Lidl UK GmbH

Land at White Rose Roundabout, Wombwell, Barnsley, South Yorkshire

Flood Risk & Foul Drainage Assessment

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Report Control

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Flood Risk & Foul Drainage Assessment

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1 INTRODUCTION

1.1 PURPOSE OF THE REPORT

Lidl UK GmbH has commissioned WYG Engineering Ltd to undertake a Flood Risk & Foul Drainage Assessment in respect of the commercial / retail development of a 1.3 ha site at White Rose Roundabout, Wombwell, Barnsley.

This report has been prepared to accompany a detailed planning application for a new retail development.

A copy of the proposed site layout is contained in Appendix A.

1.2 PROPOSED DEVELOPMENT

The proposed development comprises a new 2,345m^2 retail unit together with 133 parking spaces and associated infrastructure.

The development is to be located on land which is currently in open pasture land and is thus a designated a green field site in flood risk terms.

The proposed development is classified as "Less Vulnerable" in flood risk terms in accordance with Table 2 of the PPG - Flood Risk & Coastal Change (PPG).

1.3 REQUIREMENT FOR FLOOD RISK ASSESSMENT

According to flood risk mapping provided by the EA, the site is located predominantly within Flood Zone 1: i.e. land assessed as having an annual probability of fluvial flooding of less than 1 in 1,000 (0.1% AEP). Nonetheless, as the site area exceeds 1 ha, in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guidelines (Flood Risk & Coastal Change), a Flood Risk Assessment (FRA) is required.

1.4 SCOPE OF THE FLOOD RISK ASSESMENT

The FRA will be undertaken in accordance with the guidelines of the Environment Agency Flood Risk Assessment (FRA) Guidance Note 1.

The FRA will assess the existing flood risk to the site and establish a management regime for surface water runoff from the site such that flood risk to adjoining areas is not exacerbated. If not managed properly, surface water runoff from the site could potentially lead to increases in flood risk to other areas or the development itself.

In line with the PPG, the FRA will also consider other potential sources of flood risk, such as sewers, overland flow routes, groundwater flooding, reservoir flooding, and minor watercourses not shown on EA flood map.

1.5 FOUL DRAINAGE ASSESSMENT

The Foul Drainage Assessment will review the existing foul water drainage systems within and adjacent to the development site and identify the peak flows from the proposed development and the proposed point of connection to the public sewer system.

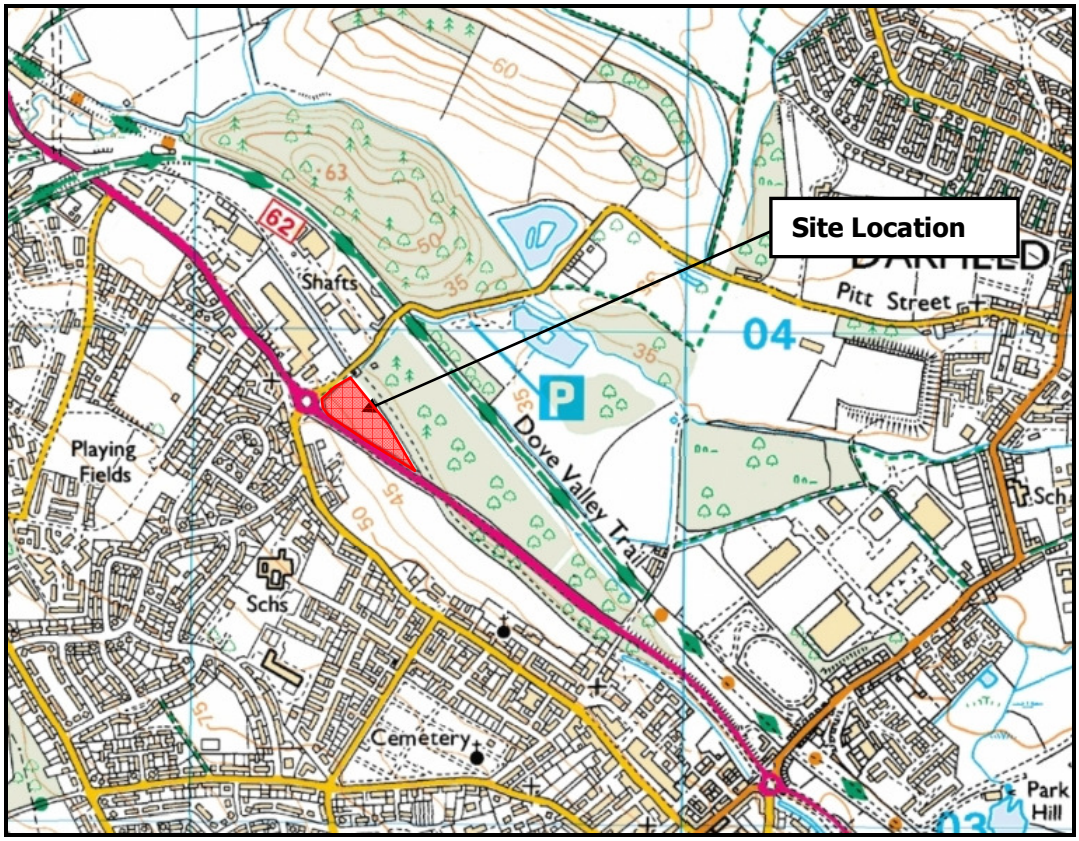
A pre-development inquiry has been issued to Yorkshire Water (YW) and the response of this will be discussed in this report.

2 SITE DESCRIPTION

2.1 EXISTING SITE

The application site covers an area of approximately 1.3 ha and is located as shown in Figure 1 and 2.

