
Barrier
Hand rail
Hedge
Overhead Powerline
Chamber
Woodland
Station and Name
Station Level
Tree / Bush / Sapling
Area of Undergrowth
Gate
Inspection chamber
Manhole
Cover
Umbilia to lift
Gully
Back Gully
Tree canopy level
Tree girth +
Multi girth
Eaves level
Ridge level
Flat roof level
Concrete paving slabs
Block paved
Tac tile paving
Road name board
Retaining wall

Fence types:

Iron railings
Wire Mesh
Post & Rail
Post & Wire
Chain Link
Wooden Panels
Concrete Panels
Steel Palisade

Electric
British Telecom
Fire Hydrant
Stop tap
Stop valve
Wash Out
Water Meter
Service Marker
Rodding eye
Lamp Post
Sign Post
Electricity Post
Telegraph Post
Bollard
Water level
Height
Internal floor level
Threshold level
Gas
Earth rod

Rev.	Date	Description	Drawn	Q. Ref.

greenhatch group

Topographical Surveys
Site Engineering

Measured Building Surveys
3D Laser Scanning

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk

CLIENT
M J Barrett Developments

PROJECT
Brookside Business Park Uttoxeter

TITLE
Topographical Survey

SCALE	DATE	DRAWN	QUALITY REF
1: 200	10.03.12	TC	D0865

Level datum	OS (GPS verified)
Grid orientation	OS (GPS verified)
Job number	15541

Drawing No. **15541a_OGL** Rev. **0**

Comments

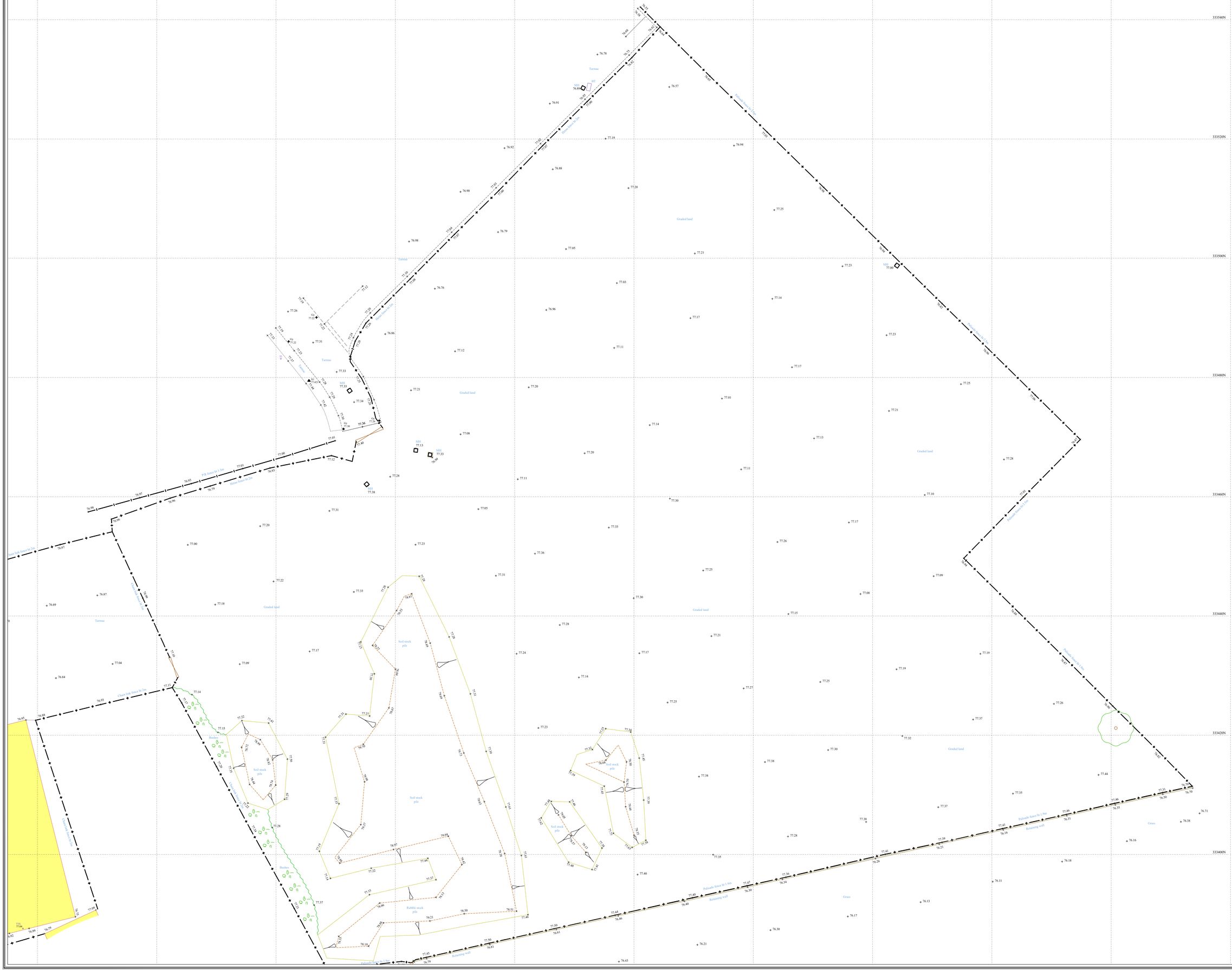
This plan should only be used for its original purpose. GreenHatch Ltd accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

DO NOT SCALE



N

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
TC1	409479.153	333388.338	78.229
TC2	409470.973	333301.127	81.731
TC3	409534.831	333282.266	77.728
TC4	409542.700	333327.916	77.440
TC5	409501.057	333311.650	77.624
TC6	409485.963	333340.307	77.680
TC7	409485.307	333370.726	77.555
TC8	409535.298	333370.737	77.465
TC9	409597.293	333376.996	77.384
TC10	409625.828	333376.980	77.266
TC11	409652.281	333392.143	77.029
TC12	409649.822	333425.765	76.963
TC30	409624.211	333295.364	77.317
TC31	409682.460	333331.189	76.872
TC32	409729.979	333362.786	76.625

Note:

Some services may have been omitted due to parked vehicles. The Ordnance Survey tile is to be used as a guide only.

OS Buildings *Surveyed Buildings*

This survey has been orientated 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 scale factor 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.

Legend:

Buildings / walls
Kerb line
Edge of surface
Canopy / Overhang
Line Marking
Centre Line
Barrier
Hand rail
Hedge
Overhead Powerline
Chamber
Woodland
Station and Name
Station Level
Tree / Bush / Sapling
Area of Undergrowth
Gate
Inspection chamber
Manhole
Cover
Unable to lift
Gully
Back Gully
Tree canopy level
Tree girth =
Multi girth
Eaves level
Ridge level
Flat roof level
Concrete paving slabs
Block paved
Tac tile paving
Road name board
Retaining wall

Fence types:

Intervision
Iron Railings
Wire Mesh
Post & Rail
Post & Wire
Chain Link
Wooden Panels
Concrete Panels
Steel Palisade

Electric
British Telecom
Fire Hydrant
Stop tap
Stop valve
Wash Out
Water Meter
Service Marker
Rodding eye
Lamp Post
Sign Post
Electricity Post
Telegraph Post
Bollard
Water level
Height
Internal floor level
Threshold level
Gas
Earth rod

Rev	Date	Description	Drawn	Q. Ref.

greenhatch group
Topographical Surveys
Site Engineering
Measured Building Surveys
3D Laser Scanning
Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044 Fax (01332) 830055
admin@greenhatch-group.co.uk

CLIENT
M J Barrett Developments

PROJECT
Brookside Business Park Uttoxeter

TITLE
Topographical Survey

SCALE	DATE	DRAWN	QUALITY REF
1: 200	10.03.12	TC	D0865

Level datum	OS (GPS verified)
Grid orientation	OS (GPS verified)
Job number	15541

Drawing No. **15541a_OGL** Rev. **0**

Comments
This plan should only be used for its original purpose. GreenHatch Ltd accepts no responsibility for this plan if supplied to any party other than the original client.
All dimensions should be checked on site prior to design and construction.
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

DO NOT SCALE

B. Historical Site Drainage Information

P:\Sheffield\392669 - Brookside, Uttoxeter\5.0 MM Drawings\Drainage\392669-MMD-00-XX-DR-D-0002 - Existing Drainage Routes.dwg Oct 25, 2018 - 8:19AM PRE27448

1:500 0 25m 50m

Notes

1. Do not scale from this drawing.
2. All levels are in meters above Ordnance Datum (mAOD) unless otherwise specified.
3. All dimensions are in metres unless specified otherwise.
4. Main car park permeable paving to have minimum level of 77.400mAOD and
5. Historic records received from MJ Barrett archive and have not been validated on site, therefore these should be judged in context.

Key to symbols

- Overland Flood Route
- Area identified draining to Picknall Brook = 8635m²
- 3 Outfall reference

Reference drawings

15541a_OGL_REV0 - Site Topographical Survey

Residual Health & Safety Risk Assessment

1. Working near live carriageway
2. Risk of dust and noise to public
3. Open excavations

Rev	Date	Drawn	Description	Ch'k'd	App'd
P01	20/05/2018	M Smith	For Information	AJP	HL

Status Stamp
NOT FOR CONSTRUCTION

MOTT MACDONALD
Mott MacDonald House
8-10 Sydenham Road
Croydon
CR0 2EE
United Kingdom
T +44 (0)20 8774 2000
F +44 (0)20 8681 5706
W www.mottmac.com

Client
Hadfield Cawkwell Davidson
Broomgrove Lodge
Sheffield
S10 2LZ

Title
LiDL Uttoxeter
Indicative Surface Water Drainage
Existing Drainage Information

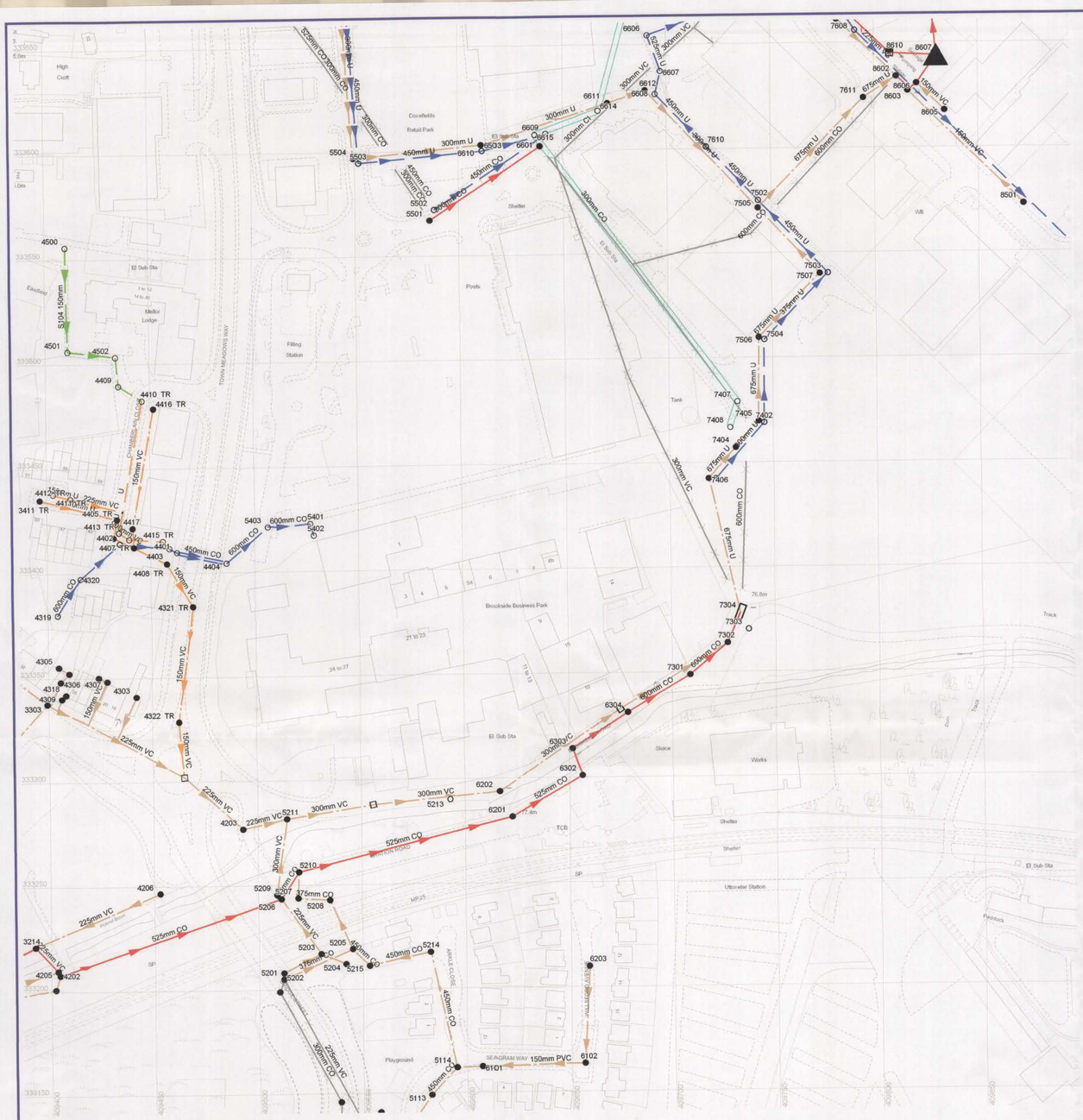
Designed	M Smith	MCS	Eng check	A Precious	AJP
Drawn	M Smith	MCS	Coordination		---
Dwg check	A Precious	AJP	Approved		

