

**On behalf of
Kraft Foods UK Ltd and
Barwood Developments Ltd**

**Southam Road Retail Park,
Banbury**

Flood Risk Assessment

Project Ref: 26004

Doc Ref: 26004/005

March 2012

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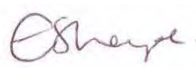
Project Name: Southam Road Retail Park, Banbury

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Date: March 2012

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1 Introduction

Peter Brett Associates LLP (PBA) has prepared this Flood Risk Assessment (FRA) in line with the guidance in Planning Policy Statement 25: Development and Flood Risk (PPS25).

Government policy with respect to development and flood risk in areas in England is contained within the Department for Communities and Local Government document PPS25, which was originally issued on 7th December 2006 followed by an accompanying Practice Guide. These were produced as 'living' documents and the most recent PPS25 Practice Guide was published in December 2009 and subsequently PPS25 was updated in March 2010 to include changes to floodplain definitions as well as development vulnerability classifications.

This site specific FRA has been prepared for Barwood Developments Ltd to accompany an outline planning application for the proposed retail development on a 5.63 hectare (ha) site located 800m to the north west of Banbury town centre. The proposed development will provide a 5,574m² (60,000 sq ft) foodstore, petrol filling station and up to 7, 432m² (80,000 sq ft) of non food retail and associated car parking.

Although Cherwell District Council as the Local Planning Authority (LPA) will make the final decision with regard to any planning application, the Environment Agency (EA) (as a statutory consultee to the planning process) has the lead role in providing advice on flooding and surface water management issues at both a strategic level and in relation to planning applications.

This FRA has been prepared in accordance with Annex E of PPS25 and in consultation with the EA.

Annex E of PPS25 states that the level of detail entered in any FRA is dependant upon the scale and potential impact of the proposed development. Annex E lists a number of requirements that any FRA should address.

Paragraph E3 of Annex E of PPS25 also states that the FRA be undertaken by competent people as early as possible in the planning process. PBA are consulting engineers with extensive experience in, amongst other areas, hydrology, flood defence and river engineering.

2 Policy Review

2.1 Introduction

This FRA was prepared with reference to national, regional and local policy, and with regard to best practice from appropriate national and local guidance. This chapter identifies specific national, regional and local policies that are relevant to the proposed development.

2.2 National Legislation Policy and Guidance

The following section details national legislation, policy and developer guidance which is directly relevant to the management of flood risk and surface water for the development. The content covers national planning policy on development and flood risk, sustainability, water resource management, EU Directives, UK Law and best practice developer guidance.

2.2.1 Planning Policy Statement 25 – Development and Flood Risk (Updated March 2010)

PPS25 focuses on national policy and seeks to provide clarity on what is required at regional and local levels to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. PPS25 outlines a risk based approach to the planning process and requires that the Sequential Test is used to guide the decision making process by steering development to areas with the lowest probability of flooding where feasible.

PPS25 defines three Flood Zones to be used as the basis for applying the Sequential Test and introduces the Flood Risk Vulnerability Classification to categorise the proposed development with respect to the consequences of flooding. Taken together, the Flood Zones and Flood Risk Vulnerability Classification are used to provide a Flood Zone “Compatibility” matrix to determine the type of development that is considered appropriate within each Flood Zone. The PPS25 Flood Zones do not take into account the presence of defences.

Planning applications for development proposals of 1 hectare or greater in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 should be accompanied by a FRA. The FRA will be required to demonstrate how flood risk from all sources of flooding to the development itself and flood risk to others will be managed.

The PPS25 Flood Zones do not currently take account of climate change impacts. However, PPS25 requires that the spatial planning process should consider such issues and contingency allowances are provided to enable the implications of climate change to be considered over the lifetime of the development.

PPS25 places a requirement on LPAs to undertake Strategic Flood Risk Assessments (SFRAs). The SFRA should be used to inform their knowledge of flooding, refine the information on the Flood Map and determine the variations in flood risk from all sources of flooding across and from their area. These should form the basis for preparing appropriate policies for flood risk management from these areas.

In addition to providing guidance in respect of flooding, PPS25 sets out guidance for managing surface water run-off from development. Specifically, the guidance requires that through the use of Sustainable Drainage Systems (SUDS) where feasible the developed rate of run-off into a watercourse or other receiving system should be no greater than the existing rate of run-off. In addition, developers are encouraged to reduce volumes of run-off using infiltration techniques where appropriate.

This FRA has been prepared in accordance with PPS25. Flood risk to the site from all potential sources has been considered in **Section 5** and a strategy for managing surface water runoff from the development is outlined in **Section 6**.

2.2.2 Water Framework Directive (2000/60/EC) (2000)

The Water Framework Directive (WFD) is a wide-ranging article of European legislation that establishes a legal framework for the protection, improvement and sustainable use of surface waters, coastal waters and groundwater across Europe in order to:

- Prevent deterioration and enhance status of aquatic ecosystems, including groundwater.
- Promote sustainable water use.
- Reduce pollution.
- Contribute to the mitigation of floods and droughts.

Water management has historically been co-ordinated according to administrative or political boundaries. The WFD promotes a new approach based upon management by river basin – the natural geographical and hydrological unit. In the UK the legislation requires that the EA complete River Basin Management Plans which include clear objectives in respect of water quality and pollution control and a detailed account of how objectives are to be met within a prescribed timeframe within pre-determined river basin districts.

The site is located within the Cherwell catchment in the Thames River Basin Management Plan (see **Section 2.3**) which aims to achieve 'Good Ecological and Chemical Status'. The surface water management strategy outlined in **Section 6** for the proposed development involves discharging surface water runoff from the site to an existing watercourse. In accordance with the objectives of the WFD, pollution control measures have been considered to ensure that the water quality of the receiving watercourse is not adversely affected as a result of the development. The receiving watercourse for the proposed development is the Birds Brook.

2.2.3 Flood Risk Regulations (2009)

The Flood Risk Regulations transpose the Floods Directive 2007/60/EC into domestic law. The Regulations require that the EA prepare Preliminary Flood Risk Assessments (PFRAs) and flood maps for flooding associated with seas, main rivers and reservoirs. Lead Local Flood Authorities (Unitary and County Councils) are to undertake the same exercise for all other sources of flood risk, except sewer flooding, not caused as a result of rainfall. PFRAs must be prepared before the end of 2011. Maps of Significant Areas of Flood Risk, determined by the aforementioned PFRAs, must be prepared by the end of 2013. Flood Risk Management Plans are to be prepared before the end of 2015.