Figure 1 – Site Location



The development is to be located on land currently in agricultural/open pasture use.

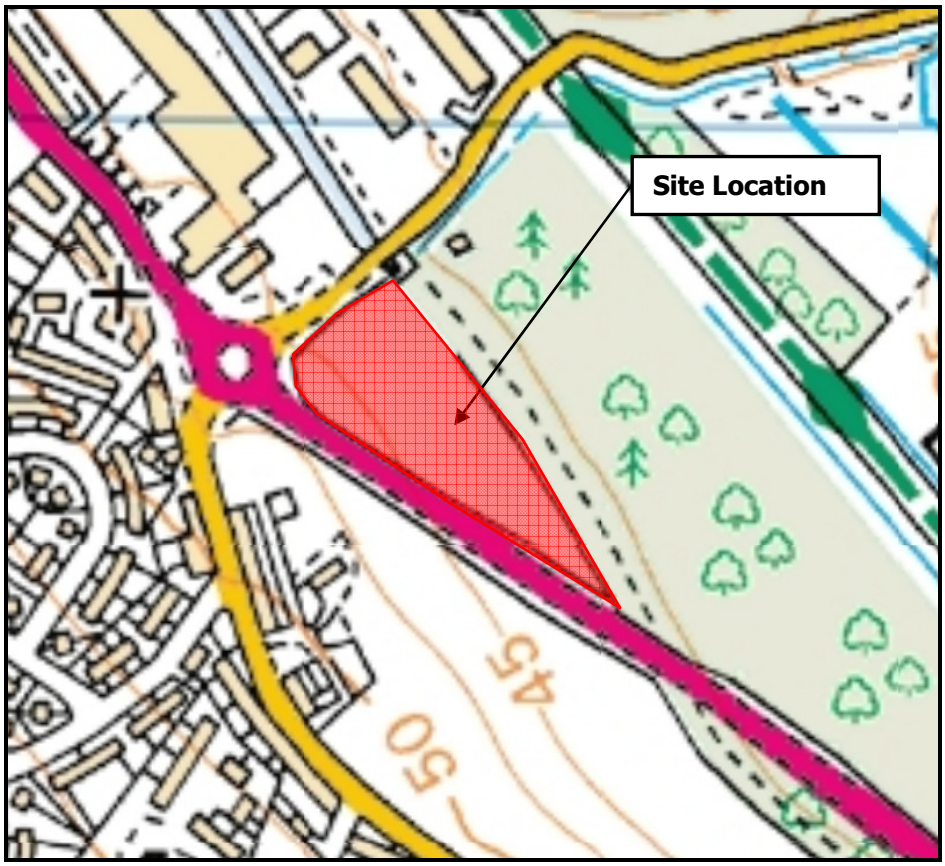
The application site is bounded to the north west by Bradberry Balk Lane, to the south west by Mitchell's Way and on the north eastern boundary by dense woodland. The application site is on the edge of the urbanised area of Wombwell with housing to the west and light industrial units on the northern side of Bradberry Balk Lane.

The highest point shown on the topographic survey is at 42.5 m AOD, located about 1/3 of the way along the south western boundary from the roundabout. The lowest surveyed point is towards the south eastern corner at 35.4 m AOD. At the northernmost point the level is 37.2 m AOD and the site falls fairly uniformly between these points. The slope of the site adjacent to Bradberry Balk Lane is approximately 1 in 17.

Along the north eastern boundary the application site is separated from the woodland area by a raised bank approximately 1m high which runs the full length of the boundary.

A copy of the topographic survey showing the site levels in more detail is contained in Appendix B.