MMD Project Number	Scale at A1	Security
392669	As Shown	STD

Suitability Description	Suit. Code
Suitable for Stage Approval	S4

Drawing Number	Revision
392669-MMD-00-XX-DR-D-0002	P01

C. Severn Trent Water Sewer Records



Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK09333214	nil	nil	75.78	C	VC	C	225	nil	0.00	nil
SK09333303	79.43	76.77	75.89	F	VC	C	225	nil	85.98	nil
SK09333411	81.25	79.60	77.55	F	U	C	150	nil	11.47	nil
SK09334201	78.65	75.46	75.43	F	CO	C	520	nil	242.67	nil
SK09334202	79.39	75.39	74.96	C	CO	C	525	nil	263.30	nil
SK09334203	77.87	75.44	75.19	F	VC	C	225	nil	86.36	nil
SK09334205	78.19	75.74	75.69	C	VC	C	225	nil	44.80	nil
SK09334206	nil	nil	nil	F	VC	C	225	nil	0.00	nil
SK09334303	78.13	77.52	nil	F	VC	C	100	nil	0.00	nil
SK09334304	79.62	78.73	nil	F	VC	C	100	nil	0.00	nil
SK09334305	79.74	78.94	78.73	F	VC	C	100	nil	27.76	nil
SK09334306	79.57	nil	nil	F	nil	nil	nil	nil	0.00	nil
SK09334307	78.57	77.73	nil	F	VC	C	150	nil	0.00	nil
SK09334308	78.50	78.10	77.84	F	VC	C	100	nil	17.19	nil
SK09334309	79.10	77.64	nil	F	VC	C	150	nil	0.00	nil
SK09334318	79.13	77.99	77.70	F	VC	C	100	nil	9.76	nil
SK09334319	81.22	78.07	77.46	S	CO	C	600	nil	35.08	2004
SK09334320	80.33	77.45	77.00	S	CO	C	600	nil	55.33	2004
SK09334321	78.95	78.67	76.55	F	VC	C	150	nil	443.12	nil
SK09334322	78.72	76.67	76.55	F	VC	C	150	nil	214.00	nil
SK09334401	78.18	76.30	76.20	S	CO	C	450	nil	241.00	2004
SK09334401	78.18	76.30	76.20	S	CO	C	450	nil	241.00	2004
SK09334402	79.28	76.65	76.40	S	CO	C	600	nil	100.00	2004
SK09334403	78.17	76.39	76.31	S	CO	C	600	nil	51.13	2004
SK09334404	77.88	76.19	76.14	S	CO	C	600	nil	510.00	2004
SK09334405	79.81	77.55	77.50	F	VC	C	150	nil	164.00	nil
SK09334406	79.14	77.50	77.42	F	VC	C	150	nil	156.56	nil
SK09334407	78.98	77.42	77.05	F	VC	C	150	nil	50.14	nil
SK09334408	78.80	77.05	76.67	F	VC	C	150	nil	63.42	nil
SK09334409	78.50	77.58	76.88	S	nil	nil	nil	nil	19.24	nil
SK09334410	78.92	78.88	76.87	S	U	R	1000	2400	6328.00	nil
SK09334411	81.08	78.88	78.50	S	U	C	150	nil	21.13	nil
SK09334412	80.51	78.50	76.87	S	VC	C	225	nil	15.78	nil
SK09334413	78.89	76.87	76.82	S	VC	C	900	nil	122.80	nil
SK09334414	78.96	76.82	76.70	S	VC	C	225	nil	137.08	nil
SK09334415	78.67	76.70	76.40	S	VC	C	225	nil	17.00	nil
SK09334416	78.90	77.87	77.53	F	VC	U	nil	nil	167.92	nil
SK09334417	79.00	77.53	77.44	F	VC	U	nil	nil	114.57	nil
SK09334500	81.77	80.57	79.00	S	nil	C	150	nil	31.71	nil
SK09334501	80.00	79.00	77.66	S	nil	C	225	nil	16.96	nil
SK09334502	78.56	77.66	77.58	S	nil	C	225	nil	162.94	nil
SK09335113	77.74	75.71	75.69	F	CO	C	450	nil	898.50	nil
SK09335114	77.64	75.66	75.56	F	CO	C	450	nil	566.70	nil
SK09335201	78.16	75.65	nil	F	CO	C	375	nil	0.00	nil
SK09335202	78.11	75.74	75.58	F	VC	C	225	nil	125.75	nil
SK09335203	77.69	75.54	75.40	F	VC	C	225	nil	247.64	nil
SK09335204	77.35	76.19	75.73	F	VC	C	225	nil	28.26	nil
SK09335205	nil	nil	75.24	F	nil	nil	nil	nil	0.00	nil
SK09335206	78.19	74.96	74.91	C	CO	C	525	nil	305.20	nil
SK09335207	78.28	75.01	74.98	F	CO	C	375	nil	433.33	nil
SK09335208	79.09	75.22	75.01	F	CO	C	375	nil	72.05	nil
SK09335209	78.11	75.39	75.37	F	CO	C	300	nil	141.50	nil
SK09335209	78.11	75.34	75.20	F	VC	C	300	nil	245.50	nil
SK09335210	77.88	74.91	74.41	C	CO	C	525	nil	209.12	nil
SK09335211	77.74	75.19	75.07	F	VC	C	300	nil	339.92	nil
SK09335214	77.56	75.54	75.43	F	CO	C	450	nil	273.18	nil
SK09335215	77.69	75.42	nil	F	CO	C	450	nil	0.00	nil
SK09335401	77.09	75.97	75.96	S	CO	C	600	nil	610.00	2004
SK09335403	77.24	76.13	73.97	S	CO	C	600	nil	8.84	2004
SK09335501	76.11	74.16	73.76	C	CO	C	300	nil	158.78	nil
SK09335502	76.36	75.23	75.12	S	CO	C	450	nil	585.91	nil
SK09335503	76.72	74.98	74.88	S	U	U	450	nil	601.52	2002
SK09335504	76.72	74.10	73.74	F	U	U	300	nil	174.31	2002
SK09336101	98.60	96.73	96.42	F	PVC	C	150	nil	39.26	nil
SK09336102	98.85	97.00	96.73	F	PVC	C	150	nil	181.85	nil
SK09336201	77.35	74.37	74.08	C	CO	C	525	nil	136.03	nil
SK09336202	77.35	74.85	74.62	F	VC	C	300	nil	301.48	nil
SK09336203	98.81	97.34	97.00	F	VC	C	150	nil	136.59	nil
SK09336302	77.25	74.11	74.08	C	CI	C	525	nil	495.67	nil
SK09336303	77.00	73.99	73.85	C	CO	C	600	nil	224.14	nil
SK09336304	76.84	73.83	73.79	C	CO	C	600	nil	862.00	nil
SK09336503	76.56	74.88	74.82	S	U	U	450	nil	604.62	2002
SK09336606	76.16	nil	nil	S	nil	nil	nil	nil	0.00	2002
SK09336607	76.19	74.77	74.73	S	U	U	525	nil	508.06	2002
SK09336608	76.22	74.79	74.77	S	U	U	525	nil	489.13	2002
SK09336610	76.50	73.74	nil	F	U	U	300	nil	0.86	2002
SK09336611	nil	nil	73.28	F	U	U	300	nil	0.00	2002
SK09336612	75.10	73.28	72.83	F	U	U	300	nil	176.47	2002
SK09336614	nil	nil	nil				nil	nil	0.00	nil
SK09336615	nil	nil	nil				nil	nil	0.00	nil
SK09337301	76.61	73.79	73.67	C	CO	C	600	nil	207.00	nil
SK09337302	76.64	73.66	73.64	C	CO	C	600	nil	808.00	nil
SK09337402	76.90	75.67	75.46	S	U	U	300	nil	181.15	2002
SK09337403	77.40	75.88	75.67	S	U	U	300	nil	181.59	2002
SK09337404	nil	nil	73.08	F	U	U	675	nil	0.00	2002
SK09337405	76.90	73.08	72.88	F	U	U	675	nil	203.79	2002
SK09337406	77.40	73.26	nil	F	U	U	675	nil	0.27	2002
SK09337407	nil	nil	nil				nil	nil	0.00	nil
SK09337408	nil	nil	nil				nil	nil	0.00	nil
SK09337502	76.10	75.00	74.94	S	U	U	450	nil	517.10	2002
SK09337503	76.10	75.15	75.00	S	U	U	450	nil	331.44	2002
SK09337504	76.70	75.38	75.23	S	U	U	375	nil	286.77	2002
SK09337505	76.10	72.46	72.09	F	U	U	675	nil	201.61	2002
SK09337506	76.70	72.88	72.67	F	U	U	675	nil	201.75	2002
SK09337507	76.10	72.67	72.46	F	U	U	675	nil	199.86	2002

Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SK09337609	75.04	73.98	73.55	S	VC	C	225	nil	368.37	nil
SK09337610	76.29	74.94	74.87	S	U	U	450	nil	508.84	2002
SK09337611	76.10	72.09	71.99	F	U	U	675	nil	203.06	2002
SK09338501	74.70	72.37	71.85	F	VC	C	150	nil	152.33	nil
SK09338602	74.98	71.92	nil	C	CO	C	720	nil	0.00	nil
SK09338603	74.98	71.85	nil	F	VC	C	225	nil	0.00	nil
SK09338605	74.90	73.88	71.74	F	VC	C	150	nil	9.25	nil
SK09338606	74.87	70.58	70.45	C	CO	C	1550	nil	128.92	nil

- Abandoned Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
- Foul Lateral Drain (SS)
- Surface Water Lateral Drain (SS)

- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- Housing, Building
- Housing, Kiosk
- Disposal Site
- Sewage Treatment Works
- Housing, Other
- Pipe Support Structure
- Sewage Pumping Facility
- Sewer Facility Connection Inlet / Outlet

- Blind Shaft
- Combined Use Manhole
- Flushing Chamber
- Foul Use Manhole
- Grease Trap
- Head Node
- Hydrobrake
- Lamphole
- Outfall
- Overflow
- Penstock
- Petrol Interceptor

- Sewer Chemical Injection Point
- Sewer Junction
- Sewerage Air Valve
- Sewerage Hatch Box Point
- Sewerage Isolation Valve
- Soakaway
- Surface Water Manhole
- Vent Column
- Waste Water Storage
- Culverted Watercourse
- Pre-1937 Properties

MATERIALS

AC	- ASBESTOS CEMENT
BR	- BRICK
CC	- CONCRETE BOX CULVERT
CI	- CAST IRON
CO	- CONCRETE
CSB	- CONCRETE SEGMENTS (BOLTED)
CSU	- CONCRETE SEGMENTS (UNBOLTED)
DI	- DUCTILE IRON
GRC	- GLASS REINFORCED CONCRETE
MAC	- MASONRY IN REGULAR COURSES
MAR	- MASONRY RANDOMLY COURSED
PE	- POLYETHLENE
PF	- PITCH
PP	- POLYPROPYLENE
PSC	- PLASTIC STEEL COMPOSITE
PVC	- POLYVINYL CHLORIDE
RPM	- REINFORCED PLASTIC MATRIX
SI	- SPUN (GREY) IRON
XXX	- OTHER

CATEGORIES

W	- WEIR
C	- CASCADE
DB	- DAMBOARD
SE	- SIDE ENTRY
FV	- FLAP VALVE
BD	- BACK DROP
S	- SIPHON
HD	- HIGHWAY DRAIN
S104	- SECTION 104

SHAPE

C	- CIRCULAR
E	- EGG SHAPED
O	- OTHER
R	- RECTANGLE
S	- SQUARE
T	- TRAPEZOIDAL
U	- UNKNOWN

TABULAR KEY

A. Sewer pipe data refers to downstream sewer pipe.

B. Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.

C. Gradient is stated a 1 in...

PURPOSE

C	- COMBINED
E	- FINAL EFFLUENT
F	- FOUL
L	- SLUDGE
S	- SURFACE WATER

All Private Sewers are shown in magenta
All section 104 sewers are shown in green
All Sewers that have been transferred to Severn Trent Water after the 1st October 2011, but have not been surveyed and confirmed by Severn Trent Water are shown in orange

N W E S

SEVERN TRENT WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD (TABULAR)

O/S Map scale: 1:1250
Date of issue: 31.07.14
Sheet No. 1 of 1

This map is centred upon:
O / S Grid reference:
x : 409640
y : 333400

D. Proposed Site Plan

D.1 HCD – drawing reference 2017-119 - A-PL-003

Large mature trees & landscaping to be removed to allow access between the two sites

Landscaping to rear of site rear to landscape architect details

Existing fence retained wherever possible

Fire Exit

PLANT AREA

2m high paladin new security fence along boundary

External plant compound, surround in secure fencing with access gate

Retaining wall to dropped service yard

New access road

2no. Designated Motorcycle parking spaces

Concrete retaining wall along perimeter of car park

New pedestrian site access via ramp with handrails in accordance with DDA requirements, subject to highways approval

LIDL FOODSTORE
(use class A1)

+77.862 FFL

Warehouse

Internal layout shown indicative only

Cold Store

Cold Store

Welfare Area

Warehouse

Shopfront curtain walling glazing looking into sales floor

5no. Sheffield cycle hoops

Entrance Lobby

Covered Trolley Storage

Fire Exit

Escape Route Corridor

Fire Exit

Fire Exit

Roller shutter / industrial door for servicing

Pedestrian route leading to Lidl & Retail Units, block paving to Lidl standard spec

Block paving to Lidl entrance & pedestrian walkways

Dashed line indicate extent of Lidl covered canopy above

RETAIL UNIT 2
(use class A1)

+77.862 FFL

Fire Exit

Staff parking facility

Above shopfront canopy to Retail main entrances

Non-permable Tarmac surface to car park circulation routes

Permable Tarmac surface to car park spaces

RETAIL UNIT 3
(use class A1)

+77.862 FFL

Fire Exit

Concrete hardstanding surface due to HGV vehicles turning

2m high paladin new security fence along boundary

HGV VEHICLE TRACK PLOTS/ TURNING CIRCLE REFER TO HIGHWAYS CONSULTANT DETAILS

Armco barrier or similar approved HGV protection to boundary fence

Staff parking facility

Trief kerb protection to sub-station

New landscaping to perimeter of car park review to Landscape Architect Details

A518 ROUND ABOUT JUNCTION

Lidl car park directional signage, subject to separate adverts application

13no. Sheffield cycle hoops

Existing Storey Offices Retained

ELECTRIC SUBSTATION

Existing landscaping retained adjacent Highways

New retaining walls to site boundary

OUTLINE PLANNING APPLICATION ONLY

DRIVE THRU RESTAURANT
(use classes A3/A5)
169sqm GIA

Access road to shared service yard

HGV ACCESS

New retaining walls to site boundary

New 7.5m high Lidl signage pylon (at the site entrance (Retail units adverts - TBC), subject to separate adverts planning application

Ex. gas housing, retained, further site investigation required

Existing site perimeter removed and ground repaired

NB; Existing highways surface is cobblestone road

New site access & egress junction, refer to Highways Engineers consultants details

Telegraph pole with overhead cable

BROOKSIDE ROAD

Picknal Brook adjacent access road, further details refer to FRA

New access and egress junction refer to Highway Consultant details

NOTES

THIS DRAWING IS STRICTLY NOT TO BE USED FOR CONSTRUCTION PURPOSES.

PROPOSED LEVELS SUBJECT TO DESIGN DEVELOPMENT.

DRAINAGE STRATEGY & RAIN WATER PIPES SUBJECT TO DESIGN DEVELOPMENT.