Oxfordshire County Council have produced a draft PFRA (April 2011) as required by their role as Lead Local Flood Authority for Oxfordshire under the Flood Risk Regulations (2009). There are no indicative Flood Risk Areas in Oxfordshire as defined by the Department of Food and Rural Affairs (DEFRA) in their document, '*Selecting and reviewing Flood Risk Areas for local sources of flooding: Guidance to Lead Local Authorities*' (2010). These are areas with what is considered to be significant flood risk on a national scale. One of the indicators for 'significant risk' is that 30,000 people might be affected. However, the evidence collected as part of the PFRA demonstrates that there are surface water flooding issues in Banbury that must be addressed in the Local Flood Risk Management Strategy. No specific information was provided and the PFRA states that further assessment is required. The information collected will be used to formulate a local strategy that addresses the local issues and the need for adaptation in the light of climate change effects.

DEFRA and Communities and Local Government have published Surface Water Management Plan (SWMP) Technical Guidance to assist lead local flood authorities. SWMPs consider the management

of surface water within a given authority, and aim to deliver water resources, flood risk and water quality benefits through a coordinated approach between local stakeholders and focussed investment. The PFRA is to be used as an evidence base to inform SWMPs that might be necessary. Oxfordshire County Council, as the Lead Local Flood Authority, are currently working with the EA, the five district councils (of which one is Cherwell District Council) and Thames Water to develop a SWMP. There are no further details available as to the timescale for publication.

2.2.4 Flood and Water Management Act (2010)

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

Further standards and guidelines, which will determine the full extent of the Act, are yet to be published. However, the forthcoming National Standards for SUDS and Oxfordshire County Council's role as SUDS approval body will need to be considered as part of the final scheme.

2.2.5 National Standards for Sustainable Drainage (Consultation Draft – December 2011)

As a requirement of the Flood and Water Management Act, the Government must publish National Standards and consult on them prior to publication. These standards are likely to address the design, construction, maintenance and operation of drainage systems. The National Standards for sustainable drainage consultation draft has been published in December 2011 and covers:

- The runoff destination – with the public sewer as the last resort for the receiving system
- The peak rate of runoff.
- The volume of runoff.
- The visibility, adaptability and biodiversity of SUDS features.
- The water quality treatment.

The standards also introduce the concept of the SUDS Approving Bodies (SAB). These bodies are likely to be the same as the Lead Local Flood Authority i.e. for this location it will be Oxfordshire County Council. Once the SAB is set up, the SAB will be required to adopt any approved SUDS unless it serves a single property or forms part of a public highway, provided it meets the design standards specified in the National Standards for SUDS. Considering the timescale for development and operation of the site, it is likely that the National Standards will apply to the development and the surface water management strategy will need to be designed accordingly. The SAB will be required to adopt any SUDS features that form part of the development unless suitable alternative management procedures are in place.

2.2.6 Land Drainage Act (1994)

There have been various updates to the Land Drainage Act, but essentially the Act consolidates the enactments relating to internal drainage boards, and to the functions of such boards and of local authorities in relation to land drainage.

The Land Drainage Act sets out the responsibilities of various authorities and stakeholders in relation to the management, maintenance and ownership of watercourses, and allows those stakeholders responsible to produce their own land drainage byelaws.

The Birds Brook flows between Ruscote Avenue and Southam Road and is part culverted and part open channel through the site and adjacent Kraft factory site. This is classified as an Ordinary Watercourse and riparian owners are responsible for its maintenance. Therefore the site owners will be responsible for the channel and culverts within the site.

2.2.7 Interim Code of Practice for Sustainable Drainage Systems (2004)

The Interim Code of Practice for SUDS is a national developer guidance document which sets out the best practice design measures for SUDS.

This Code of Practice provides support for developers in promoting and implementing a sustainable approach to water management and in particular Sustainable Drainage Systems (SUDS), to ensure their long-term viability and to promote consistent application. The document summarises key requirements that should be considered and adhered to before SUDS are installed and commissioned. These are considered further in **Section 6**.

The principles of the Interim Code of Practice for Sustainable Drainage Systems are to be adopted under the forthcoming National Standards for SUDS (**section 2.2.5**).

2.2.8 Sewers for Adoption (2006)

Sewers for Adoption is the standard in England and Wales for the design and construction of sewers to adoptable standards. It is a guide to assist developers in preparing their submission to a Sewerage Undertaker prior to entering an Adoption Agreement under Section 104 of the Water Industry Act of 1991.

Detailed design of the final on-site drainage system will need to consider, as appropriate, the relevant standards if it is to be adopted.

2.3 Regional Policy and Guidance

2.3.1 Thames River Basin Management Plan, EA (Thames Region) (December 2009)

The River Basin Management Plan focuses on achieving protection, improvement and sustainable use of water and is a requirement of the Water Framework Directive (WFD). The plan identifies the management of future development as one of the key aspects which can influence achievement of the WFD requirements.

The plan identifies historic urban development as being responsible for some of flood risk and water quality issues faced within the region. The plan places particular emphasis on ensuring that all development considers the requirements for adequate infrastructure and potentially improve levels of water quality, availability and flood risk.

The site is located in the north western part of the Thames River Basin. The Birds Brook is not referenced specifically within the Thames River Basin Management Plan. The River Cherwell in the vicinity of the site is currently classed as 'good ecological' status and the groundwater is classed as 'good chemical quality'. It is therefore a requirement that the development is designed to ensure no adverse impact on the River Cherwell and surrounding area in terms of water quality, availability and flood risk.

2.3.2 Thames Catchment Flood Management Plan, EA (December 2009)

Banbury lies within the Thames Catchment Flood Management Plan (CFMP) unit. The Birds Brook is not referenced within the CFMP. However, the River Cherwell located approximately 600m from the site, falls within the Towns and villages in open floodplain (north and west) sub-area (Sub Area 1), which is predominantly comprised of undeveloped floodplain with villages and market towns. The preferred policy (Policy 6) for the sub area is categorised as 'an area of low to moderate flood risk

where the EA will take action with others to store water or manage run-off in locations that provide overall reduction or environmental benefits.'