Figure 2 – Site Plan



2.2 EXISTING DRAINAGE

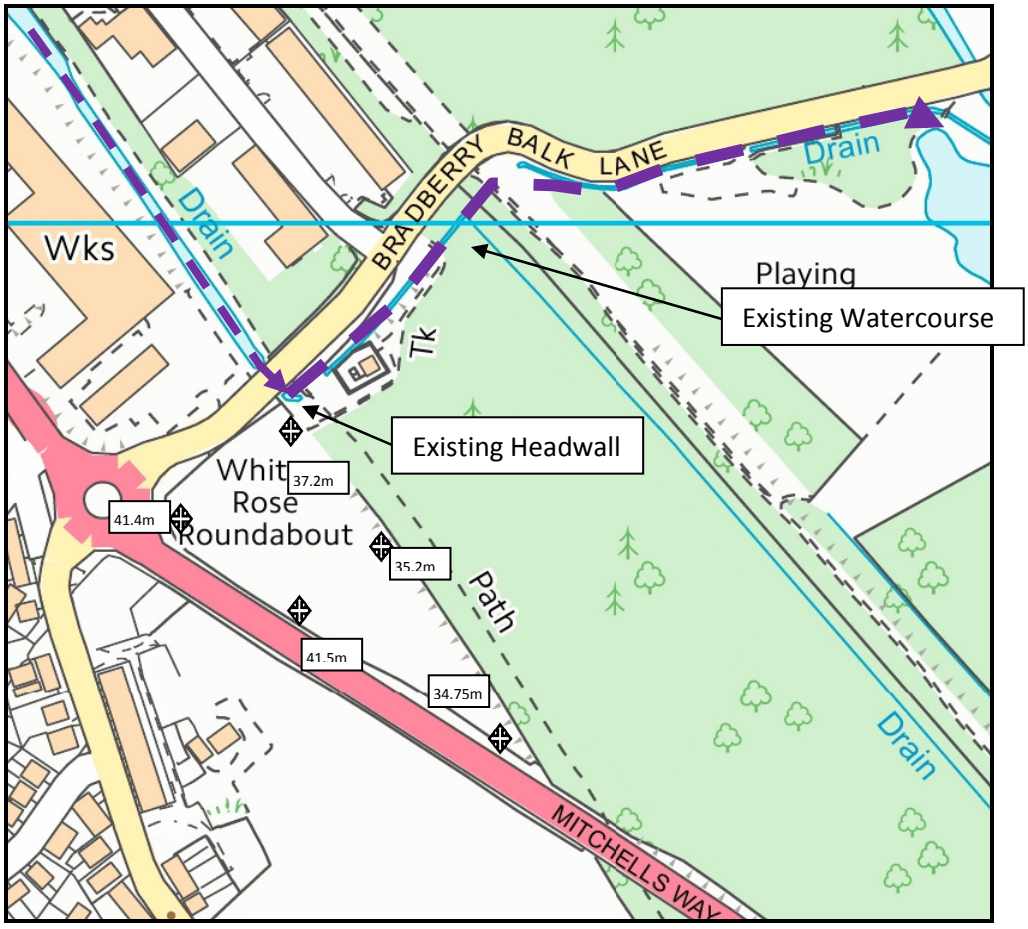
2.2.1 Main Rivers

The nearest main river is the River Dove, which flows from northwest to southeast as it passes the site 450 metres to the northeast. The Dove then flows eastwards to join the Dearne just upstream of Wath upon Dearne.

2.2.2 Ordinary and Manmade Watercourses

The Dearne and Dove canal, which closed in the first half of the last century, ran along the northeast boundary of the site. Within the northern part of the application site there is an existing headwall which receives the flows from the old Dearne and Dove canal where it passes under Bradberry Balk Lane together with the flows from the Yorkshire Water 600mm diameter surface water sewer. This watercourse then flows north east and eventually discharges into the River Dove.

Figure 3 – Site Plan showing Levels and Watercourses



2.2.3 Sewers

Yorkshire Water Sewers

The Yorkshire Water sewer records show a 600mm diameter public surface water sewer draining within the verge of Bradberry Balk Lane adjacent to the site boundary and discharging into the ordinary watercourse mentioned above. At this point the sewer is a concrete pipe.

Within the verge of Bradberry Balk Lane there is a 150 mm vitrified clay foul sewer which runs northwest into the adjacent industrial estate and this is the head of the sewer run as shown on Figure 4. It should also be noted that there is also a 600mm diameter public combined sewer located approximately 110m to the north east further along Bradberry Balk Lane, as shown on Figure 5.

Figure 4 – Extract from Yorkshire Water sewer records

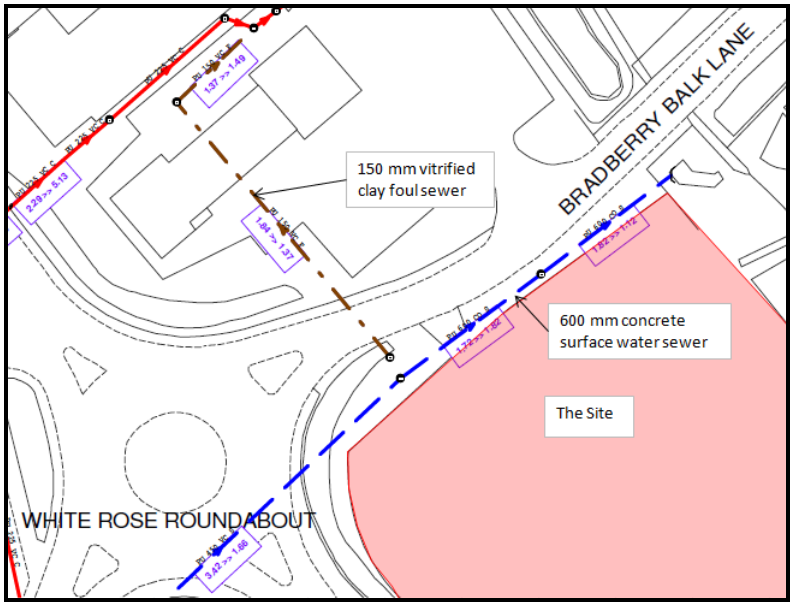
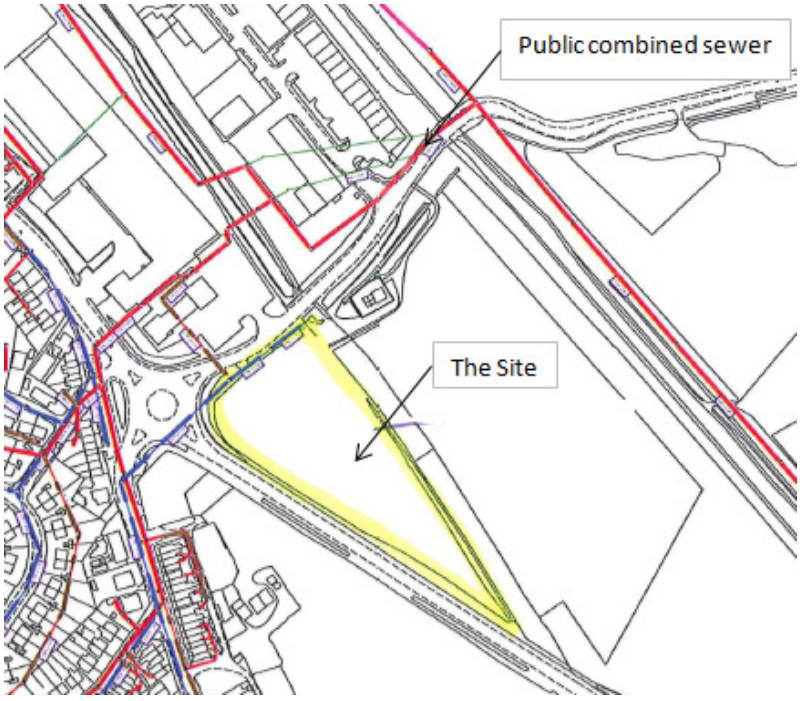


Figure 5 –Extract from small scale Yorkshire Water sewer records



A copy of the sewer records received from Yorkshire Water is contained in Appendix C.