THIS DRAWING CONSISTS OF THE FOLLOWING THIRD PARTY INFORMATION & DRAWINGS:-

Topographical Survey by Green Hatch, drawing 15541a_OGL, received via email on 27/07/2017.

Highway Consultants Vectos drg. VN70855/101 - Brookside Road Improvements, Proposed Access off 6m wide carriageway, dated Jan 2018. HCD received via email on 09/03/2018.

TO BE READ IN CONJUNCTION WITH HCD DRAWINGS;

A-PL-001 - SITE LOCATION PLAN
A-PL-002 - EXISTING SITE PLAN
A-PL-004 - PROPOSED STORE PLAN
A-PL-005 - PROPOSED RETAIL UNIT BUILDING PLAN
A-PL-006 - PROPOSED STORE ROOF PLAN
A-PL-007 - PROPOSED RETAIL UNIT ROOF PLAN
A-PL-008 - PROPOSED RETAIL UNIT ELEVATIONS
A-PL-009 - PROPOSED RETAIL UNIT ELEVATIONS
A-PL-010 - PROPOSED SITE SECTIONS

1:200 scale bar: 0, 5, 10, 15, 20 m

N

Foodstore Areas		
Sales Area	1325 m²	14,262 ft²
Gross Internal Area	2125 m²	22,873 ft²
Gross External Area	2206 m²	23,745 ft²

Retail Area Unit 2		
Gross Internal Area	700 m²	7535 ft²
Gross External Area	730 m²	7858 ft²

Retail Area Unit 3		
Gross Internal Area	700 m²	7535 ft²
Gross External Area	730 m²	7858 ft²

Car Parking Numbers	
Customer Parking	149
Disabled Parking	11
Parent & Child	12
Staff	10
Grand Total:	182

Shared Cycle Hoops on site	18
Motorcycle Parking	2

Outline Planning Application Boundary Only

	GIA	GEA	Max. Height
Drive Thru Restaurant	169m² / 1819sqft	200m² / 2153sqft	5 - 6m

PERMEABLE TARMAC AREAS

77.540 PROPOSED SITE LEVEL

(77.410) EXISTING SITE LEVEL

REVISION	BY	CHECKED	DATE	
F	DJW		06/08/2018	FFL raised to +77.862 following Local Authority comments on flood levels.
E	DJW		14/05/2018	Existing two storey offices retained adjacent shared service yard.
D	DJW		09/04/2018	Scale of drawing amended to 1:200. Site levels added as per FRA. Highways consultant 6m wide road on
C	DJW		20/02/2018	Issued for Planning. Permeable tarmac to car park spaces added and to be read in conjunction with Flood Risk Assessment. Non-permable tarmac surface to circulation routes in car park.
B	DJW		03/01/2018	Issued for Planning. Red Line Boundaries Updated to include site access junction, service road access/ egress junction, top of pedestrian ramp and Tesco shared site access. Site Boundary area updated.
A	DJW		22/11/2017	Issued for Planning. Application boundary updated. Cycle parking moved closer to Lidl main store entrance.
*	DJW		15/11/2017	Issued for Planning.

PLANNING

PLOT DATE:

CLIENT:

LiDL UK GmbH
BROOKSIDE ROAD
UTTOXETER

PROJECT:

PROPOSED SITE PLAN

DRAWN BY:	SCALE:	DATE:
GOV	1:200 @ A0	OCTOBER 2017

Hadfield Cawkwell Davidson
Broomgrove | odge, 13 Broomgrove Rd, Sheffield, S10 2LZ T 0114 266 8181 www.hcd.co.uk
Architecture | Engineering | Interior Design | MasterpLanning | Urban Design

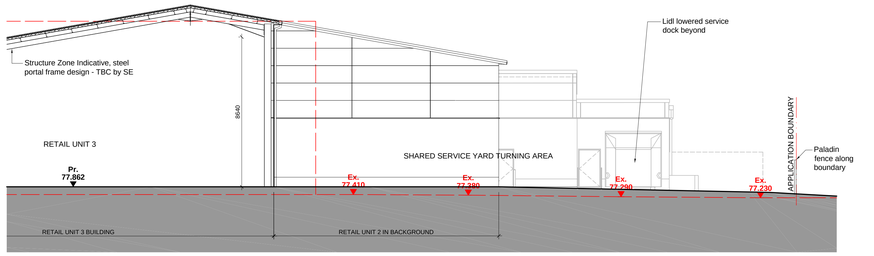
JOB NO: 2017-119 | DRAWING NO: A-PL-003 | REV: F

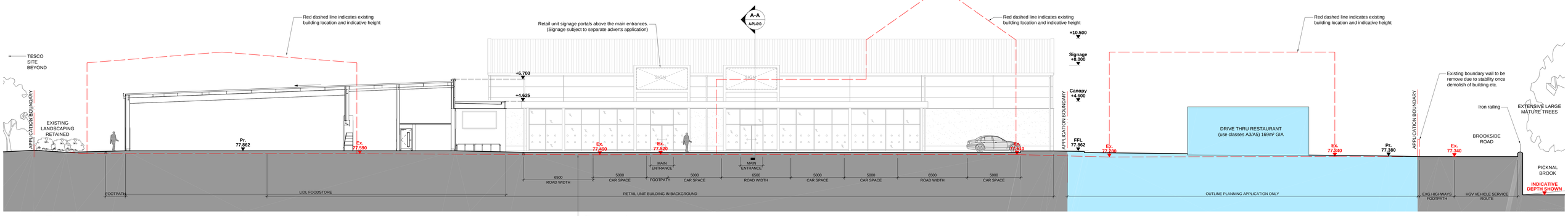
S:\Architecture\2017-119\Drawings\DR - Pinfo\html\A-PL-003_Proposed Site Plan.dwg

NOTES

A-A SITE SECTION INCLUDING RETAIL BUILDING SECTION

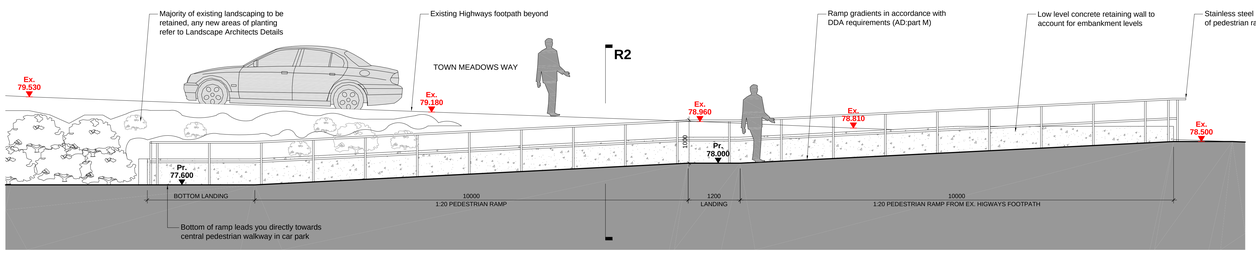
1:125





B-B SITE SECTION INCLUDING LIDL BUILDING SECTION

1:125

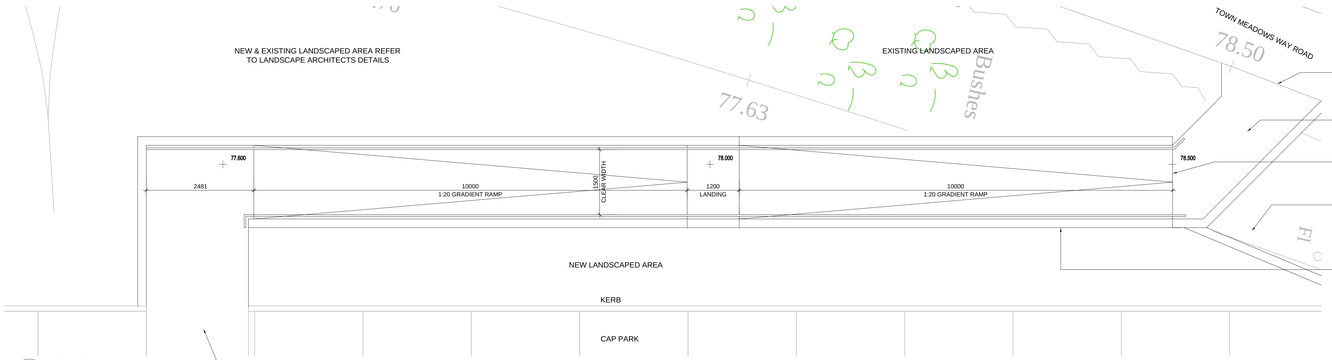


R1 SECTION THROUGH PEDESTRIAN RAMP FROM TOWN MEADOWS WAY

1:50

R2 SECTION THROUGH PEDESTRIAN RAMP

1:50



PLAN

1:50

1:50 — 0 1 2 3 4 5 m

1:125 — 0 5 10 m

1:1000 — 0 20 40 60 80 100 m

THIS DRAWING IS STRICTLY NOT TO BE USED FOR CONSTRUCTION PURPOSES.

PROPOSED LEVELS SUBJECT TO DESIGN DEVELOPMENT.

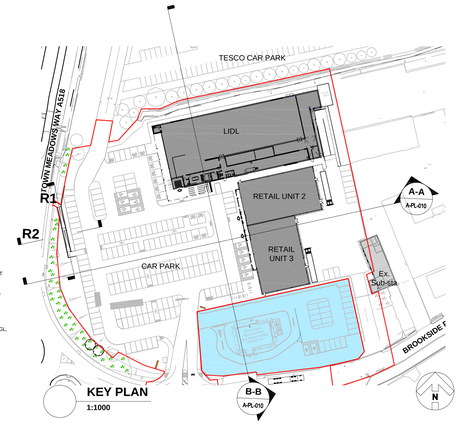
DRAINAGE STRATEGY & RAIN WATER PIPES SUBJECT TO DESIGN DEVELOPMENT.

THIS DRAWING CONSISTS OF THE FOLLOWING THIRD PARTY INFORMATION & DRAWINGS:-

Topographical Survey by Green Hatch, drawing 13541a_OGL, received via email on 27/07/2017.

TO BE READ IN CONJUNCTION WITH HCD DRAWINGS;

A-PL-001 - SITE LOCATION PLAN
A-PL-002 - EXISTING SITE PLAN
A-PL-003 - PROPOSED SITE PLAN
A-PL-004 - PROPOSED STORE PLAN
A-PL-005 - PROPOSED RETAIL UNIT BUILDING PLAN
A-PL-006 - PROPOSED STORE ROOF PLAN
A-PL-007 - PROPOSED RETAIL UNIT ROOF PLAN
A-PL-008 - PROPOSED STORE ELEVATIONS
A-PL-009 - PROPOSED RETAIL UNIT ELEVATIONS



KEY PLAN

1:1000

REVISION: D BY: DJW CHECKED: DATE: 06/08/2018
FFL raised to +77.862 following Local Authority comments on flood levels.

REVISION: C BY: DJW CHECKED: DATE: 09/04/2018
Bottom landing level on pedestrian ramp changed to suit FRA.

REVISION: B BY: DJW CHECKED: DATE: 03/01/2018
Issued for Planning. Red Line Boundaries Updated to include site access junction, service road access/ egress junction, top of pedestrian ramp and Tesco shared site access. Site Boundary area updated.

REVISION: A BY: DJW CHECKED: DATE: 28/11/2017
Issued for Planning. Red Line Boundaries Updated.

REVISION: * BY: DJW CHECKED: DATE: 15/11/2017
Issued for Planning.

PLANNING

PLOT DATE:

CLIENT:

LIDL UK GmbH
BROOKSIDE ROAD
UTTOXETER

PROJECT:

PROPOSED
SITE/ BUILDING SECTIONS

DRAWING		
DRAWN BY:	SCALE:	DATE:
DJW	1:500 @ A1	NOV 2017

Hadfield Cawkwell Davidson
Bircengrove Lodge, 13 Broomgrove Rd, Sheffield S10 2LZ T 0114 266 8181 www.hcd.co.uk
Architecture | Engineering | Interior Design | Masterplanning | Urban Design

JOB NO: 2017-119 | DRAWING NO: A-PL-010 | REV: D

E. Fluvial Modelling Technical Note

E.1 Mott Macdonald Ltd – reference R02_392669

MOTT MACDONALD

Technical Note

Project:	Brookside (Uttoxeter) Modelling Update		
Our reference:	**R02_392669**	**Your reference:**	
Prepared by:	Christopher Rhodes	**Date:**	**29 March 2018**
Approved by:	**David Ocio**	**Checked by:**	**Emily Fowler**
Subject:	Picknall Brook Model Update		

1 Introduction

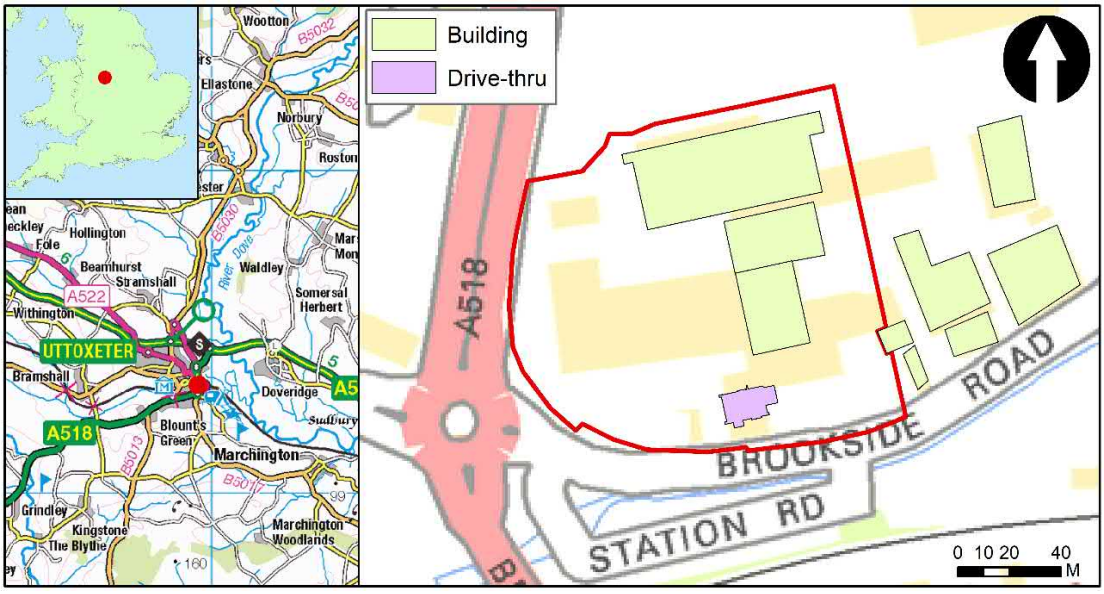
Modelling activities were undertaken in 2014 for the proposed development of land off Brookside Road in Uttoxeter (Figure 1). The Environment Agency 1D-2D ISIS-TUFLOW catchment model for the River Dove, initially developed by Halcrow in 2011, was updated to reflect the proposed development and assess the impact on fluvial flood risk, and develop mitigation measures. There have been changes since then to the proposed development and an update in climate change allowances along with a new topographic survey. These updates need to be incorporated into the modelling.