The CFMP does not mention any specific actions for the River Cherwell area but the EA has set out the following proposed actions to implement Policy 6:

- *We want to maintain the existing capacity of the river systems in developed areas that reduces the risk of flooding from more frequent events.*
- *We will identify locations where the storage of water could benefit communities by reducing flood risk and providing environmental benefits (by increasing the frequency of flooding) and encourage flood compatible land uses and management. For example in the Roding catchment, planned flood storage will reduce the risk to local communities and larger urban areas downstream.*
- *We will work with Local Planning Authorities to retain the remaining floodplain for uses that are compatible with flood risk management and put in place policies that lead to long-term adaptation of urban environments in flood risk areas.*
- *We will continue to increase public awareness, including encouraging people to sign-up for the free Floodline Warnings Direct service.*
- *We will help communities and local authorities manage local flood risk. This could include flood resilience (for example in Witney and Bampton), community flood plans that identify vulnerable people and infrastructure and community based projects (for example in East Hanney).*

The flood risk to the site and potential mitigation measures required are considered in **Section 5**.

2.4 Development Planning Background and Local Planning Policy

2.4.1 Cherwell District Council Local Plan and Draft Core Strategy

Relevant policies in the Draft Core Strategy include Policy SD 1 (Mitigating & Adapting to Climate Change) and Policy SD6 (Sustainable Drainage Systems). These highlight the importance of minimising the risk of flooding and making use of sustainable drainage methods.

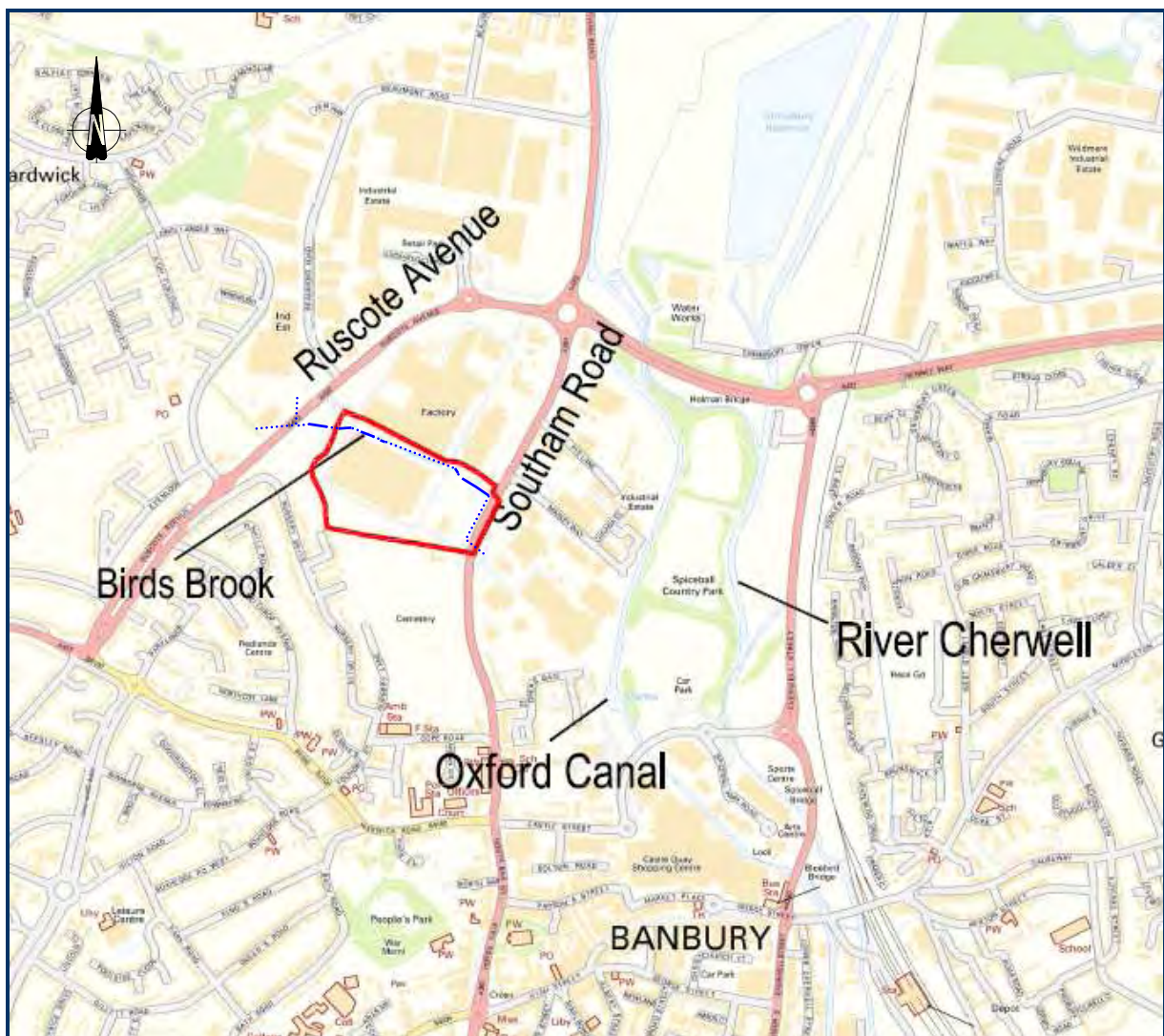
2.4.2 Level 1 Strategic Flood Risk Assessment (April 2009)

The Level 1 Final Strategic Flood Risk Assessment (SFRA) for Cherwell District Council was completed in April 2009 by Scott Wilson. Mapping within the SFRA is based on EA modelled floodplain levels and floodplain mapping from their Cherwell (Banbury) Flood Mapping Study completed in 2005 (now superseded). The mapping indicates that the entire site is located in Flood Zone 1.

3 Site Location & Description

3.1 Development Location and Plan

The site is located to the north west of Banbury town centre on Southam Road, as shown in **Figure 1**. A site location plan (drawing number **26004/005/001** is included in **Appendix A**. The culverted sections of the Birds Brook are shown in a blue dashed line and the open channel sections highlighted blue.



Contains Ordnance Survey data © Crown Copyright and database right 2011

Figure 1 Location Plan and Key Watercourses

The site is currently Brownfield and forms the southern part of the existing Kraft factory site. The site is bound by the Kraft staff car park to the west and Southam Road to the east. A cemetery is located to the south of the site. The site currently comprises industrial units and a grassed area in the east of the site.

3.1.1 On-site Watercourses

A tributary of the River Cherwell, the Birds Brook, is culverted upstream of the site and discharges into open channel at the western site boundary, just downstream of Ruscott Avenue. The Brook flows through the north western and north eastern parts of the site passing through a number of culverts and beneath a building within the larger Kraft site area. The Brook enters a culvert at the eastern site boundary. This culvert turns sharply to the south and runs parallel to Southam Road along the eastern site boundary and then passes underneath Southam Road. **Figure 2** shows the open channel and culverted sections of the Birds Brook throughout the site. The key culvert dimensions are stated below.