Private Sewers

There is no evidence of any positive drainage systems within the application site. At present any surface water runoff drains to the south and appears to drain naturally into the ground. It is noted from a review of the surface water flooding maps and information provided by Barnsley Council that localised flooding occurs in the southeast corner of the site.

3 FLOOD RISK

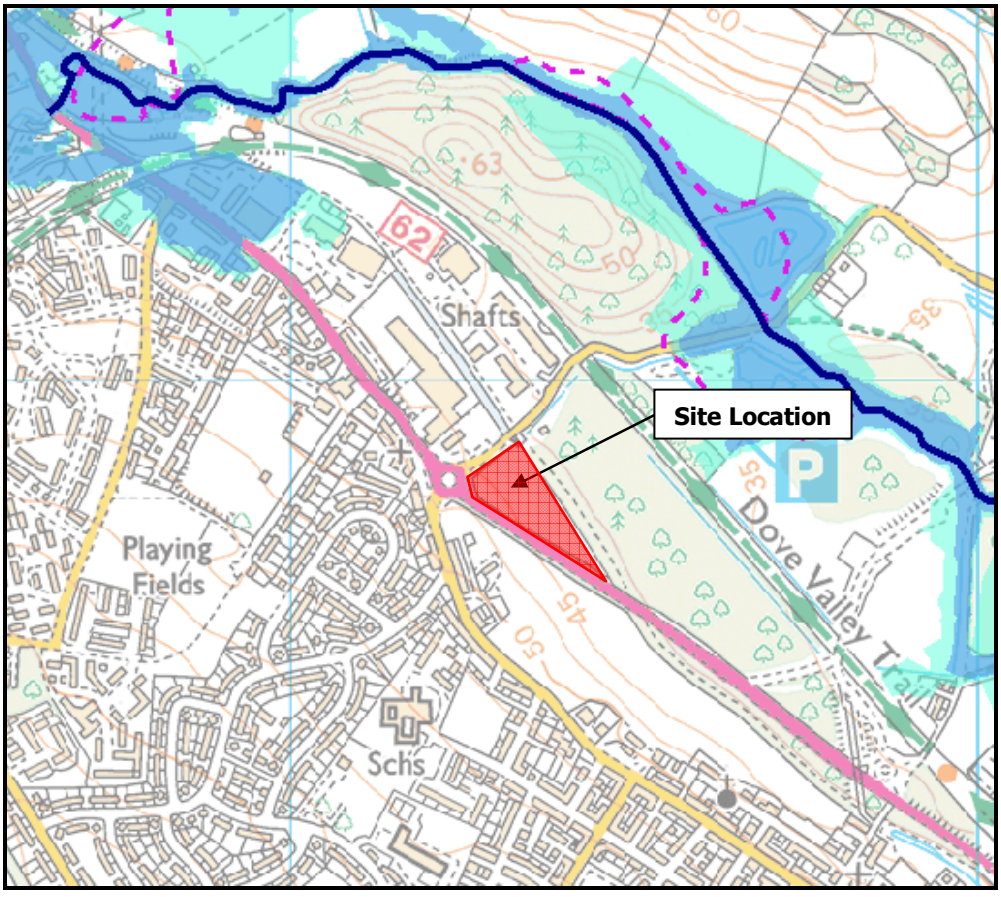
3.1 FLUVIAL FLOOD RISK

Fluvial flood risk is the risk of flooding arising from rivers and watercourses.

3.1.1 Environment Agency Data Review – Fluvial Flooding

Reference to the EA Flood Map (Figure 6) reveals that the site is in Flood Zone 1, i.e. the probability of fluvial flooding is less than 0.1 % Annual Exceedance Probability (AEP), or the return period of flooding is more than 1,000 years.

Figure 6 - Environment Agency Flood Map for Planning (downloaded 20/07/2015)



Flood Zone 2 (medium risk)

Flood Zone 3a (high risk)

Main River

Areas Benefitting from Flood Defences

3.1.2 Barnsley Metropolitan Borough Council

A consultation was issued to Barnsley Metropolitan Borough Council (MBC) which acts as the Lead Local Flood Authority (LLFA) for the area. The council's response is below:

"We have no evidence of flooding on this location, but there has been standing water in the corner of this site, which appears on EA maps (see attached). The watercourse was created when the Canal was in filled and this is the overflow discharge to the River Dove. This area of land and the watercourse is in Council ownership."

The map mentioned in the response is the EA surface water flooding map (Figure 7).

3.1.3 Barnsley Council - Strategic Flood Risk Assessment (SFRA) Level 1

A review was undertaken of the Barnsley Council SFRA (dated September 2010). And this confirmed the following:

a) The application site is not at risk of any fluvial flooding and which correlates with the current Environment Agency's Flood Map for Planning

b) The southern part of the site is shown as being at risk of surface water flooding

c) The application site falls within the Danvm Drainage Board catchment

d) Groundwater flooding is not considered to be an issue within the area

e) The site is not defined as being in a Critical Drainage Area.

f) There are no records of any historical flooding within the application site.