The objectives of the project are to update the model to reflect the changes to the proposed development, shown in Figure 1, and to review and amend the proposed mitigation options to ensure there is no increase in fluvial flood risk due to the proposed development.

The proposed development is located to the north of Brookside Road, and is located next to Picknall Brook, a tributary of the River Dove. The existing site is at risk of flooding from Picknall Brook and therefore the area of developable land is restricted.

This Technical Note has been prepared for the purposes outlined above. The consultant has followed accepted procedures in providing the services but given the residual risk associated with any prediction and the variability which can be experienced in flood conditions, the consultant takes no liability for and gives no warranty against actual flooding of any property (client's or third party) or the consequences of flooding in relation to the performance of the service.

Figure 1: Site location and proposed development



1.1 Scope

The scope outlines the following key deliverables:

- Develop new 30% climate change scenario
- Review and update model with new topographic survey
- Update the post development model with the new proposed development
- Update the post development with mitigation model with agreed mitigation measures.
- Stabilise and run the following six design events for the baseline, post-development and post-development with mitigation options:
  - 1 in 20-year
  - 1 in 100-year
  - 1 in 100-year+20% climate change
  - 1 in 100-year+30% climate change
  - 1 in 1000-year
  - Blockage scenario (bridge PB_446 blocked by 50%)

2 Methodology

The climate change allowance for the Picknall Brook has increased from 20% to 30%. The new 30% climate change scenario was produced by applying a factor to the 1 in 100-year inflows. There are two inflows to the model (Pick 1 and Pick 2). Table 1 show the peak flows for the 100-year return period scenarios.

Table 1: Peak flow for the 100-year return period scenarios for Pick 1

Return Period	Peak flow (m3/s)	Increase from 100-year (%)
100	19.3	-
100+20% CC	23.2	20
100+30% CC	25.1	30

Table 2: Peak flow for the 100-year return period scenarios for Pick 2

Return Period	Peak Flow	Increase from 100-year
100	2.09	-
100+20%CC	2.51	20
100+30%CC	2.72	30

2.1 LiDAR Update

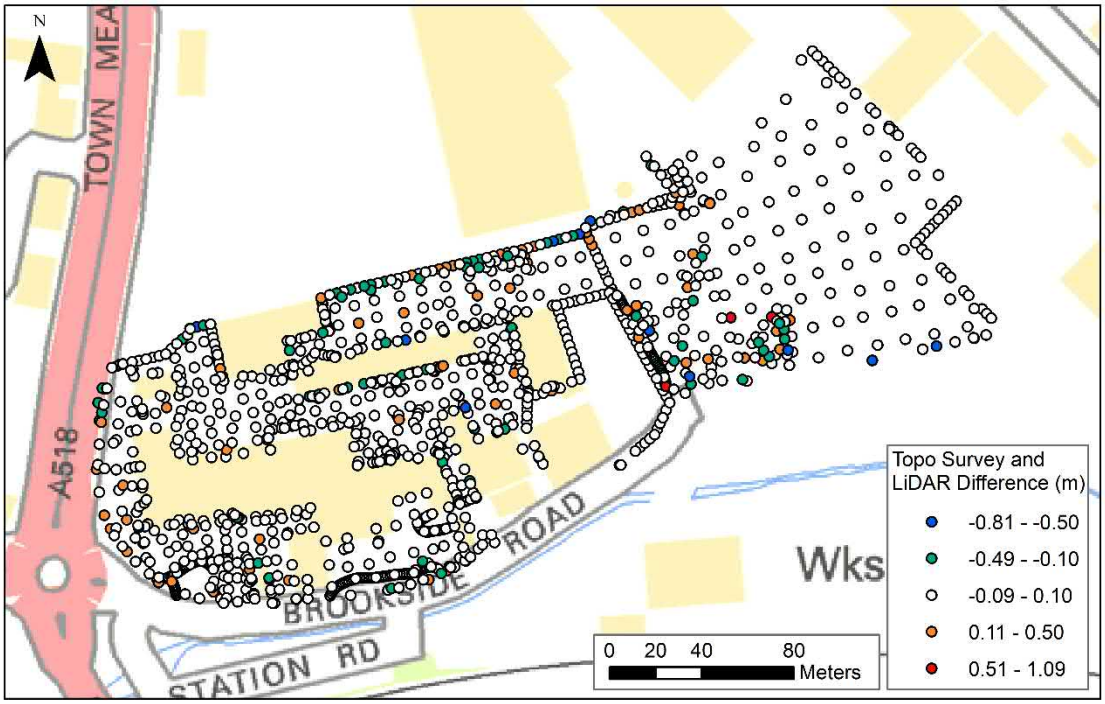
A new topographic survey was provided for this model update. Figure 2 shows a comparison of the new site topographic survey against the zpts (ground levels) in the EA model (derived from LiDAR data, 2008).

The survey comparison focuses on the proposed development area. It should be noted that the boundaries of the new survey are slightly different from the zpts (ground level), therefore only points where both the survey and zpts exist have been compared.

This comparison shows that the difference between the topographic survey and the LiDAR tends to be +/-10cm. There is a greater difference (+/-0.5m) along the north boundary of the site, along the south-west boundary of the site and at the end of Brookside Road. This latter area also exhibits differences of up to +1.09/-0.81m. These differences are likely to be a result of changes in level of the spare land and the building of a boundary wall.

The new survey appears consistent with the existing survey and a comparison between the two has not raised any major concerns. Therefore, the new survey will be used to overwrite the existing zpts (ground levels) in the model, where coverage allows.

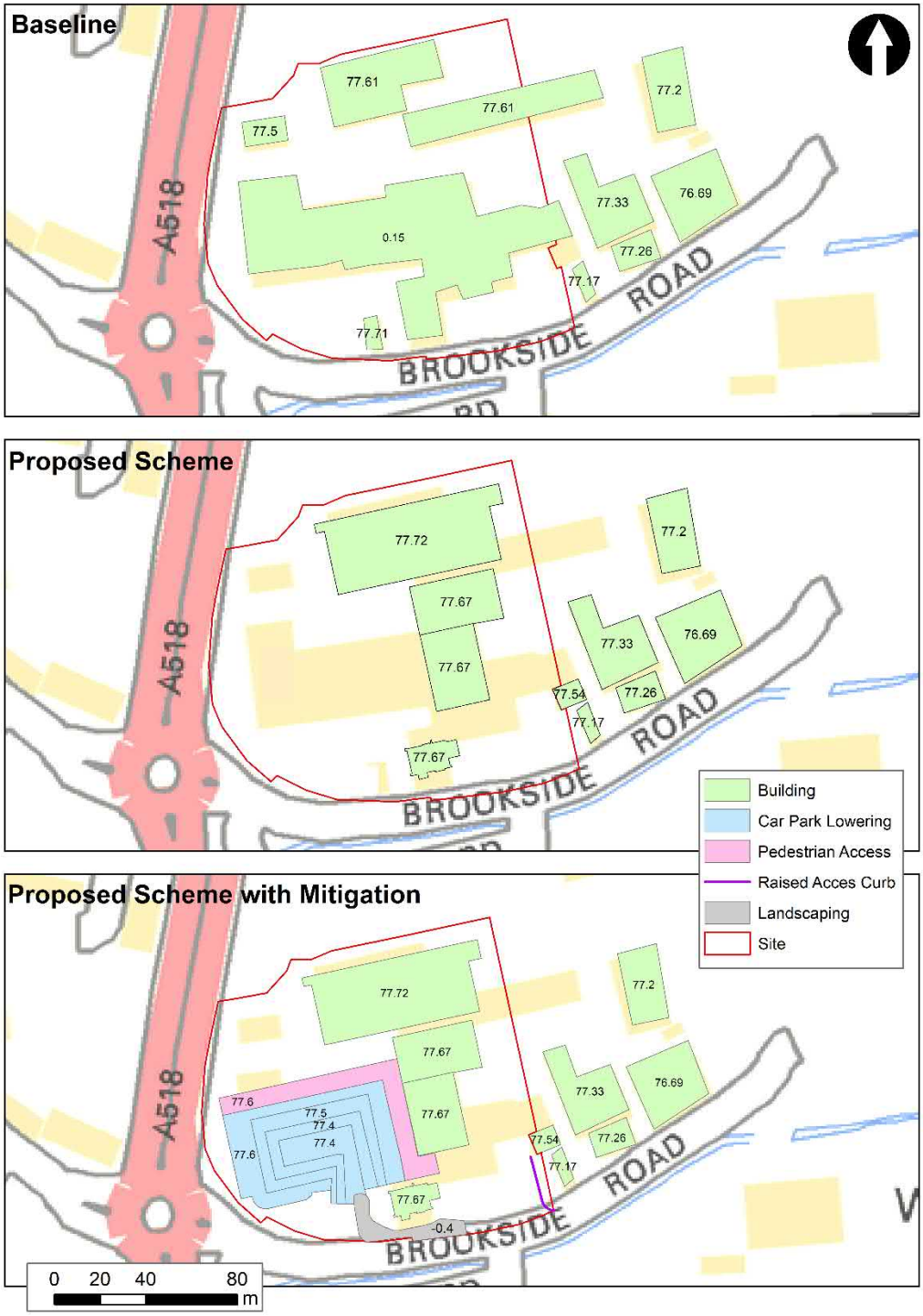
Figure 2: Topographic survey and LiDAR difference



2.2 Finalised models

The updated baseline model, proposed scheme model and proposed scheme with mitigation model are shown in Figure 3. The baseline model includes threshold levels for the existing buildings at the site. The proposed scheme model includes a threshold level for the proposed buildings at the site and the existing buildings to the east of the site. The proposed scheme with mitigation consists of the proposed scheme scenario with a pedestrian access across the car park raised (to 77.6mAOD) and car park levelling to create an area to attenuate floodwaters (with levels stepped from 77.4mAOD). This area is connected to the first spill point of the river by landscaping of -0.4m around the proposed drive-thru (see Figure 1). In addition, the roadside curb on the proposed HGV access road to the south-east of the site is raised to 77.3mAOD.

Figure 3: Finalised models with absolute elevations or adjustments to existing elevation values



Labels provided are absolute levels or relative (+/-) levels to the ground surface, as defined by the most recent survey.

3 Results

The following design events were modelled for each of the baseline, post development and post development with mitigation scenarios: 1 in 20-year, 1 in 100-year, 1 in 100-year with 20% climate change allowance, 1 in 100-year with 30% climate change allowance, 1 in 1000 year and a bridge blockage scenario. This blockage scenario assumed the 50% blockage of bridge PB_446 under the 1 in 100-year with 30% allowance for climate change scenario.

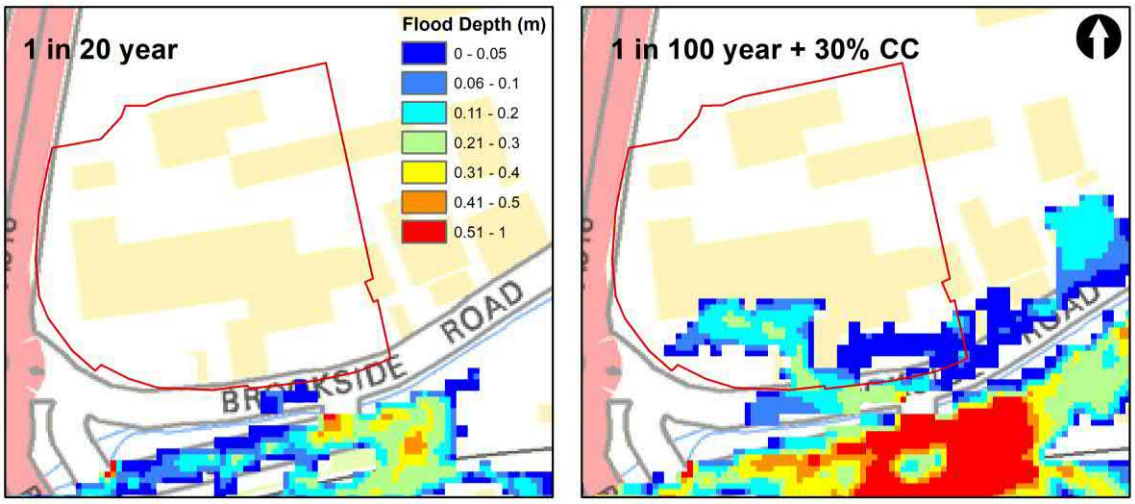
In the main body of this technical note the 20-year and 100-year with 30% climate change results are presented and considered in detail. Results for the other model scenarios are presented in Appendix A.

3.1 Baseline

The modelled flood outlines indicate that the proposed development site is at low risk from flooding during the 1 in 20-year flood event (Figure 4). During the 1 in 100-year and 1 in 100-year with climate change allowances flood events, the area at risk from flooding increases along the southern boundary, with one building particularly at risk.

The blocked scenario and 1000-year event shows a sizable increase in area at risk with the modelled flood extending further northwards from the south west corner so that it connects to flood water coming from the central southern flooded area (Appendix A).

Figure 4: Baseline model flood extents



3.2 Post development

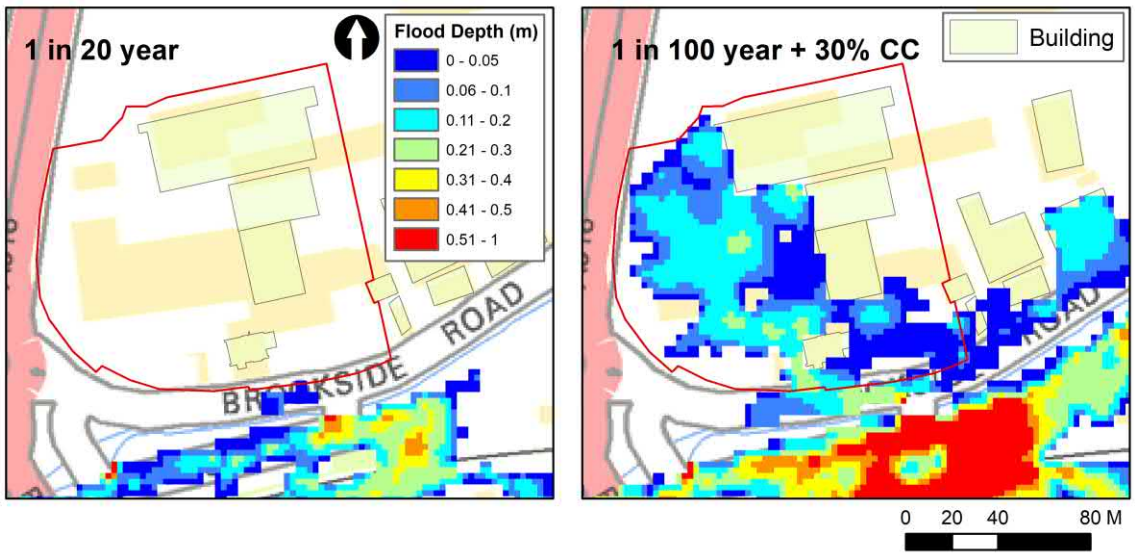
The modelled flood outlines indicate the proposed development site (without mitigation) shows a significant increase in flood extent for the 1 in 100-year + 30% climate change scenario, as discussed below.