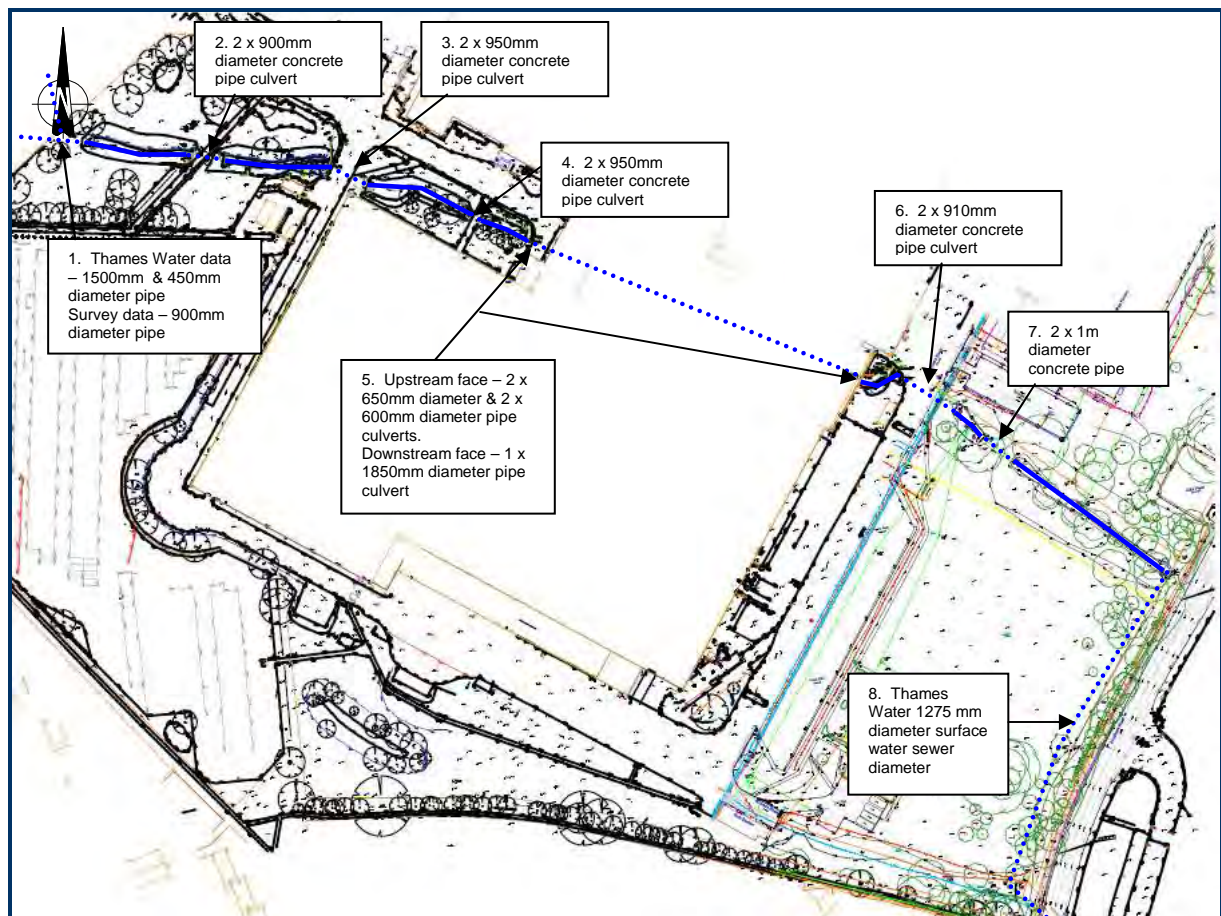


Figure 2 Plan of Birds Brook indicating key culverts

(Based on topographical survey drawing 11097 by ST Associates in February 2012)

At the western end of the site, the open channel of the Birds brook is approximately 1.3m wide and 0.3m deep. However, the watercourse flows through a two stage channel and the bank width at the top of the channel is approximately 6m wide and 1.4m deep. A typical cross section is shown in **Figure 3**.



Figure 3 View looking upstream along open channel of Birds Brook at western end of site

The Birds Brook flows mainly in open channel from the western site boundary but is culverted underneath access roads. The Birds Brook then enters a 120m long culverted section. This commences as two 650mm diameter pipes and two 600mm diameter pipes and combines into a single 1850mm diameter culvert underneath the building.

At the eastern end of the site the open channel of the Birds Brook is approximately 1.5m wide and 0.4m deep. However, the watercourse flows through a two stage channel and the bank width at the top of the channel is approximately 4m wide and 1.5m deep. The Birds Brook enters a 1275mm Thames Water culvert at the eastern site boundary. This culvert runs in a southerly direction, parallel to Southam Road before passing underneath Southam Road at the south eastern site corner.

3.1.2 Off site Watercourses and Flood Defences

The River Cherwell flows through Banbury town centre. At this location, it is designated Main River and flows in a south easterly direction approximately 600m to the east of the site. The Banbury Flood Alleviation Scheme (FAS) is currently under construction and due to be completed in Spring 2012. It will reduce the risk of flooding from the River Cherwell throughout Banbury.

3.2 Local Ground Conditions

British Geological Survey mapping in the Envirocheck report (included in the Ground Stability and Phase 1 Contaminated Land Risk Study Report dated February 2012) for the site confirms that the site is underlain by Lower Lias Clay which is defined as non aquifer and is therefore relatively impermeable. The south eastern corner of the site, adjacent to the Birds Brook is classified as minor aquifer.

The Ground Stability and Phase 1 Contaminated Land Risk Study Report states that the site is underlain by Charmouth Mudstone. A review of online EA mapping and correspondence from the EA indicates that the site is not located within an EA Groundwater Source Protection Zone.

3.3 Topography

Topographical survey of the site was undertaken ST Associates in February 2012 providing level data to OSGPS datum. A copy of the final topographical survey is included in [Appendix B](#).

The majority of the site is impermeable comprising buildings, car parking and access yards. However, the eastern part of the site consists of a grassed area and there is grassed landscaping including a small bund in the southern part of the site.

Ground levels within the grassed area in the eastern part of the site generally slope down in a north easterly direction, ranging between approximately 94.8mAOD to 95.7mAOD. Bank levels along the right (southern) bank of the Birds Brook are approximately 93.8mAOD in this area.

Ground levels slope up in a westerly direction in the area to the south of the existing units, with ground levels rising from approximately 95.7mAOD to the south east of the units up to approximately 97.9mAOD to the south west of the existing units, adjacent to the staff car park.