3.1.4 Barnsley Council - Preliminary Flood Risk Assessment (PFRA)

The PFRA for The Barnsley Council area was published in June 2011. It was reviewed to identify any known flood risks associated with the application site and no additional flood risk issues were identified although the PFRA does confirm that there have been no DG5 flood reports in the area of the application site.

3.1.5 Danvm Drainage Commissioners

The site lies partially within the area covered by the Dearne and Dove Internal Drainage Board (IDB), which is now part of the Danvm Drainage Commissioners, who are in turn part of the Shire Group of IDBs. At the time of writing a response is awaited.

3.2 SEWER FLOODING

There are no records of sewer flooding in the area.

3.3 SURFACE WATER FLOODING

Surface water flooding occurs where high rainfall events exceed the drainage capacity in an area (i.e. sewer system and/or watercourse), leading to flooding.

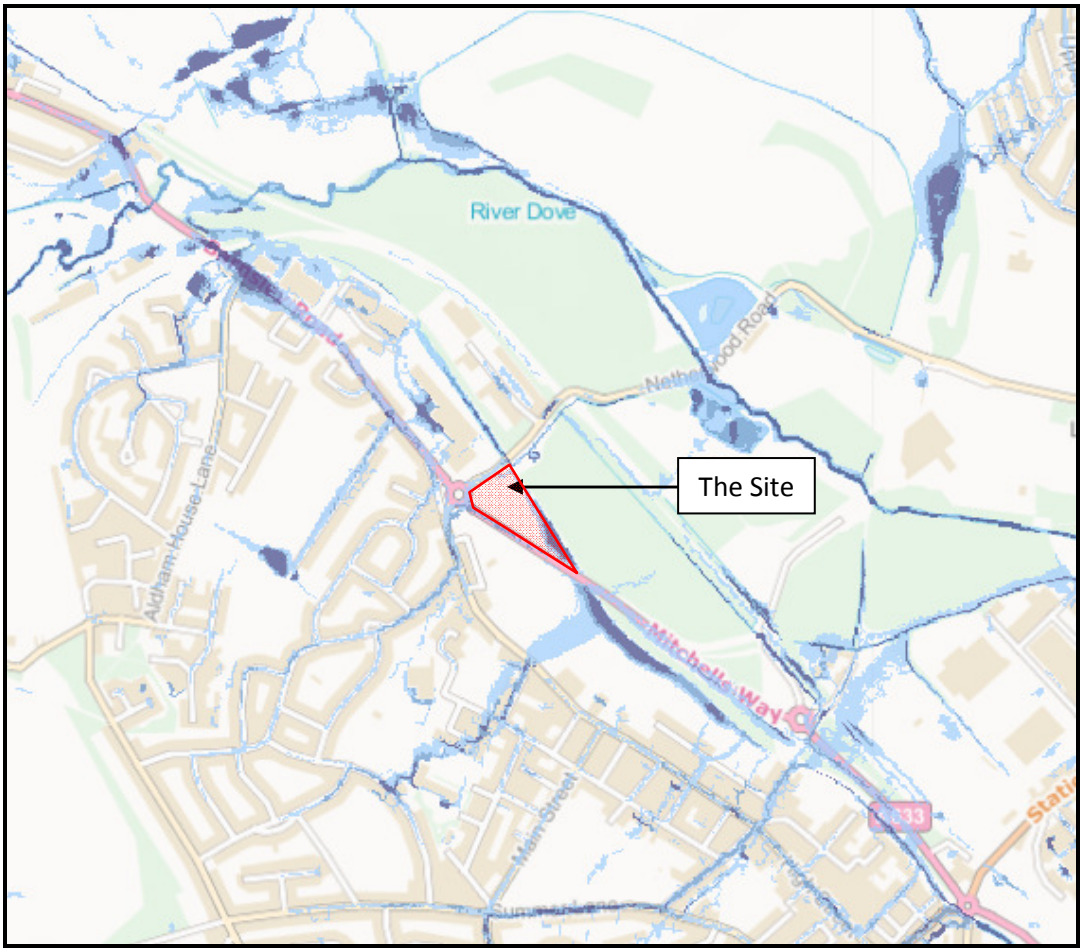
An extract of the Environment Agency's Risk of Surface Water Flooding map downloaded from the EA website is shown in Figure 7.

Figure 7 shows that the site is subject to either a low risk or a very low risk of flooding, apart from a narrow strip at the bottom of the very steep site.

There are no historical records of surface water flooding affecting the application site, although some ponding due to poor drainage has been reported. This is in an area that is not proposed for development.

It is concluded that the application site is at low risk from surface water flooding.

Figure 7 - Extract from the Environment Agency's Risk of Surface Water Flooding Map



High Risk of Flooding
Low Risk of Flooding
Medium Risk of Flooding
Very Low Risk of Flooding

3.4 RUN OFF FROM OVERLAND SOURCES

3.4.1 Assessment of Existing Overland Flows into the Site

The land around the application site steeply falls to the north east towards the River Dove; therefore there is no risk of overland flows from the north east affecting the site. The highway drainage on Bradberry Balk Lane would intercept any overland flows originating from the north west of the application site and the drainage on Mitchell's Way would similarly intercept any flows from that direction, so it is concluded that the site is at very low risk of overland flow flooding.

3.5 GROUND WATER

3.5.1 Groundwater Source Protection Zone - Groundwater Vulnerability

A review of the EA's Ground Water Source Protection Zone (GWSPZ) map for the development site location shows that the site is not located within a groundwater source protection zones. The use of Infiltration SUDs techniques to dispose of surface water will therefore not be precluded on this basis.