In the 1 in 20-year flood event the modelled floodwater does not encroach on the site, therefore the post development scenario modelled flood extent and depth show no change from the baseline.

The risk from flooding during the 1 in 100-year event with 30% climate change allowance for the post development scenario is significantly greater across the west half of the site (see Figure 4). Under the baseline scenario the large building to the south of the site limits the modelled flood extent across the west

half of the site. Its absence in the proposed development scenario allows modelled flood water of up to 0.3m (in places) to extend across the full length of the west of the site and to the east of the proposed drive-thru.

Figure 5: Proposed development model flood extents

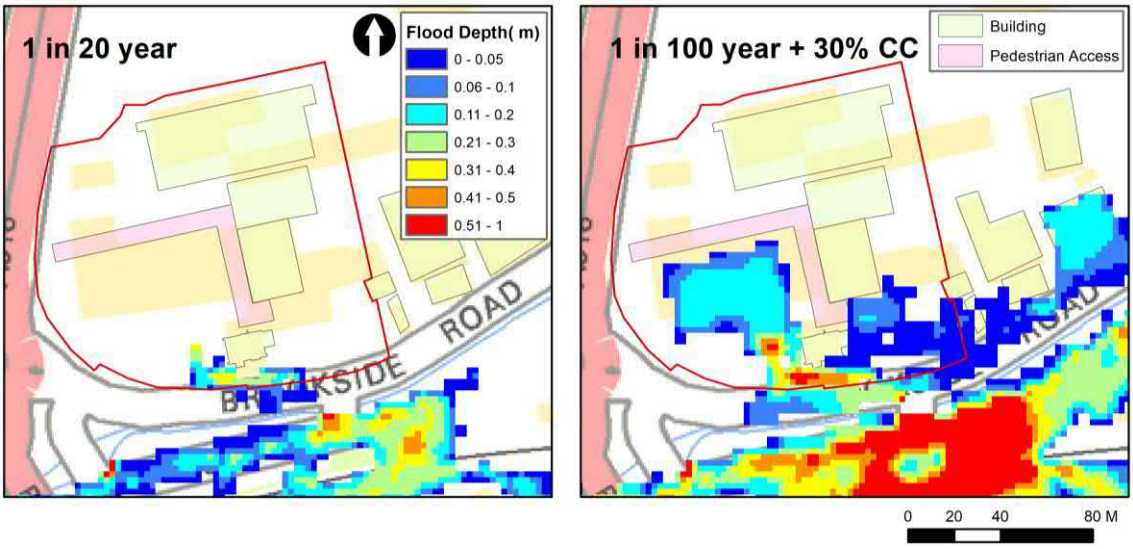


3.3 Post development with mitigation

When including mitigation there is an increase in the risk of flooding across the south of the site during the 1 in 20-year event. This is a result of the landscaping around the proposed drive-thru.

For the 1 in 100-year with a 30% allowance for climate change post development with mitigation scenario, the modelled flood extent is limited to the lowered car park area, with depths of approximately 0.11-0.2m and the pedestrian access walkway is not shown to be at risk from flooding. Additionally, the mitigation has decreased the modelled flood depths (and flood extend to a small degree) in the region to the east of the proposed drive-thru.

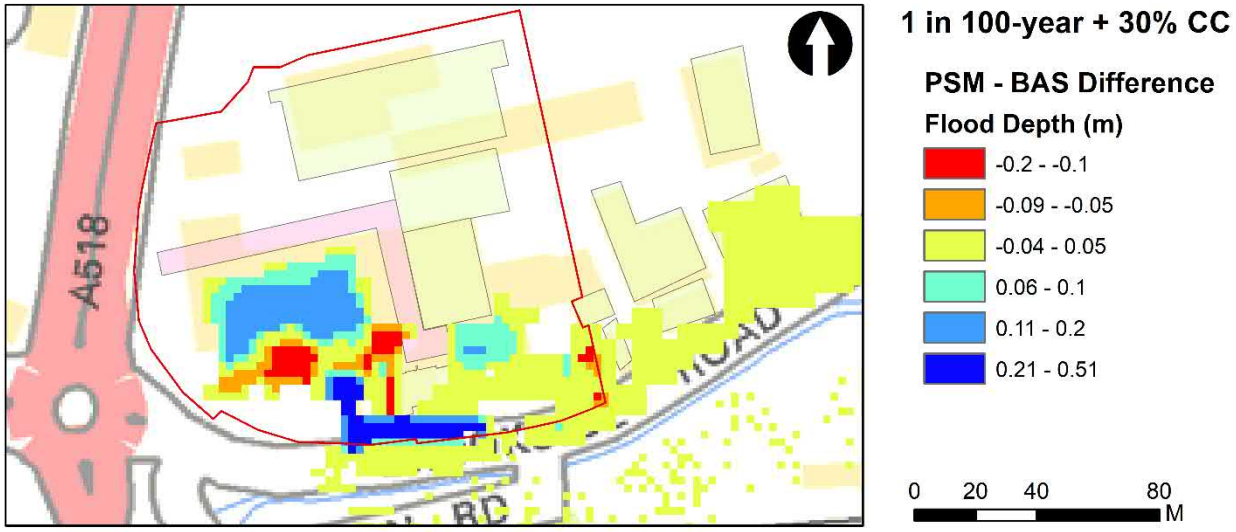
Figure 6: Post development with mitigation model flood extents



3.4 1 in 100-year with 30% climate change allowance comparison

Figure 7 shows the difference in modelled flood depth between the proposed scheme with mitigation and the baseline scenario for the 1 in 100-year with 30% climate change allowance return period. The largest increase in flood depth (up to 0.51m) is located where the landscaping has taken place (around the proposed drive-thru) and the car park levelling (up to 0.2m difference). There are noticeable decreases in water level located to the south of the main car park. These are likely to be a result of the car park levelling resulting in different ground levels and consequently different modelled flood depths.

Figure 7: Difference in flood depth between the Proposed Scheme with Mitigation and the Baseline for the 1 in 100-year with 30% climate change scenario



3.5 Post development model results off site

In line with the National Planning Policy Framework (NPPF), the proposed development should not cause an increase in flood risk off site. Figure 8 shows a comparison of the pre-development flood outlines to with the post-development flood outlines. The proposed development with mitigation alters the extent of flooding on site; however, there is no increase in the risk from flooding off site for the 1 in 100-year with 30% climate change allowance. A comparison of flood depth at seven locations off-site show no increase in flood risk (Table 3). A small decrease (1cm and 5cm) in flood depth was recorded at locations 2 and 3.

Figure 8: 1 in 100-year + 30% climate change flood outline comparison

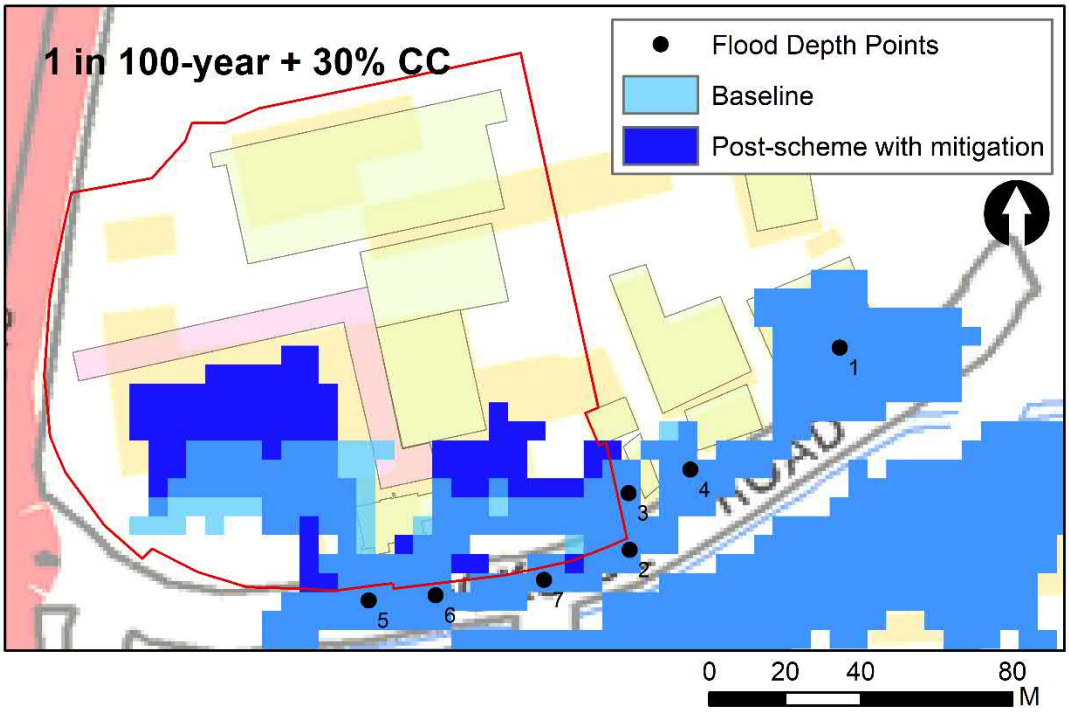


Table 3: Flood depths at locations 1 to 7 for 1 in 100-year + 30% climate change scenario

Location	Baseline (m)	Post-scheme with mitigation (m)	Difference (m)
1	0.12	0.12	0.00
2	0.05	0.03	-0.01
3	0.06	0.01	-0.05
4	0.03	0.03	0.00
5	0.18	0.18	0.00
6	0.25	0.25	0.00
7	0.10	0.10	0.00

4 Conclusions

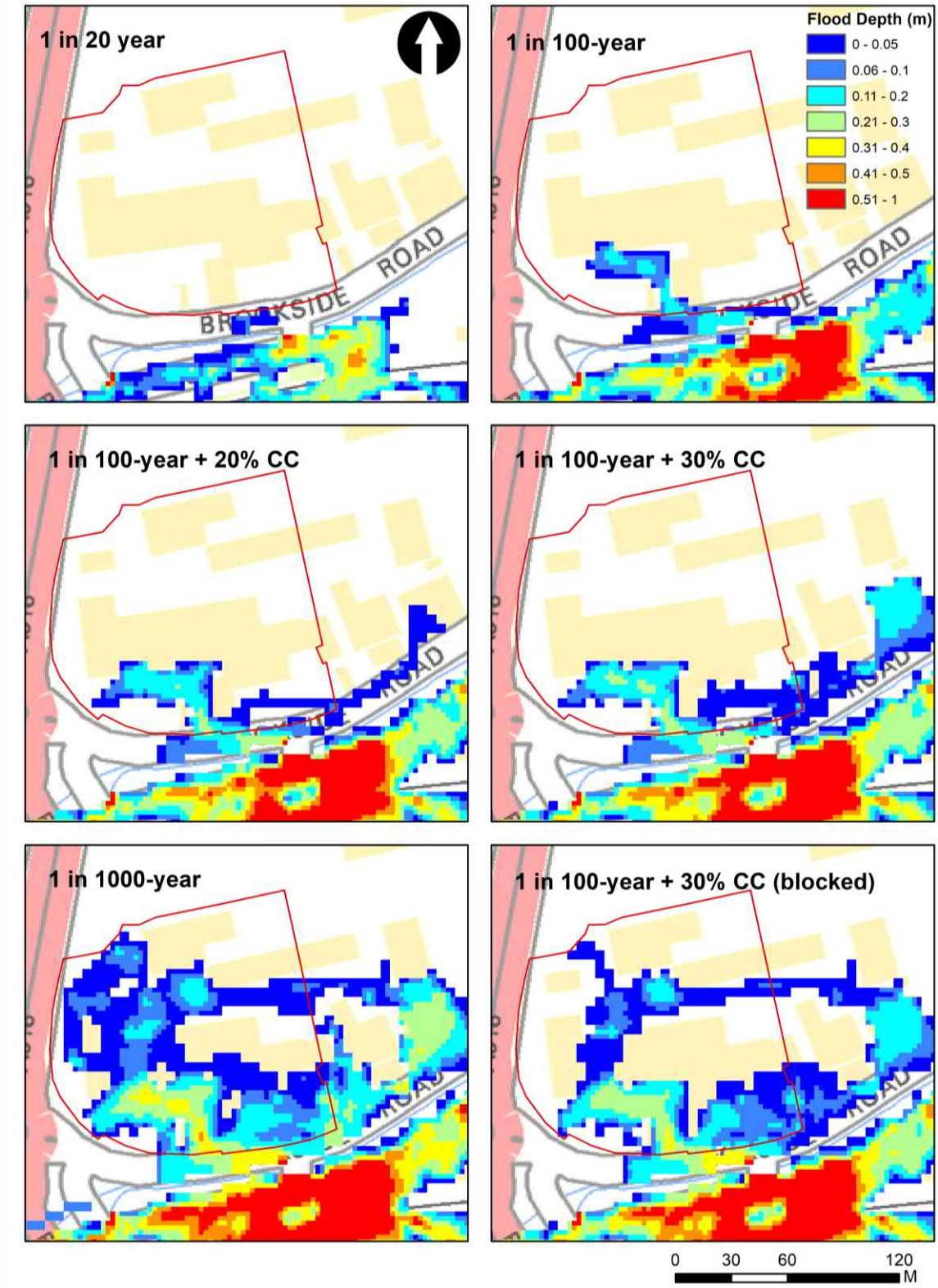
The existing Uttoxeter 1D-2D ISIS-TUFLOW model was updated with a new 30% climate change scenario and updated topographic survey. An updated baseline model was run with a further two model configurations, post development and post development with mitigation, for six scenarios.