Ground levels in the adjacent Kraft staff car park are significantly higher and range from 98.9mAOD up to 102.7mAOD.

Road levels at Southam Road are approximately 93.9mAOD at the north eastern site corner, sloping up to approximately 94.1mAOD at the south eastern site corner.

3.4 Development Proposals

The illustrative masterplan is shown on drawing number 11619/0200 Rev C dated February 2012 and a copy is included in [Appendix C](#). The proposed development will provide:

- 75, 574m² (60,000 sq ft) foodstore
- Petrol filling station
- Up to 7, 432m² (up to 80,000 sq ft) non food retail
- 712 car parking spaces with 24 disabled spaces.

4 Stakeholder Consultation

4.1 Environment Agency

Correspondence from the EA (dated 21st December 2011) confirmed the following:

- There are no formal flood defences for the Birds Brook in the area and the Banbury Flood Alleviation Scheme will not affect the site.
- The EA cannot provide a flood warning service for the area. The area of Banbury at the confluence of the Birds Brook and River Cherwell (downstream of the site) is covered by a Flood Alert Area and a Flood Warning Area.
- A 5m buffer zone is required either side of an ordinary watercourse
- The site is situated on Charmouth Mudstone classified as unproductive strata
- The site does not lie within a Source Protection Zone.

A copy of the correspondence is included in [Appendix D](#).

Further liaison with the EA Development and Flood Risk Team confirmed that the site is located in Flood Zone 1 and there are no recorded incidences of historic flooding.

4.2 Thames Water

Thames Water public sewer records have been obtained. Upstream of the site, the Birds Brook flows in a 1500mm diameter surface water sewer. Just before the western site boundary, a 450mm diameter surface water sewer joins the 1500mm diameter sewer. However, topographical survey data indicates that the outfall to the site is a 900mm diameter culvert.

The open channel section of the Birds Brook within the site enters a 1275mm diameter Thames Water surface water sewer at the north eastern site boundary. This sewer runs just inside the eastern site boundary before running under Southam Road at the south eastern site corner and flowing in a south easterly direction, eventually outfalling to the Oxford Canal.

A copy of the records is included in [Appendix D](#).

4.3 Oxfordshire County Council

4.3.1 Drainage Team

Correspondence from the County Drainage Engineer (dated 3rd January 2012) states that the Birds Brook system is owned by Thames Water upstream and downstream of the site. It also states that the ditch and culvert system throughout the site is owned and maintained by Kraft.

Flooding occurred in July 2006 on Ruscote Avenue caused by a bad joint in the pipe system under the road and the right angled bend that the watercourse takes in the site. County drainage engineers relaid the pipework and there have been no incidences of flooding since.

The County Council have confirmed that “*there will be no issues*” with adopting SUDS under the Flood and Water Management Act and their role as the Local Lead Flood Authority.

A copy of the correspondence is included in [Appendix D](#).

4.3.2 Highways Team

Correspondence from the Highways Engineer at Oxfordshire County Council (dated 13th December 2011) confirmed that the majority of the surface water sewer network in the vicinity of the site is owned by Thames Water. There is a small length of highways drainage infrastructure along Ruscote Avenue to the north west of the site, which is maintained by Oxfordshire County Council.

The Council confirmed that the Thames Water surface water system in Ruscote Avenue discharges to the Birds Brook at Ruscote Avenue. The Birds Brook flows through the Kraft site and then rejoins the Thames Water network along Southam Road.

A copy of the correspondence and a plan showing the surface water drainage system in the vicinity of the site is included in **Appendix D**.

4.4 Cherwell District Council

Correspondence from Cherwell District Council (dated 23rd December 2011) confirms that the District Council no longer has a drainage team and that all drainage related matters are now covered by the County Council.

A copy of the correspondence is included in **Appendix D**.

5 Flood Risk Assessment

5.1 Sources of Flooding

PPS25 states that all potential sources of flooding should be considered. Data provided from the consultation and review of other information confirms:

Fluvial Flooding

The River Cherwell flows in a south easterly direction approximately 600m to the east of the site. It is designated Main River at this location. Furthermore, the Birds Brook, an ordinary watercourse flows through the northern part of the site and is part culverted throughout the site. As such the site is potentially at risk of fluvial flooding and this is assessed in more detail in [Section 5.4](#).

Tidal/Coastal Flooding

Due to the inland location of the development area there is no risk of tidal/coastal flooding at this location.

Groundwater

EA correspondence confirms that the site is not at risk of flooding from groundwater.

Surface Water Flooding

Thames Water has confirmed that the site has not been affected by surface water flooding.

Foul Water

Thames Water has confirmed that the site has not been affected by foul water flooding.

5.2 Historic Flooding

Oxfordshire County Council confirmed that Ruscot Avenue has been affected by flooding in July 2006 due to faulty pipework in the surface water sewer network and the right angled bend that the Birds Brook passes through in the site. Maintenance works were carried out and there have been no flooding incidences since.

5.3 Flood Defences

The EA has confirmed that there are no formal flood defences in the area and the Banbury Flood Alleviation Scheme will not affect the site.

5.4 Fluvial Flood Risk to Site

Potential fluvial flooding from the River Cherwell and the Birds Brook is assessed in this section.

5.4.1 River Cherwell

The EA provided detailed Flood Mapping (a copy is included in [Appendix D](#)). The site is shown to be located outside of the 0.1% annual probability (1 in 1000 year) flood extent and is therefore indicated to lie in Flood Zone 1 as defined in Table D.1 in PPS25.

The EA also provided modelled flood levels from the Cherwell (Banbury) Flood Study completed in February 2011. The nearest model node to the site is OXC055. The 0.1% annual probability (1 in 1000 year) modelled flood level for this model node is 92.22mAOD. Ground levels within the site are greater than 94mAOD and, notwithstanding the fact there is no evidence of an overland flow route to the site, it is therefore at a very low probability of flooding from the River Cherwell.

A copy of the modelled flood levels is included in [Appendix D](#).

5.4.2 Birds Brook

The EA Flood Map does not indicate a floodplain associated with the Birds Brook. Correspondence from Oxfordshire County Council confirms that Ruscote Avenue in the vicinity of the site has been affected by flooding from the Birds Brook due to faulty pipe work and maintenance works have since been carried out.

To assess potential flood risk to the site from the Birds Brook, flows in the open channel at this location are estimated and the channel capacity is calculated from the topographical survey and channel details. The flow can be estimated from the overall catchment and also from a review of the inflow pipe size and gradient. Both estimates have been made and the highest flow considered.