3.5.2 Groundwater

The Sirius Desk Top Study identified the underlying ground to potentially consist of made ground overlying silts and clays. The British Geological Survey site was also interrogated and one borehole was found in the vicinity of the site, BH SE30SE 125, located on the northern boundary of the site. This borehole shows a layer of topsoil over made ground to a depth of 1.3m which is underlain by 3 m of clay and clayey sand. Below 5m, the underlying ground consisted of clayey sands with occasional gravels. The borehole log for SE30SE 125 is included in Appendix E.

The Borehole log also identified that groundwater was not found.

There are no historical records of groundwater flooding.

It is concluded that the risk of groundwater flooding to the site is low, due to no recorded historical instances of groundwater flooding.

3.6 RESERVOIR FLOODING

Although the probability of a catastrophic dam failure is considered to be extremely low, the consequence of such an event would be severe. A review of the EA online 'Risk of Flooding from Reservoirs' identified that the site is not in the zone at risk of flooding as a result of reservoir failure.

3.7 SUMMARY OF FLOOD RISK

3.7.1 Overview of Flood Risk

Based on the above, as the application site lies in Flood Zone 1 it is considered to be at low risk of fluvial flooding.

Furthermore, the application site is considered to be at low risk of flooding from groundwater, surface water, sewers, overland sources, groundwater, artificial water bodies or reservoir failure.

However, it will be essential to ensure that no increase in flooding occurs downstream of the site and within the site as a result of the development and this is discussed in Section 4.

4 DEVELOPMENT PROPOSALS

4.1 PROPOSED DEVELOPMENT

The proposed development comprises a new 2,345m2 retail unit together with 133 parking spaces and associated infrastructure.

A copy of the proposed site layout is included in Appendix A.

The proposed development is classified as "Less Vulnerable" in flood risk terms, but in any event it is located in Flood Zone 1, so will be acceptable in flood risk terms.

4.2 SEQUENTIAL TEST

One of the aims of NPPF is to steer development away from zones of high flood risk towards Flood Zone 1. The development is classified as "Less Vulnerable" in accordance with Table 2 of the PPG - Flood Risk & Coastal Change (PPG) and is entirely within Flood Zone 1 according to the current EA Flood Map for Planning.

Based on the above it can be shown that the development proposals comply with the requirements of Table 3 of the Flood Risk & Coastal Erosion (PPG) and therefore the Sequential Test is considered to have been passed.

4.3 BARNSLEY COUNCIL PLANNING POLICY

Barnsley Council Planning Policy CSP4 - Flood Risk, requires that any development will seek to reduce the extent and impact of flooding by:

a) not permitting new development where it would be at an unacceptable risk of flooding or would will give rise to flooding elsewhere

b) requiring site-specific Flood Risk Assessments (FRAs) for development proposals over 1 hectare in Flood Zone 1 and all development proposals in Flood Zones 2 and 3

c) requiring proposals over 1000 m2 floor space or 0.4 hectares in Flood Zone 1 to demonstrate how the proposal will make a positive contribution to reducing or managing flood risk

d) requiring development proposals to use Sustainable Drainage Systems (SuDS) in accordance with policy CSP3

Policy CSP 3 Sustainable Drainage Systems (SuDS) requires that:

a) All development will be expected to use Sustainable drainage systems (SuDS)

b) Only in exceptional circumstances, where it can be demonstrated that all types of SuDS are impractical, will other drainage management systems be permitted.

c) Planning applications must include an assessment to show that SuDS will work and be maintained. Measures should be taken to avoid water contamination and safeguard groundwater supply.

d) Developers will be required to contribute to the maintenance of SuDS.

4.4 DEVELOPMENT AND FLOOD RISK

4.4.1 Flood Risk to the Development

As identified previously, the application site is at low risk of flooding from any source, including groundwater, surface water, sewers, overland sources, artificial water bodies and reservoir failure and therefore no mitigation works are required.

4.4.2 Flood Risk Arising from the Development

The proposal will result in the development of a green field site, with a commensurate increase in impermeable area. It is proposed to restrict the rate of surface water discharge from the application site to the existing green field run off rate to ensure that there is no increase in risk further downstream within the receiving watercourses.

4.5 ASSESSMENT OF PRE & POST SURFACE WATER DISCHARGE RATES

4.5.1 Existing Greenfield Discharge Rate

At present the application site is 100% permeable as it is used as agricultural and open pasture land with no formal drainage.

Therefore an assessment has been undertaken using the ICP SUDS module in the Micro Drainage modelling package to identify the existing green field run off rates and this has identified the following:

1 in 1 year = 1.7 l/s

1 in 30 year = 3.5 l/s

1 in 100 year = 4.1 l/s

Q_{bar} = 2.0 l/s.

A copy of the above ICP SuDS Green filed run off assessment calculation is contained within Appendix G.

4.5.2 Proposed Post Development Discharge Rates

As the assessed green field discharge rate for the application site is less than 5 l/s this discharge rate has been adopted as the maximum design discharge rate as is accepted practice. Although discharge rates below 5 l/s can be achieved, maintenance problems become an issue due to the small size of the required outlet pipe and it is accepted practice to adopt a minimum flow control device rated at 5 l/s.

4.6 ASSESSMENT OF POST DEVELOPMENT AREAS

The proposed development will result in a developed site providing 7,200m^2 of impermeable area comprising the access road, car parking and building footprint and this value has been adopted in assessing the required on site surface water attenuation volumes.

4.7 SURFACE WATER DRAINAGE STRATEGY

It is proposed to drain the surface water runoff from the new development into a gravity surface water drainage system which will eventually discharge into the existing headwall and ordinary watercourse located to the north of the application site as identified in Figure 3.