For the 100-year with 30% climate change allowance, the baseline model shows a risk of flooding of up to 0.2m to the south of the site with flow being restricted by the presence of a large building. The proposed development updated the existing building location and threshold levels. This configuration shows extensive risk from flooding of up to 0.2m across the western half of the site, primarily due to the absence of buildings blocking the flow paths. A series of landscaping and car park levelling was used to create a post-development with mitigation configuration.

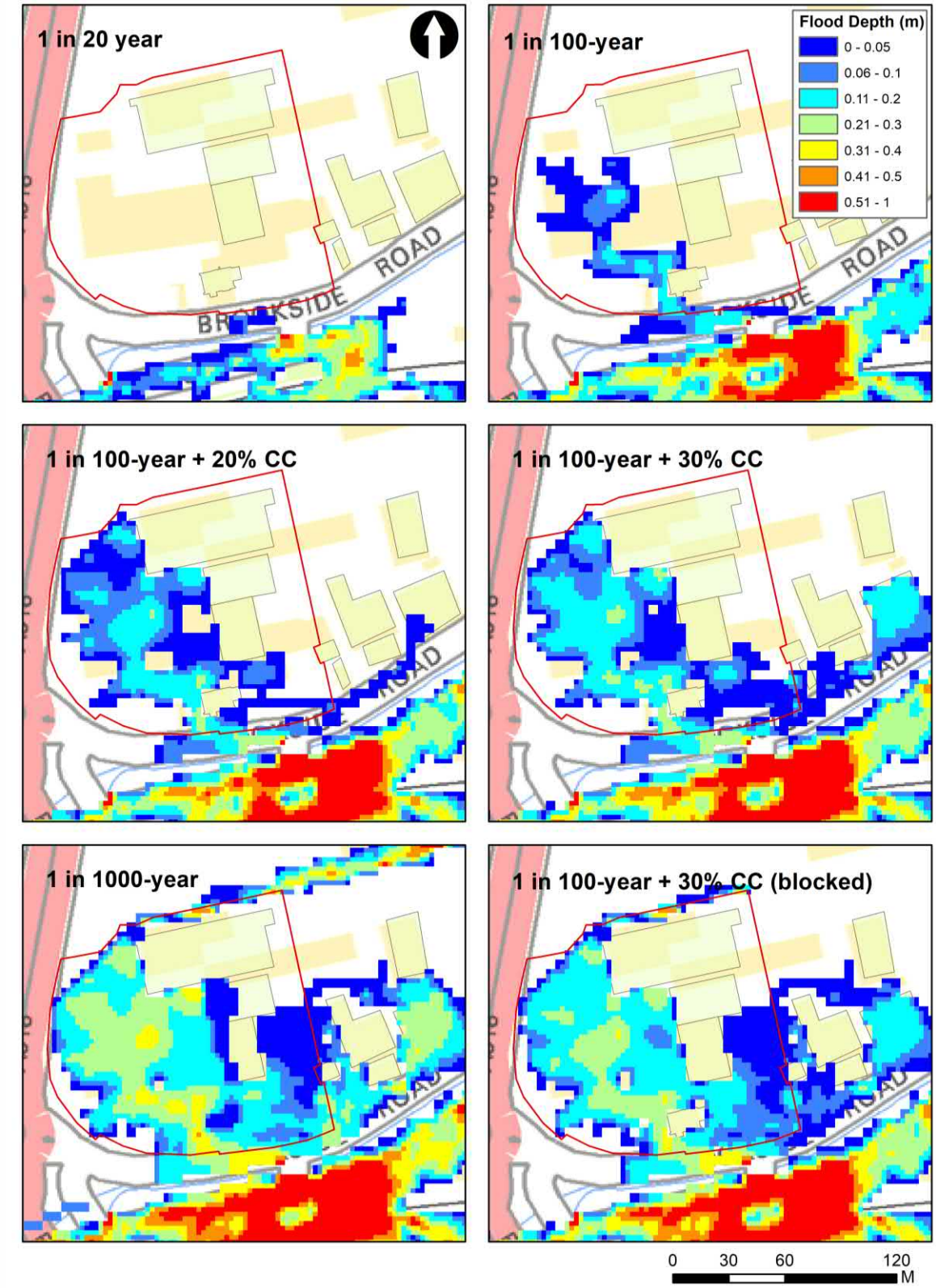
The modelled flood extent for this was restricted to the car park area in the south-west of the site (mostly 0.2m deep) and did not increase flood depths to the north-east of the proposed drive-thru nor flooding offsite.

A. Appendix A: Flood depth figures for all return periods

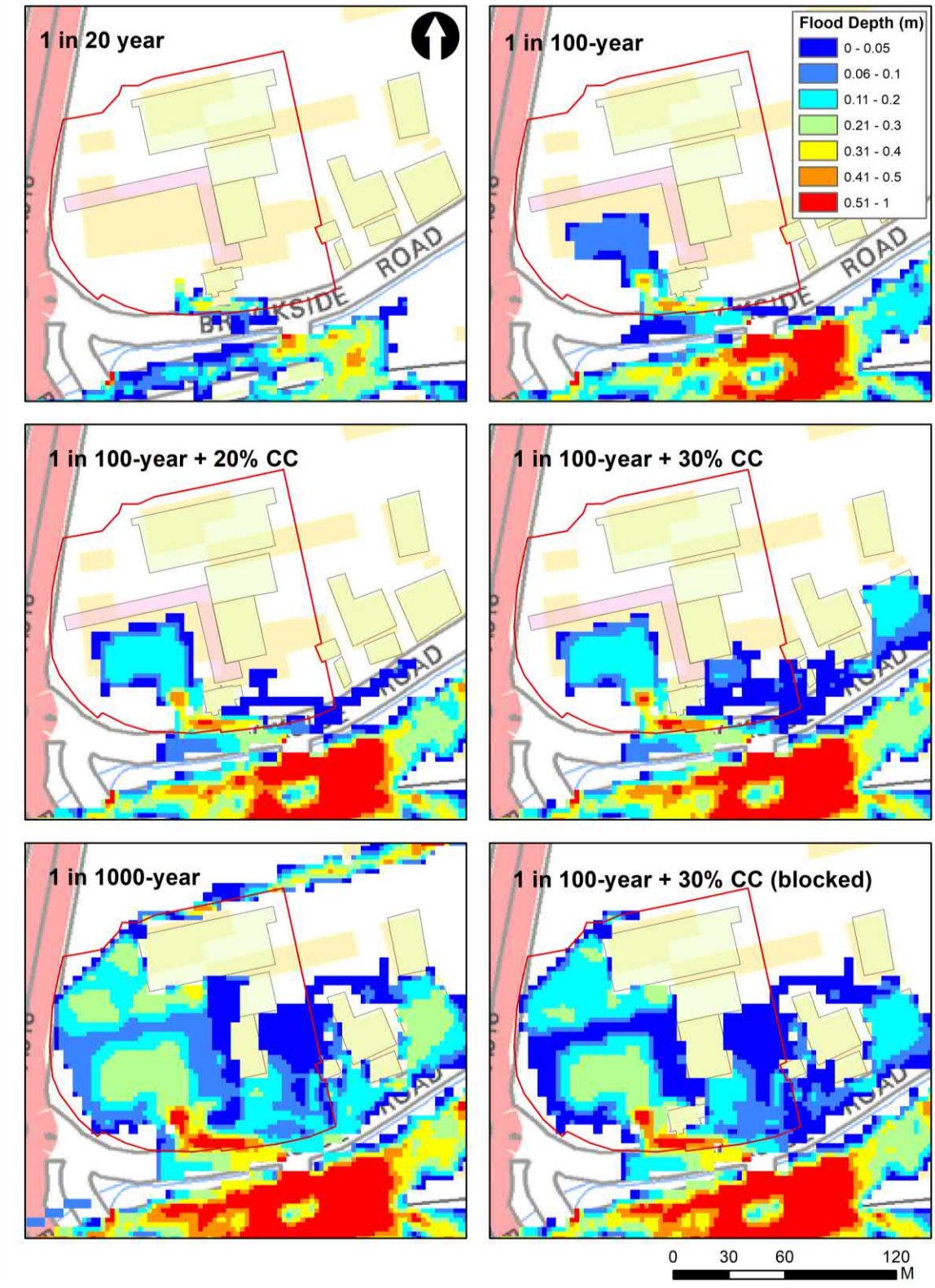
A.1 Baseline



A.2 Proposed scheme



A.3 Proposed scheme with mitigation



Note: The detailed car park levelling has not been included in these figures but is shown in Figure 3.

F. Preliminary Design Calculations

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SA	77.650	0.950	Open Manhole	600	S1.000	76.700	350				
S1	77.720	0.525	Open Manhole	600	S2.000	77.195	225				
S2	77.720	0.704	Open Manhole	600	S2.001	77.016	225	S2.000	77.016	225	
S3	77.720	0.926	Open Manhole	600	S2.002	76.794	225	S2.001	76.794	225	
S4	77.400	0.800	Open Manhole	600	S1.001	76.600	350	S1.000	76.600	350	
								S2.002	76.732	225	7
S5	77.400	1.147	Open Manhole	600	S1.002	76.253	350	S1.001	76.253	350	
S6	77.650	0.825	Open Manhole	600	S3.000	76.825	225				
S7	77.525	0.994	Open Manhole	600	S3.001	76.531	225	S3.000	76.531	225	
S8	77.070	1.070	Open Manhole	600	S1.003	76.000	350	S1.002	76.008	350	8
								S3.001	76.125	225	
S	77.470	1.561	Open Manhole	0		OUTFALL		S1.003	75.909	350	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
S1.000	o	350	SA	77.650	76.700	0.600	Open Manhole		600
S2.000	o	225	S1	77.720	77.195	0.300	Open Manhole		600
S2.001	o	225	S2	77.720	77.016	0.479	Open Manhole		600
S2.002	o	225	S3	77.720	76.794	0.701	Open Manhole		600
S1.001	o	350	S4	77.400	76.600	0.450	Open Manhole		600
S1.002	o	350	S5	77.400	76.253	0.797	Open Manhole		600
S3.000	o	225	S6	77.650	76.825	0.600	Open Manhole		600
S3.001	o	225	S7	77.525	76.531	0.769	Open Manhole		600
S1.003	o	350	S8	77.070	76.000	0.720	Open Manhole		600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
S1.000	3.002	30.0	S4	77.400	76.600	0.450	Open Manhole		600
S2.000	26.837	149.9	S2	77.720	77.016	0.479	Open Manhole		600
S2.001	33.360	150.0	S3	77.720	76.794	0.701	Open Manhole		600
S2.002	9.263	150.0	S4	77.400	76.732	0.443	Open Manhole		600
S1.001	52.082	150.1	S5	77.400	76.253	0.797	Open Manhole		600
S1.002	37.909	154.7	S8	77.070	76.008	0.712	Open Manhole		600
S3.000	6.676	22.7	S7	77.525	76.531	0.769	Open Manhole		600
S3.001	6.676	16.4	S8	77.070	76.125	0.720	Open Manhole		600
S1.003	13.680	150.3	S	77.470	75.909	1.211	Open Manhole		0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.786	0.786	0.786
2.000	User	-	100	0.095	0.095	0.095
2.001	-	-	100	0.000	0.000	0.000
2.002	User	-	100	0.033	0.033	0.033
1.001	User	-	100	0.312	0.312	0.312
1.002	User	-	100	0.042	0.042	0.042
3.000	User	-	100	0.175	0.175	0.175
3.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.443	1.443	1.443

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	77.470	75.909	75.750	0	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	1.561	24	1.561	47	1.561	70	1.561	93	1.561	116	1.561	139	1.561
2	1.561	25	1.561	48	1.561	71	1.561	94	1.561	117	1.561	140	1.561
3	1.561	26	1.561	49	1.561	72	1.561	95	1.561	118	1.561	141	1.561
4	1.561	27	1.561	50	1.561	73	1.561	96	1.561	119	1.561	142	1.561
5	1.561	28	1.561	51	1.561	74	1.561	97	1.561	120	1.561	143	1.561
6	1.561	29	1.561	52	1.561	75	1.561	98	1.561	121	1.561	144	1.561
7	1.561	30	1.561	53	1.561	76	1.561	99	1.561	122	1.561	145	1.561
8	1.561	31	1.561	54	1.561	77	1.561	100	1.561	123	1.561	146	1.561
9	1.561	32	1.561	55	1.561	78	1.561	101	1.561	124	1.561	147	1.561
10	1.561	33	1.561	56	1.561	79	1.561	102	1.561	125	1.561	148	1.561
11	1.561	34	1.561	57	1.561	80	1.561	103	1.561	126	1.561	149	1.561
12	1.561	35	1.561	58	1.561	81	1.561	104	1.561	127	1.561	150	1.561
13	1.561	36	1.561	59	1.561	82	1.561	105	1.561	128	1.561	151	1.561
14	1.561	37	1.561	60	1.561	83	1.561	106	1.561	129	1.561	152	1.561
15	1.561	38	1.561	61	1.561	84	1.561	107	1.561	130	1.561	153	1.561
16	1.561	39	1.561	62	1.561	85	1.561	108	1.561	131	1.561	154	1.561
17	1.561	40	1.561	63	1.561	86	1.561	109	1.561	132	1.561	155	1.561
18	1.561	41	1.561	64	1.561	87	1.561	110	1.561	133	1.561	156	1.561
19	1.561	42	1.561	65	1.561	88	1.561	111	1.561	134	1.561	157	1.561
20	1.561	43	1.561	66	1.561	89	1.561	112	1.561	135	1.561	158	1.561
21	1.561	44	1.561	67	1.561	90	1.561	113	1.561	136	1.561	159	1.561
22	1.561	45	1.561	68	1.561	91	1.561	114	1.561	137	1.561	160	1.561
23	1.561	46	1.561	69	1.561	92	1.561	115	1.561	138	1.561	161	1.561

Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
162	1.561	211	1.561	260	1.561	309	1.561	358	1.561	407	1.561	456	1.561
163	1.561	212	1.561	261	1.561	310	1.561	359	1.561	408	1.561	457	1.561
164	1.561	213	1.561	262	1.561	311	1.561	360	1.561	409	1.561	458	1.561
165	1.561	214	1.561	263	1.561	312	1.561	361	1.561	410	1.561	459	1.561
166	1.561	215	1.561	264	1.561	313	1.561	362	1.561	411	1.561	460	1.561
167	1.561	216	1.561	265	1.561	314	1.561	363	1.561	412	1.561	461	1.561
168	1.561	217	1.561	266	1.561	315	1.561	364	1.561	413	1.561	462	1.561
169	1.561	218	1.561	267	1.561	316	1.561	365	1.561	414	1.561	463	1.561
170	1.561	219	1.561	268	1.561	317	1.561	366	1.561	415	1.561	464	1.561
171	1.561	220	1.561	269	1.561	318	1.561	367	1.561	416	1.561	465	1.561
172	1.561	221	1.561	270	1.561	319	1.561	368	1.561	417	1.561	466	1.561
173	1.561	222	1.561	271	1.561	320	1.561	369	1.561	418	1.561	467	1.561
174	1.561	223	1.561	272	1.561	321	1.561	370	1.561	419	1.561	468	1.561
175	1.561	224	1.561	273	1.561	322	1.561	371	1.561	420	1.561	469	1.561
176	1.561	225	1.561	274	1.561	323	1.561	372	1.561	421	1.561	470	1.561
177	1.561	226	1.561	275	1.561	324	1.561	373	1.561	422	1.561	471	1.561
178	1.561	227	1.561	276	1.561	325	1.561	374	1.561	423	1.561	472	1.561
179	1.561	228	1.561	277	1.561	326	1.561	375	1.561	424	1.561	473	1.561
180	1.561	229	1.561	278	1.561	327	1.561	376	1.561	425	1.561	474	1.561
181	1.561	230	1.561	279	1.561	328	1.561	377	1.561	426	1.561	475	1.561
182	1.561	231	1.561	280	1.561	329	1.561	378	1.561	427	1.561	476	1.561
183	1.561	232	1.561	281	1.561	330	1.561	379	1.561	428	1.561	477	1.561
184	1.561	233	1.561	282	1.561	331	1.561	380	1.561	429	1.561	478	1.561
185	1.561	234	1.561	283	1.561	332	1.561	381	1.561	430	1.561	479	1.561
186	1.561	235	1.561	284	1.561	333	1.561	382	1.561	431	1.561	480	1.561
187	1.561	236	1.561	285	1.561	334	1.561	383	1.561	432	1.561	481	1.561
188	1.561	237	1.561	286	1.561	335	1.561	384	1.561	433	1.561	482	1.561
189	1.561	238	1.561	287	1.561	336	1.561	385	1.561	434	1.561	483	1.561
190	1.561	239	1.561	288	1.561	337	1.561	386	1.561	435	1.561	484	1.561
191	1.561	240	1.561	289	1.561	338	1.561	387	1.561	436	1.561	485	1.561
192	1.561	241	1.561	290	1.561	339	1.561	388	1.561	437	1.561	486	1.561
193	1.561	242	1.561	291	1.561	340	1.561	389	1.561	438	1.561	487	1.561
194	1.561	243	1.561	292	1.561	341	1.561	390	1.561	439	1.561	488	1.561
195	1.561	244	1.561	293	1.561	342	1.561	391	1.561	440	1.561	489	1.561
196	1.561	245	1.561	294	1.561	343	1.561	392	1.561	441	1.561	490	1.561
197	1.561	246	1.561	295	1.561	344	1.561	393	1.561	442	1.561	491	1.561
198	1.561	247	1.561	296	1.561	345	1.561	394	1.561	443	1.561	492	1.561
199	1.561	248	1.561	297	1.561	346	1.561	395	1.561	444	1.561	493	1.561
200	1.561	249	1.561	298	1.561	347	1.561	396	1.561	445	1.561	494	1.561
201	1.561	250	1.561	299	1.561	348	1.561	397	1.561	446	1.561	495	1.561
202	1.561	251	1.561	300	1.561	349	1.561	398	1.561	447	1.561	496	1.561
203	1.561	252	1.561	301	1.561	350	1.561	399	1.561	448	1.561	497	1.561
204	1.561	253	1.561	302	1.561	351	1.561	400	1.561	449	1.561	498	1.561
205	1.561	254	1.561	303	1.561	352	1.561	401	1.561	450	1.561	499	1.561
206	1.561	255	1.561	304	1.561	353	1.561	402	1.561	451	1.561	500	1.561
207	1.561	256	1.561	305	1.561	354	1.561	403	1.561	452	1.561	501	1.561
208	1.561	257	1.561	306	1.561	355	1.561	404	1.561	453	1.561	502	1.561
209	1.561	258	1.561	307	1.561	356	1.561	405	1.561	454	1.561	503	1.561
210	1.561	259	1.561	308	1.561	357	1.561	406	1.561	455	1.561	504	1.561

Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
505	1.561	554	1.561	603	1.561	652	1.561	701	1.561	750	1.561	799	1.561
506	1.561	555	1.561	604	1.561	653	1.561	702	1.561	751	1.561	800	1.561
507	1.561	556	1.561	605	1.561	654	1.561	703	1.561	752	1.561	801	1.561
508	1.561	557	1.561	606	1.561	655	1.561	704	1.561	753	1.561	802	1.561
509	1.561	558	1.561	607	1.561	656	1.561	705	1.561	754	1.561	803	1.561
510	1.561	559	1.561	608	1.561	657	1.561	706	1.561	755	1.561	804	1.561
511	1.561	560	1.561	609	1.561	658	1.561	707	1.561	756	1.561	805	1.561
512	1.561	561	1.561	610	1.561	659	1.561	708	1.561	757	1.561	806	1.561
513	1.561	562	1.561	611	1.561	660	1.561	709	1.561	758	1.561	807	1.561
514	1.561	563	1.561	612	1.561	661	1.561	710	1.561	759	1.561	808	1.561
515	1.561	564	1.561	613	1.561	662	1.561	711	1.561	760	1.561	809	1.561
516	1.561	565	1.561	614	1.561	663	1.561	712	1.561	761	1.561	810	1.561
517	1.561	566	1.561	615	1.561	664	1.561	713	1.561	762	1.561	811	1.561
518	1.561	567	1.561	616	1.561	665	1.561	714	1.561	763	1.561	812	1.561
519	1.561	568	1.561	617	1.561	666	1.561	715	1.561	764	1.561	813	1.561
520	1.561	569	1.561	618	1.561	667	1.561	716	1.561	765	1.561	814	1.561
521	1.561	570	1.561	619	1.561	668	1.561	717	1.561	766	1.561	815	1.561
522	1.561	571	1.561	620	1.561	669	1.561	718	1.561	767	1.561	816	1.561
523	1.561	572	1.561	621	1.561	670	1.561	719	1.561	768	1.561	817	1.561
524	1.561	573	1.561	622	1.561	671	1.561	720	1.561	769	1.561	818	1.561
525	1.561	574	1.561	623	1.561	672	1.561	721	1.561	770	1.561	819	1.561
526	1.561	575	1.561	624	1.561	673	1.561	722	1.561	771	1.561	820	1.561
527	1.561	576	1.561	625	1.561	674	1.561	723	1.561	772	1.561	821	1.561
528	1.561	577	1.561	626	1.561	675	1.561	724	1.561	773	1.561	822	1.561
529	1.561	578	1.561	627	1.561	676	1.561	725	1.561	774	1.561	823	1.561
530	1.561	579	1.561	628	1.561	677	1.561	726	1.561	775	1.561	824	1.561
531	1.561	580	1.561	629	1.561	678	1.561	727	1.561	776	1.561	825	1.561
532	1.561	581	1.561	630	1.561	679	1.561	728	1.561	777	1.561	826	1.561
533	1.561	582	1.561	631	1.561	680	1.561	729	1.561	778	1.561	827	1.561
534	1.561	583	1.561	632	1.561	681	1.561	730	1.561	779	1.561	828	1.561
535	1.561	584	1.561	633	1.561	682	1.561	731	1.561	780	1.561	829	1.561
536	1.561	585	1.561	634	1.561	683	1.561	732	1.561	781	1.561	830	1.561
537	1.561	586	1.561	635	1.561	684	1.561	733	1.561	782	1.561	831	1.561
538	1.561	587	1.561	636	1.561	685	1.561	734	1.561	783	1.561	832	1.561
539	1.561	588	1.561	637	1.561	686	1.561	735	1.561	784	1.561	833	1.561
540	1.561	589	1.561	638	1.561	687	1.561	736	1.561	785	1.561	834	1.561
541	1.561	590	1.561	639	1.561	688	1.561	737	1.561	786	1.561	835	1.561
542	1.561	591	1.561	640	1.561	689	1.561	738	1.561	787	1.561	836	1.561
543	1.561	592	1.561	641	1.561	690	1.561	739	1.561	788	1.561	837	1.561
544	1.561	593	1.561	642	1.561	691	1.561	740	1.561	789	1.561	838	1.561
545	1.561	594	1.561	643	1.561	692	1.561	741	1.561	790	1.561	839	1.561
546	1.561	595	1.561	644	1.561	693	1.561	742	1.561	791	1.561	840	1.561
547	1.561	596	1.561	645	1.561	694	1.561	743	1.561	792	1.561	841	1.561
548	1.561	597	1.561	646	1.561	695	1.561	744	1.561	793	1.561	842	1.561
549	1.561	598	1.561	647	1.561	696	1.561	745	1.561	794	1.561	843	1.561
550	1.561	599	1.561	648	1.561	697	1.561	746	1.561	795	1.561	844	1.561
551	1.561	600	1.561	649	1.561	698	1.561	747	1.561	796	1.561	845	1.561
552	1.561	601	1.561	650	1.561	699	1.561	748	1.561	797	1.561	846	1.561
553	1.561	602	1.561	651	1.561	700	1.561	749	1.561	798	1.561	847	1.561

Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
848	1.561	897	1.561	946	1.561	995	1.561	1044	1.561	1093	1.561	1142	1.561
849	1.561	898	1.561	947	1.561	996	1.561	1045	1.561	1094	1.561	1143	1.561
850	1.561	899	1.561	948	1.561	997	1.561	1046	1.561	1095	1.561	1144	1.561
851	1.561	900	1.561	949	1.561	998	1.561	1047	1.561	1096	1.561	1145	1.561
852	1.561	901	1.561	950	1.561	999	1.561	1048	1.561	1097	1.561	1146	1.561
853	1.561	902	1.561	951	1.561	1000	1.561	1049	1.561	1098	1.561	1147	1.561
854	1.561	903	1.561	952	1.561	1001	1.561	1050	1.561	1099	1.561	1148	1.561
855	1.561	904	1.561	953	1.561	1002	1.561	1051	1.561	1100	1.561	1149	1.561
856	1.561	905	1.561	954	1.561	1003	1.561	1052	1.561	1101	1.561	1150	1.561
857	1.561	906	1.561	955	1.561	1004	1.561	1053	1.561	1102	1.561	1151	1.561
858	1.561	907	1.561	956	1.561	1005	1.561	1054	1.561	1103	1.561	1152	1.561
859	1.561	908	1.561	957	1.561	1006	1.561	1055	1.561	1104	1.561	1153	1.561
860	1.561	909	1.561	958	1.561	1007	1.561	1056	1.561	1105	1.561	1154	1.561
861	1.561	910	1.561	959	1.561	1008	1.561	1057	1.561	1106	1.561	1155	1.561
862	1.561	911	1.561	960	1.561	1009	1.561	1058	1.561	1107	1.561	1156	1.561
863	1.561	912	1.561	961	1.561	1010	1.561	1059	1.561	1108	1.561	1157	1.561
864	1.561	913	1.561	962	1.561	1011	1.561	1060	1.561	1109	1.561	1158	1.561
865	1.561	914	1.561	963	1.561	1012	1.561	1061	1.561	1110	1.561	1159	1.561
866	1.561	915	1.561	964	1.561	1013	1.561	1062	1.561	1111	1.561	1160	1.561
867	1.561	916	1.561	965	1.561	1014	1.561	1063	1.561	1112	1.561	1161	1.561
868	1.561	917	1.561	966	1.561	1015	1.561	1064	1.561	1113	1.561	1162	1.561
869	1.561	918	1.561	967	1.561	1016	1.561	1065	1.561	1114	1.561	1163	1.561
870	1.561	919	1.561	968	1.561	1017	1.561	1066	1.561	1115	1.561	1164	1.561
871	1.561	920	1.561	969	1.561	1018	1.561	1067	1.561	1116	1.561	1165	1.561
872	1.561	921	1.561	970	1.561	1019	1.561	1068	1.561	1117	1.561	1166	1.561
873	1.561	922	1.561	971	1.561	1020	1.561	1069	1.561	1118	1.561	1167	1.561
874	1.561	923	1.561	972	1.561	1021	1.561	1070	1.561	1119	1.561	1168	1.561
875	1.561	924	1.561	973	1.561	1022	1.561	1071	1.561	1120	1.561	1169	1.561
876	1.561	925	1.561	974	1.561	1023	1.561	1072	1.561	1121	1.561	1170	1.561
877	1.561	926	1.561	975	1.561	1024	1.561	1073	1.561	1122	1.561	1171	1.561
878	1.561	927	1.561	976	1.561	1025	1.561	1074	1.561	1123	1.561	1172	1.561
879	1.561	928	1.561	977	1.561	1026	1.561	1075	1.561	1124	1.561	1173	1.561
880	1.561	929	1.561	978	1.561	1027	1.561	1076	1.561	1125	1.561	1174	1.561
881	1.561	930	1.561	979	1.561	1028	1.561	1077	1.561	1126	1.561	1175	1.561
882	1.561	931	1.561	980	1.561	1029	1.561	1078	1.561	1127	1.561	1176	1.561
883	1.561	932	1.561	981	1.561	1030	1.561	1079	1.561	1128	1.561	1177	1.561
884	1.561	933	1.561	982	1.561	1031	1.561	1080	1.561	1129	1.561	1178	1.561
885	1.561	934	1.561	983	1.561	1032	1.561	1081	1.561	1130	1.561	1179	1.561
886	1.561	935	1.561	984	1.561	1033	1.561	1082	1.561	1131	1.561	1180	1.561
887	1.561	936	1.561	985	1.561	1034	1.561	1083	1.561	1132	1.561	1181	1.561
888	1.561	937	1.561	986	1.561	1035	1.561	1084	1.561	1133	1.561	1182	1.561
889	1.561	938	1.561	987	1.561	1036	1.561	1085	1.561	1134	1.561	1183	1.561
890	1.561	939	1.561	988	1.561	1037	1.561	1086	1.561	1135	1.561	1184	1.561
891	1.561	940	1.561	989	1.561	1038	1.561	1087	1.561	1136	1.561	1185	1.561
892	1.561	941	1.561	990	1.561	1039	1.561	1088	1.561	1137	1.561	1186	1.561
893	1.561	942	1.561	991	1.561	1040	1.561	1089	1.561	1138	1.561	1187	1.561
894	1.561	943	1.561	992	1.561	1041	1.561	1090	1.561	1139	1.561	1188	1.561
895	1.561	944	1.561	993	1.561	1042	1.561	1091	1.561	1140	1.561	1189	1.561
896	1.561	945	1.561	994	1.561	1043	1.561	1092	1.561	1141	1.561	1190	1.561