Flows in Birds Brook

A flow estimate using WINFAP-FEH version 3 based on FEH CD-rom data (version 3) for the Birds Brook catchment to the site estimated the 1% annual probability (1 in 100 year) flow to be $0.99\text{m}^3/\text{s}$. This is based on the overall catchment and an estimate of urbanisation. It should be noted that the Birds Brook primarily receives flow from storm drains in the area, and therefore, the potential flow in the watercourse based on catchment area to the site could be very different. However, it would be limited by the pipe sizes in the network.

Pipe Capacity Calculations

HR Wallingford hydraulic design tables (8th edition) have been used to estimate the full bore pipe capacity of the inflow culvert to the site and the outfall culvert (marked 1 and 8 on [Figure 4](#)) to be approximately $2.23\text{m}^3/\text{s}$ and $6.8\text{m}^3/\text{s}$ respectively (the inflow culvert has been assumed to be 900mm diameter from topographical survey data). The parameters used are shown in [Table 1](#).

Culvert	Size (mm)	Gradient	Roughness (ks value)	Full Bore Capacity (m^3/s)	Average Full Bore Capacity (m^3/s)
1 (Inflow)	900	0.01	0.6	1.99	2.23
			0.06	2.46	
8 (Outflow)	1275	0.015	0.6	6.08	6.79
			0.06	7.49	

Table 1 Pipe capacity estimations

Southam Road Retail Park, Banbury

Flood Risk Assessment

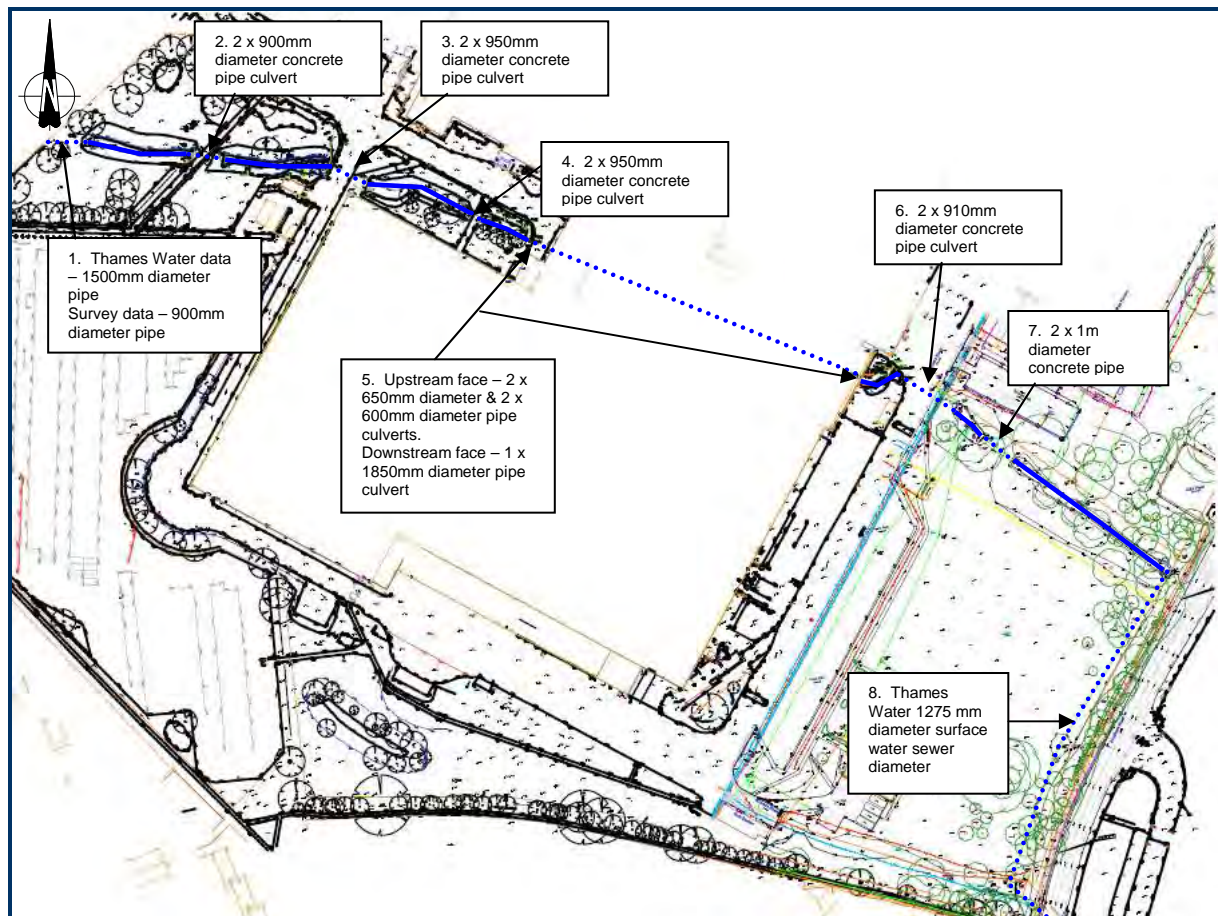


Figure 4 Plan of Birds Brook indicating key culverts

(Based on topographical survey drawing 11097 by ST Associates in February 2012)

Channel and Culvert Capacities

The culvert dimensions increase in size throughout the site and will not act as a constraint to flows. The channel capacity has been estimated based on the following parameters:

- Discharge estimated using Mannings 'n' equation
- Channel dimensions stated in section 3.1.1 (bank width of 6m, depth of 1.4m)
- Channel gradient of 0.011 (based on topographical survey data)
- Mannings 'n' of 0.035 for natural channels

Using the above parameters, the two stage channel of the Birds Brook has an estimated capacity of over $10\text{m}^3/\text{s}$.

As the maximum inflow to the western end of the Birds Brook is $2.23\text{m}^3/\text{s}$ and the two stage channel capacity is for a flow of greater than $10\text{m}^3/\text{s}$, there is a low probability of flooding at the site. This concurs with anecdotal information that the Birds Brook may run full but not overtop.

5.5 Impact of the Proposed Scheme on Fluvial Flood Risk

The development proposals include the realignment and deculverting of some sections of the Birds Brook throughout the site with the potential for some channel improvements.

The design will be outlined at the detailed design stage, however, general design principles will be adhered to, to ensure that the proposed channel capacity is sufficient to accommodate the inflow to the site.

5.6 PPS25 and Sequential Test

The site is located in Flood Zone 1 and therefore there is no requirement to apply the Sequential Test as defined in PPS25 as the site is already located in an area with the lowest possible flood risk.