As stated above in Section 4.4.2 it is proposed to restrict the peak discharge to 5 l/s, with on site attenuation being provided by utilising below ground cellular storage tanks to store the 1 in 100 year plus 20 allowance for climate change storm event volume.

In addition a suitable sized oil/petrol interceptor will be incorporated into the drainage system to minimise any pollution of the receiving watercourse.

A copy of the proposed surface water drainage plan is included in Appendix D.

4.8 PROPOSED MITIGATION

4.8.1 Flood Risk due to Surface Water Runoff from the Site

In order to ensure that surface water runoff from the site does not cause an increase in flood risk the management of runoff has been considered via a sequential approach, in line with Building Regulations. The following options for the disposal of surface water runoff were considered, in order of preference[1]:

[1] Building Regulations H3(3), Rainwater drainage

i) A soakaway or some other infiltration system,

ii) A watercourse

iii) A sewer

Discharge to soakaway

As has been identified above, no site specific ground investigation study has been undertaken at present to provide details of the underlying ground conditions, so the results of the Sirius Desk Top Study have been reviewed.

This has identified the potential presence of made ground and clayey sands and silts which indicate that infiltration techniques would not be a viable means of surface water disposal.

However, it is recommended that a site specific site investigation is undertaken prior to commencing the detailed design in order to establish the site specific ground conditions and if suitable strata are identified that permeability tests and ground water monitoring are undertaken to fully identify if infiltration techniques could be utilized.

In the event that these further investigations and testing identify suitable strata for infiltration, then the proposed surface water drainage strategy and attenuation volumes should be revised accordingly to incorporate the proposed infiltration techniques.

Discharge to Watercourse

In the absence of being able to utilise infiltration techniques then it is proposed to discharge the surface water run off from the application site to the existing ordinary watercourse located to the north of the application site. This watercourse eventually discharges to the River Dove and would be able to accept the runoff from the site.

The peak discharge to this watercourse will be restricted to 5 l/s as detailed in Section 4.2.2 with on site attenuation provided.

It is understood that the land in which the existing headwall and watercourse is located is owned by Barnsley Council and approval from the Council will be required in respect to the construction of the new outfall and discharge of the additional flows.

Discharge to Sewer

As it is proposed to discharge to the existing watercourse this option has not been assessed any further although it is noted that there is a 600mm diameter surface water sewer present along the northern boundary which discharges into the above mentioned ordinary watercourse.

Surface Water Attenuation Volume

A preliminary design of the surface water drainage system has been undertaken utilising the MicroDrainage software package and this has identified that an attenuation tank sized at 334 m3 will be necessary to store the 1 in 100 year plus 20% climate change storm, whilst ensuring the discharge rate is restricted to 5 l/s (the green field runoff rate for the development footprint).

It should be noted that preliminary assessment and drainage design has not allowed for any exceedance volumes to be stored within the car parking areas due to the sloping nature of the final car parking levels which fall to the south east.

Should, through the detailed car park design process, the car park levels be set such that an element of surface flooding and hence storage of the 1 in 30 year exceedance flows can be provided, then the below ground storage volumes can be decreased accordingly.

A copy of the Micro Drainage calculations in respect of the above surface water drainage design are included in Appendix H.

4.9 OFF SITE IMPROVEMENTS

No offsite improvements are anticipated to be required at present.

4.10 RESIDUAL FLOOD RISK

Provided the measures already discussed are implemented the residual risks are small.

As the site is to be set on a raised platform there is a small risk that water may overflow from this during a severe event. In order to prevent this it is proposed that there should be a raised kerb around the periphery of the raised area.

There remains a residual risk of a storm event that exceeds the capacity of the drainage system, as events beyond the 1 in 100 year storm event will not be catered for by the attenuation volume provided.

4.11 FUTURE MAINTENANCE RESPONSIBILITIES

Responsibility for the maintenance of the new surface water drainage systems including the below ground cellular storage tank will be undertaken by the site owner and operator.

5 SUSTAINABLE DRAINAGE (SUDS)

In order to comply with the national guidelines and policies set by the Environment Agency and Barnsley Council (i.e. planning policy CSP 7), the design of the surface water drainage system should seek to maximise the use of SUDS techniques.

As discussed within Section 4, based on the Sirius Desk Top Study it would appear that the underlying ground conditions are not suitable for utilising infiltration techniques, although this is yet to be ascertained by means of a detailed site investigation including permeability testing and long term ground water monitoring where the ground conditions indicate infiltration techniques may be viable.

In the absence of incorporating infiltration techniques, due to the site layout, the required levels and the design constraints imposed by the required development layout there are limited opportunities to consider other options such as use of infiltration swales or detention ponds.

Consideration has been given to locating a detention pond within the landscaped area to the south or a swale along the western frontage; however, due to the levels this would have resulted in incorporating a surface water pumping station which would be unsustainable and not a reasonable alternative.

However, during the detailed design stage consideration should be given to considering the use of permeable paving within parts of the application site, which in this instance would not act as an infiltration system but would act to extend the time of entry of the run off into the drainage system plus providing an additional element of water quality treatment.

It should be noted that the design of the surface water drainage system is to restrict the proposed run off to the equivalent green field discharge rate and provide on site attenuation to cater for the 1 in 100 plus CC storm event which is in line with the general SUDS design principles.

6 FOUL DRAINAGE ASSESSMENT

6.1 EXISTING FOUL DRAINAGE

As stated within Section 2.2.3, within the verge of Bradberry Balk Lane there is a 150 mm vitrified clay foul sewer which runs northwest into the adjacent industrial estate and this is the head of the sewer run as shown on Figure 4. It should also be noted that there is also a 600mm diameter public combined sewer located approximately 110m to the north east further along Bradberry Balk Lane (Figure 5).