Surcharged Outfall Details for Storm

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1191	1.561	1227	1.561	1263	1.561	1299	1.561	1335	1.561	1371	1.561	1407	1.561
1192	1.561	1228	1.561	1264	1.561	1300	1.561	1336	1.561	1372	1.561	1408	1.561
1193	1.561	1229	1.561	1265	1.561	1301	1.561	1337	1.561	1373	1.561	1409	1.561
1194	1.561	1230	1.561	1266	1.561	1302	1.561	1338	1.561	1374	1.561	1410	1.561
1195	1.561	1231	1.561	1267	1.561	1303	1.561	1339	1.561	1375	1.561	1411	1.561
1196	1.561	1232	1.561	1268	1.561	1304	1.561	1340	1.561	1376	1.561	1412	1.561
1197	1.561	1233	1.561	1269	1.561	1305	1.561	1341	1.561	1377	1.561	1413	1.561
1198	1.561	1234	1.561	1270	1.561	1306	1.561	1342	1.561	1378	1.561	1414	1.561
1199	1.561	1235	1.561	1271	1.561	1307	1.561	1343	1.561	1379	1.561	1415	1.561
1200	1.561	1236	1.561	1272	1.561	1308	1.561	1344	1.561	1380	1.561	1416	1.561
1201	1.561	1237	1.561	1273	1.561	1309	1.561	1345	1.561	1381	1.561	1417	1.561
1202	1.561	1238	1.561	1274	1.561	1310	1.561	1346	1.561	1382	1.561	1418	1.561
1203	1.561	1239	1.561	1275	1.561	1311	1.561	1347	1.561	1383	1.561	1419	1.561
1204	1.561	1240	1.561	1276	1.561	1312	1.561	1348	1.561	1384	1.561	1420	1.561
1205	1.561	1241	1.561	1277	1.561	1313	1.561	1349	1.561	1385	1.561	1421	1.561
1206	1.561	1242	1.561	1278	1.561	1314	1.561	1350	1.561	1386	1.561	1422	1.561
1207	1.561	1243	1.561	1279	1.561	1315	1.561	1351	1.561	1387	1.561	1423	1.561
1208	1.561	1244	1.561	1280	1.561	1316	1.561	1352	1.561	1388	1.561	1424	1.561
1209	1.561	1245	1.561	1281	1.561	1317	1.561	1353	1.561	1389	1.561	1425	1.561
1210	1.561	1246	1.561	1282	1.561	1318	1.561	1354	1.561	1390	1.561	1426	1.561
1211	1.561	1247	1.561	1283	1.561	1319	1.561	1355	1.561	1391	1.561	1427	1.561
1212	1.561	1248	1.561	1284	1.561	1320	1.561	1356	1.561	1392	1.561	1428	1.561
1213	1.561	1249	1.561	1285	1.561	1321	1.561	1357	1.561	1393	1.561	1429	1.561
1214	1.561	1250	1.561	1286	1.561	1322	1.561	1358	1.561	1394	1.561	1430	1.561
1215	1.561	1251	1.561	1287	1.561	1323	1.561	1359	1.561	1395	1.561	1431	1.561
1216	1.561	1252	1.561	1288	1.561	1324	1.561	1360	1.561	1396	1.561	1432	1.561
1217	1.561	1253	1.561	1289	1.561	1325	1.561	1361	1.561	1397	1.561	1433	1.561
1218	1.561	1254	1.561	1290	1.561	1326	1.561	1362	1.561	1398	1.561	1434	1.561
1219	1.561	1255	1.561	1291	1.561	1327	1.561	1363	1.561	1399	1.561	1435	1.561
1220	1.561	1256	1.561	1292	1.561	1328	1.561	1364	1.561	1400	1.561	1436	1.561
1221	1.561	1257	1.561	1293	1.561	1329	1.561	1365	1.561	1401	1.561	1437	1.561
1222	1.561	1258	1.561	1294	1.561	1330	1.561	1366	1.561	1402	1.561	1438	1.561
1223	1.561	1259	1.561	1295	1.561	1331	1.561	1367	1.561	1403	1.561	1439	1.561
1224	1.561	1260	1.561	1296	1.561	1332	1.561	1368	1.561	1404	1.561	1440	1.561
1225	1.561	1261	1.561	1297	1.561	1333	1.561	1369	1.561	1405	1.561		
1226	1.561	1262	1.561	1298	1.561	1334	1.561	1370	1.561	1406	1.561		

Simulation Criteria for Storm

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.359		

Online Controls for Storm

Crown Vortex Valve® Manhole: S4, DS/PN: S1.001, Volume (m³): 0.8

Design Head (m) 0.800 Vortex Valve® Type R3 SW Only Invert Level (m) 76.600
Design Flow (l/s) 50.0 Diameter (mm) 228

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.9	1.200	61.4	3.000	97.1	7.000	148.3
0.200	19.9	1.400	66.3	3.500	104.9	7.500	153.5
0.300	30.1	1.600	70.9	4.000	112.1	8.000	158.6
0.400	35.5	1.800	75.2	4.500	118.9	8.500	163.4
0.500	39.6	2.000	79.3	5.000	125.4	9.000	168.2
0.600	43.4	2.200	83.2	5.500	131.5	9.500	172.8
0.800	50.1	2.400	86.9	6.000	137.3		
1.000	56.1	2.600	90.4	6.500	142.9		

Hydro-Brake® Optimum Manhole: S7, DS/PN: S3.001, Volume (m³): 0.5

Unit Reference	MD-SHE-0203-2100-1000-2100
Design Head (m)	1.000
Design Flow (l/s)	21.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	203
Invert Level (m)	76.531
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	21.0	Kick-Flo®	0.724	18.0
Flush-Flo™	0.345	21.0	Mean Flow over Head Range	-	17.6

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	7.0	1.200	22.9	3.000	35.5	7.000	53.6
0.200	19.3	1.400	24.7	3.500	38.3	7.500	55.4
0.300	20.9	1.600	26.3	4.000	40.8	8.000	57.1
0.400	20.9	1.800	27.8	4.500	43.2	8.500	58.8
0.500	20.6	2.000	29.2	5.000	45.5	9.000	60.5
0.600	19.9	2.200	30.6	5.500	47.6	9.500	62.1
0.800	18.9	2.400	31.9	6.000	49.7		
1.000	21.0	2.600	33.2	6.500	51.7		

Storage Structures for Storm

Porous Car Park Manhole: SA, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	57.5
Membrane Percolation (mm/hr)	1000	Length (m)	90.0
Max Percolation (l/s)	1437.5	Slope (1:X)	300.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	77.050	Membrane Depth (mm)	0

Porous Car Park Manhole: S6, DS/PN: S3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	29.0
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	201.4	Slope (1:X)	300.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	77.220	Cap Volume Depth (m)	0.300

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.359
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 5, 10, 30, 100, 101
Climate Change (%)	30, 30, 30, 30, 30, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SA	120 Winter	101	+40%	1/15 Summer			
S2.000	S1	60 Winter	101	+40%	100/15 Summer			
S2.001	S2	15 Winter	101	+40%	5/60 Summer			
S2.002	S3	15 Winter	101	+40%	1/15 Summer			
S1.001	S4	120 Winter	101	+40%	1/15 Summer	100/60 Winter		
S1.002	S5	15 Winter	101	+40%				
S3.000	S6	60 Winter	101	+40%	30/30 Summer			
S3.001	S7	60 Winter	101	+40%	30/30 Summer			
S1.003	S8	15 Winter	101	+40%				

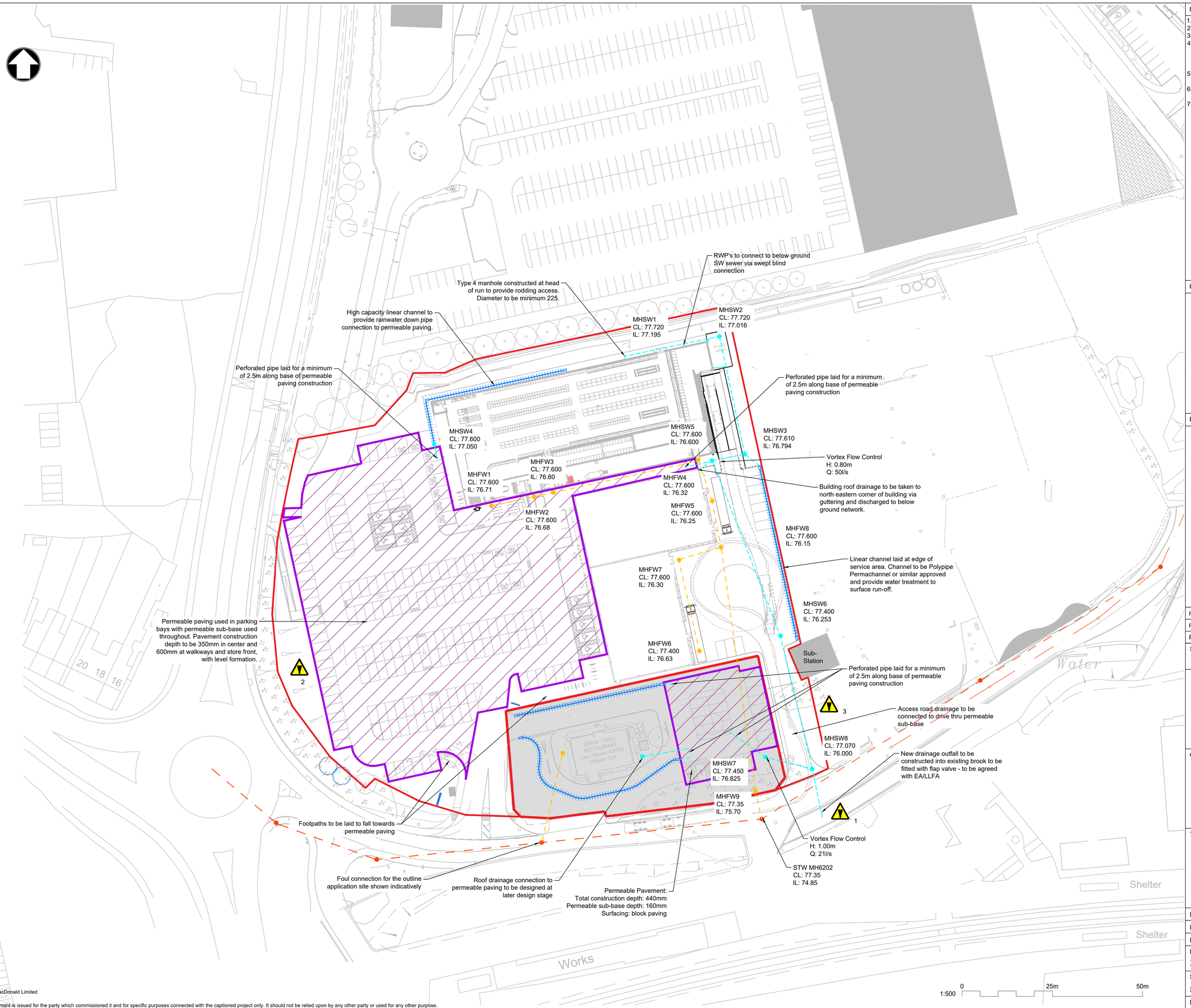
PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	SA	77.425	0.375	0.000	0.47		50.7	FLOOD RISK	
S2.000	S1	77.503	0.083	0.000	0.48		18.9	FLOOD RISK	
S2.001	S2	77.472	0.231	0.000	0.38		15.0	FLOOD RISK	
S2.002	S3	77.444	0.425	0.000	0.83		28.9	FLOOD RISK	

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S4	77.418	0.468	18.065	0.40		50.7	FLOOD	7
S1.002	S5	76.451	-0.152	0.000	0.60		72.7	OK	
S3.000	S6	77.349	0.299	0.000	0.30		22.8	SURCHARGED	
S3.001	S7	77.521	0.765	0.000	0.23		20.4	FLOOD RISK	
S1.003	S8	76.259	-0.091	0.000	0.88		91.0	OK	

G. Indicative Surface Water Drainage Masterplan

G.1 MML drawing ref 392669-MMD-00-XX-DR-D-0001



Notes

1. Do not scale from this drawing.
2. All levels are in meters above Ordnance Datum (mAOD) unless otherwise specified.
3. All dimensions are in metres unless specified otherwise.
4. Main car park permeable paving to have minimum level of 77.400mAOD and maximum level of 77.650mAOD. Sub-base base to be laid at constant formation level of 77.050mAOD throughout with constant surfacing build up, permeable sub-base thickness to be increased to account for difference.
5. Permeable paving systems to be lined with welded impermeable tanking membrane, with suitable specification for use in on-site ground conditions.#
6. Foul drainage system to discharge via gravity to adopted assets, subject to S106 agreement with Severn Trent Water.
7. Adopted drainage assets taken from STW sewer records and shown here indicatively only.

Key to symbols

- Existing Foul Sewer
- Linear Channel with Sump Unit
- Proposed Surface Water Sewer
- Proposed Foul Drainage
- Proposed Permeable Paving

Reference drawings

15541a_OGL_REV0 - Site Topographical Survey
A-PL-003 - Proposed Site Plan
A-PL-010 - Proposed Site Sections

Residual Health & Safety Risk Assessment

1. Working near live carriageway
2. Risk of dust and noise to public
3. Open excavations

Rev	Date	Drawn	Description	Ch'k'd	App'd
P02	22/10/2018	AJP	Discharge details updated	AJP	BAP
P01	20/03/2018	M Smith	For Information	AJP	HL

Status Stamp

NOT FOR CONSTRUCTION

MOTT MACDONALD
Mott MacDonald House
8-10 Sydenham Road
Croydon
CR0 2EE
United Kingdom
T +44 (0)20 8774 2000
F +44 (0)20 8681 5706
W www.mottmac.com

Client

Hadfield Cawkwell Davidson
Broomgrove Lodge
Sheffield
S10 2LZ

Title

LiDL Uttoxeter
Indicative Surface Water Drainage General Arrangement

Designed	M Smith	MCS	Eng check	A Precious	AJP
Drawn	M Smith	MCS	Coordination		---
Dwg check	A Precious	AJP	Approved		

MMD Project Number	Scale at A1	Security
392669	As Shown	STD

Suitability Description	Suit. Code
Suitable for Stage Approval	S4

Drawing Number	Revision
392669-MMD-00-XX-DR-D-0001	P02

mottmac.com