PPS25 classifies retail use as a 'Less Vulnerable' land use type. This is a compatible land use for Flood Zones 1, 2 and 3a, as shown in Table D3 in **Figure 5** and the Exception Test is not applicable.

Table D.3²²: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	✗	✗	✗

Key:
✓ Development is appropriate
✗ Development should not be permitted

Figure 5 Extract of Table D3 from PPS25

5.7 Design Considerations

The site is shown to be in Flood Zone 1 and there is a low probability of flooding from the Birds Brook. However, flood risk can be further mitigated through design of the scheme. In addition, further benefits may be achieved through appropriate management of the watercourse.

5.7.1 Deculverting

As outlined in **section 5.5**, currently over 120m of the Birds Brook flows in a culvert throughout the site. The illustrative masterplan (11619-0200) shows a scheme where the Birds Brook is realigned and deculverted for a substantial length, through the majority of the site. This will reduce the residual risk of flooding as the risk of culvert blockages will be greatly reduced.

Where deculverting takes place, the new channel form will be designed to ensure no reduction in the channel capacity. Preliminary calculations indicate that a 2.5m wide channel at least 1m deep will provide sufficient capacity.

The following design considerations are also recommended:

5.7.2 Recommended Finished Floor Levels

In order to minimise the risk of flooding from the watercourse or surface water flooding, it is recommended that finished floor levels are set above proposed ground levels in the adjacent areas or car parks to reduce the risk of flooding to the units.

5.7.3 Buffer Zone

The Birds Brook is an Ordinary Watercourse and the EA therefore requires a buffer zone of 5m to be provided either side of the watercourse.

5.7.4 Maintenance of watercourse

The Birds Brook is an ordinary watercourse and therefore the riparian owner (i.e. site owner) is responsible for the maintenance of the watercourse. It is recommended that ground maintenance staff on site undertake regular clearances of culvert trash screens and inspection of culverts to reduce the risk of flooding due to blockages.

5.8 Potential Impact of Climate Change on Fluvial Flood Risk

PPS25 states that any Flood Risk Assessment should take into account the effects of climate change when assessing fluvial and surface water flood risk. According to Table B2 in PPS25, an increase of 20% on peak river flows should be taken into account when assessing the potential changes in the nature of fluvial flood risk to the site over its 'lifetime' (estimated to be 50 years).

The potential impacts of climate change on the Birds Brook include increasing the inflow into the watercourse. The channel has sufficient capacity throughout the site to accommodate a 20% increase in flows.

6 Surface Water Management

This section outlines the proposals for the management of surface water runoff from the development in accordance with National and Regional policy requirements, and best practice guidance

6.1 Planning Policy: Management of Surface Water Runoff

6.1.1 National Policy

PPS25

PPS25 Annex F paragraph F5 states that 'The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land.'

PPS25 Annex F paragraph F6 states that 'Surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. This should be demonstrated as part of the flood risk assessment.'

PPS25 recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites through the use of sustainable drainage systems (SUDS), this being complementary to the control of development within the floodplain.

The latest guidance on the use of SUDS is provided in 'The SUDS Manual' by CIRIA (ref: C697 dated March 2007). This defines SUDS as 'Surface water drainage systems developed in line with the ideals of sustainable development....the philosophy of SUDS is to replicate, as closely as possible, the natural drainage from a site before development.' As such, SUDS drainage can be in a variety of forms, including infiltration trenches, swales, permeable surfaces, green roofs and underground storage.

The EA encourages the use of SUDS to prevent the water environment being adversely affected by increased surface water runoff and the increased risk of pollution and in particular diffuse pollution.

Table B2 of PPS25 states that an increase of 20% over the 1990 peak rainfall intensity is suggested as a suitable allowance for the impact of climate change up to 2085. This has been incorporated into the quick storage estimate outlined in **Section 6.4**.

Pollution Prevention Guidelines (PPG7): The safe operation of refuelling facilities (July 2011)

Management of surface water runoff from the proposed petrol filling station will require specific pollution prevention measures as outlined in 'Pollution Prevention Guidelines (PPG7): The safe operation of refuelling facilities' (July 2011). This is discussed further in **section 6.5**.

6.1.2 Local Planning Policies

The Cherwell District Council Draft Core Strategy (February 2010) defers to general guidance documents (PPS25) to be used in assessing and designing suitable strategies for managing surface water runoff from new development.

Oxfordshire County Council has taken on the role of Lead Local Flood Authority following the requirements of the Flood and Water Management Act and will also take on the role of the SUDS Approval Body for the county. The County Council have confirmed that "*there will be no issues*" with

adopting SUDS under the Flood and Water Management Act and their role as the Local Lead Flood Authority.

6.1.3 Building Regulations Surface Water Drainage Hierarchy

The Building Regulations Requirement H3 stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- a) An adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable;
- b) A watercourse, or where that is not practicable;
- c) A sewer.

6.2 Infiltration Potential

According to Building Regulations Part H, infiltration should be the first preference for the disposal of runoff from roof and paved areas.

The Ground Stability and Phase 1 Contaminated Land Risk Study Report (February 2012) states that the underlying Charmouth Mudstone Formation is classified as 'Unproductive Strata'. Unproductive Strata are rock layers or drift deposits with low permeability that has negligible significance for water supply of river base flow.

The site has a history of industrial and commercial use and therefore there is a greater pollution potential to groundwater at the site

For the purposes of the FRA the use of infiltration measures has been ignored in estimating attenuation requirements and in outlining the surface water management strategy. Should site investigation indicate suitable conditions and the final scheme include infiltration measures, the storage requirements for the surface water strategy may be revised accordingly.

6.3 Existing Regime for Surface Water Runoff

Surface water runoff from the site currently drains to the Birds Brook along the northern site boundary. The site is drained by a piped surface water system with multiple outfalls along the Birds Brook. The Kraft staff car park in the western part of the site is not to be developed. The total proposed development area within the site boundary that currently discharges to the watercourse is 3.2ha.

6.3.1 Assessment of Existing Drainage System

An assessment of the existing drainage system was made based on the following topographical survey and drainage record data:

- Development Land Site Survey - drawing number 23456-01-B dated August 2008 supplied by Kraft (a copy is provided in [Appendix E](#))
- Additional survey data provided by ST Associates in January 2012
- Storm Water System Survey - drawing number 21180-01-C dated February 1999 supplied by Kraft (a copy is provided in [Appendix E](#)).