A copy of the sewer records received from Yorkshire Water is included in Appendix C.

6.2 PROPOSED POST DEVELOPMENT FLOWS

Based on the proposed development, the peak foul flows from the new building have been identified as being 1.5 l/s.

6.3 YORKSHIRE WATER PRE-DEVELOPMENT ENQUIRY

A pre development enquiry was submitted to Yorkshire Water with respect to the additional design flow of 1.5 l/s and the response is appended as Appendix F and summarised below.

- Development of the site should take place with separate systems for foul and surface water drainage.
- Foul water domestic waste should discharge to the 150 mm diameter public foul/combined sewer recorded in Bradberry Balk Lane, at a point to the north of the site.
- Foul water from kitchens and/or food preparation areas of any restaurants and/or canteens etc. must pass through a fat and grease trap.
- If sewage pumping is required foul water discharge must not exceed 3 (three) litres per second.
- Any new connection to an existing public sewer will require the prior approval of Yorkshire Water.
- Please note that capacity in the public sewer network is not reserved for specific future development

6.4 PROPOSED FOUL DRAINAGE STRATEGY

It is proposed to drain the application site via a gravity system draining to a new below ground foul pumping station located within the southern part of the application site. From here the foul drainage will be pumped up along the western boundary to discharge into the existing Yorkshire Water foul manhole.

Alternatively, a gravity system can be adopted which will drain from the application site into Bradberry Balk Lane and then drain along the highway and discharge into the existing 600mm diameter combined public sewer located approximately 110m to the north west of the application site.

It should be noted that within the site the new foul drainage system should ensure that any kitchen or food preparation waste passes through a grease trap before discharging into the site drainage system.

A copy of the proposed foul drainage layout is enclosed in Appendix D.

7 CONSENTS REQUIRED

7.1 SECTION 23 LAND DRAINAGE ACT 1991

The new surface water outfall to the existing ordinary watercourse to the north of the application site will require Flood Defence Consent approval under Section 23 of the Land Drainage Act 1991 and in this instance this will be required to be obtained from Barnsley Council who are understood to be responsible for the watercourse into which the new site surface water drainage is to discharge to.

8 CONCLUSIONS

- This report has identified the following:
- The development site is shown on the EA statutory flood maps for Planning as being entirely within Flood Zone 1.
- The new building and associated car parking are classified as "Less Vulnerable" in accordance with Table 2 of the PPG - Flood Risk & Coastal Change (PPG).
- The highest point shown on the topographic survey is at 42.5 m AOD, the lowest surveyed point is 35.4 m AOD and the site falls fairly uniformly between these points. The slope of the site adjacent to Bradberry Balk Lane is approximately 1 in 17.
- The nearest main river is the River Dove, which flows from northwest to southeast as it passes the site 450 metres to the northeast.
- Within the verge of Bradberry Balk Lane there is a 150 mm vitrified clay foul sewer which runs northwest into the adjacent industrial estate and this is the head of the sewer run as shown on Figure 4. It should also be noted that there is also a 600mm diameter public combined sewer located approximately 110m to the north east further along Bradberry Balk Lane.
- The underlying ground comprises made ground overlying silts and clays, so the site is unlikely to be suitable for infiltration drainage.
- From a review of all available information it can be demonstrated that the application site is at low risk of flooding from coastal, fluvial and pluvial sources and also at low risk of flooding from surface water, groundwater sources, sewer flooding, overland flows, and reservoir failure.
- The development is located within Flood Zone 1 and as it is designated a "Less Vulnerable" form of development is an acceptable form of development in flood risk terms and therefore the NPPF Sequential Test is considered to have been passed and there is no requirement to apply the Exception Test.
- The proposed development meets the requirements of Barnsley MBC Planning policies.

- The green field runoff rate for the developed area has been identified as 1.7 l/s for the 1 year return period event. As this is less than the practical minimum of 5 l/s, an outflow rate of 5 l/s has been adopted as the outflow rate to the nearby watercourse.
- The application site is to be drained by a new gravity surface water drainage system which will incorporate a below ground cellular attenuation tank and connecting sewers which will provide sufficient storage to cater for the 1 in 100 year + climate change storm event.
- If the mitigation measures detailed within this report are provided as part of the development, it is considered that the primary residual failure would be as a result of some type of failure of the site drainage system during the life of the development and regular, ongoing maintenance will be required to ensure that the capacity of the system is maintained as it has been designed.
- In addition there remains a residual risk of a storm event that exceeds the capacity of the drainage system, as events beyond the 1 in 100 year storm event will not be catered for explicitly.
    - Yorkshire Water has confirmed that the existing public foul sewer network can accept the proposed foul flows from the development.
- Foul drainage from the new development will be drained either by a new gravity foul drainage system discharging into the existing combined sewer approximately 110m to the east of the application site or via drained to a small packaged treatment plant which will then be pumped up into the existing 150mm diameter public foul sewer adjacent to the application site..

Based on the above the following recommendations are made:

- A detailed site investigation shall be undertaken to identify the underlying ground conditions and should the ground conditions experienced identify suitable soils for the use of infiltration techniques then site permeability testing shall be undertaken including monitoring of ground water levels to establish the criteria for adopting infiltration techniques and the surface water drainage design amended accordingly.
- The finished floor levels of the new buildings are to be set generally at 150mm above the average ground level and this will ensure that in the event of extensive overland flows, during an extreme event, no flooding of the buildings will occur.
- Responsibility for the maintenance of the new surface water drainage systems including the below ground cellular storage tank lies with the Site Owner.

- A review shall be undertaken of the options available to discharge the foul drainage from the site this being via pumped system or via an off site foul sewer.