The area of the sub catchment draining to each outfall has been assessed from the plans. [Table 2](#) summarises the data for each sub catchment. The existing drainage regime and sub catchments are shown on drawing [26004/005/002](#) in [Appendix A](#).

Sub Catchment	Impermeable Area (ha)	Outfall Ref	Outfall Diameter (mm)	Outfall Invert Level (mAOD)
Sub Catchment 1	0.079	1	100	93.77
Sub Catchment 2	0.066	2	225	93.83
Sub Catchment 3	2.11	3	375	93.72
Sub Catchment 4	0.321	4	225	94.99
Sub Catchment 5	0.628	5	450	95.28
TOTAL	3.2			

Table 2 Existing surface water drainage sub catchments and outfall details

The eastern part of the site is currently a grassed area. The Greenfield runoff rate for this part of the site has been estimated using the ICP SUDS Greenfield runoff rate methodology and calculated using the ICP SUDS calculator in WinDes MicroDrainage for the site location. The site area and general characteristics of the catchment have been determined using the topographical survey for the site. Rainfall and catchment descriptors have been determined using FEH CD-ROM (2009) data for the area. The Greenfield runoff rates for the site are as follows (a copy of the calculations is provided in **Appendix E**):

$Q_{bar} = 4l/s/ha$ (mean annual flood)

$Q_{30} = 9.1l/s/ha$ (3.33 % annual probability – 1 in 30 year)

$Q_{100} = 12.8l/s/ha$ (1 % annual probability – 1 in 100 year)

6.4 Outline Strategy for Management of Surface Water

Currently, the 3.2ha impermeable developable area discharges to the Birds Brook unattenuated. The proposed scheme will continue to discharge 3.2ha unattenuated and discharge the remainder of the development site at the Greenfield runoff rate with attenuation provided on site to achieve this.

It is proposed that surface water from the roof and service yard areas, the petrol filling station and part of the car park will be drained unattenuated (but will be intercepted and treated with appropriate pollution control measures) and ultimately discharge to the watercourse. The forecourt of the petrol station will drain in accordance with PPG7 (see section 6.5).

The proposed impermeable area of the units, service yards, car park and petrol filling station to be drained unattenuated is shown on drawing number **26004/005/003** in **Appendix A**. The total impermeable area to be drained unattenuated is 3.2ha. This is comparable to the current impermeable area draining to the watercourse. As such, there will be no increase in either the volume of water discharged or the peak flow rate from the area in comparison with the existing impermeable area

The remainder of the development i.e. rest of the car park, is proposed to positively drain at a discharge rate limited to Greenfield runoff rates. The proposed car park area to be drained at a restricted Greenfield rate is 1.15ha (i.e. the residual proposed impermeable area). Runoff from the carpark will be collected and routed by a gravity system to an outfall downstream of the foodstore at the allowable discharge rate to the Birds Brook as shown on drawing number **26004/005/003**. Flow control measures such as a hydrobrake will restrict the runoff rate from the car park to the allowable discharge rate entering the piped system serving the foodstore. Attenuation is to be provided in shallow sub base replacement storage beneath the car park.

6.4.1 Design Criteria for Surface Water Drainage Strategy

The preliminary surface water drainage strategy is shown on drawing number **26004/005/003** in **Appendix A**. The preliminary surface water management strategy has been developed in line with general EA requirements and hierarchy of drainage options laid out in Part H3 of the Building Regulations, as stated in **Section 6.1.3**. A copy of the calculations is included in **Appendix E**.

The preliminary surface water drainage strategy has been prepared utilising the following principles:

- For the car park –
 - For rainfall events up to the 1 in 30 year, all runoff from the site will be limited to the respective Greenfield runoff rate.
 - For rainfall events above the 1 in 30 yr and up to the 1 in 100 year plus climate change rainfall event, all runoff from the site will be limited to the Q_{30} Greenfield runoff rate.
- For the roof, service yard area and petrol filling station and some areas of the car park (totalling 3.2ha)– unattenuated discharge to match existing roof and service yard areas drained unattenuated to the watercourse, with runoff to be intercepted and treated before discharging to the Birds Brook
- Total proposed impermeable area of 4.35ha including 2.35ha (roof area, petrol station and service yard) and 2ha (car park) (based on illustrative masterplan drawing number 11619-0200)
- Total area to be drained unattenuated is 3.2ha. The residual impermeable area to be drained attenuated is 1.15ha.
- 20% additional allowance on rainfall intensity to account for the potential impacts of climate change (as per Table B2 in PPS25 for lifetime of development estimated to be 50 years to year 2066).
- FEH rainfall data and Cv of 0.85 used in Quick Storage Estimates

Using the above parameters, WinDes Quick Storage Estimates have been produced to provide an indication of the volume of storage that would be required on site to provide the necessary attenuation in the car park areas for rainfall events up to the 1% annual probability (1 in 100 year) event plus an additional allowance of 20% on rainfall intensity to account for the potential impacts of climate change.

For events up to and including the 1 in 30 year plus climate change rainfall event, surface water will be attenuated in below ground storage units with a volume of 480m^3 to be provided. It is proposed to store excess surface water runoff between the 1 in 30 year plus climate change rainfall event and the 1 in 100 year plus climate change rainfall events above ground within the car park area. Therefore the volume of water required to be stored above ground is 230m^3 . Given that the car park area drained is in excess of 1ha, the maximum depth of storage will be significantly less than kerb depth. A copy of the calculations is included in [Appendix E](#).

There is sufficient space beneath the car park to provide the estimated storage volume and an appropriate fall across the car park area can be achieved to allow a gravity outfall to the watercourse assuming a shallow sub base replacement storage using Geocellular modular units with a depth of 0.4m and porosity of 95%.

6.5 Other Issues

Other design issues, in addition to the criteria to satisfy flood risk issues should also be considered at this outline design stage and in masterplanning for the proposed development. These are set out below.

Long term management

Long term management of surface water drainage assets is essential. SUDS such as shallow sub base replacement storage require maintenance in the same way as other drainage systems. As outlined in [section 2.2](#) legal issues with regard to the long term management of SUDS will be resolved through the Flood and Water Management Act. This will give powers to 'SUDS Approving Bodies' to

Southam Road Retail Park, Banbury

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both approve the design and construction of SUDS and later to adopt them, in this case, Oxfordshire County Council.

At an appropriate stage in the scheme, discussions will be held with the SUDS approving body with regard to the design standards and long term adoption.

Exceedance

Whilst the drainage system will be designed to cope with a 1 in 100 year storm, including an allowance for climate change, it is possible that a more extreme event will occur and that the design standard for the system will be exceeded. The final scheme including plot levels will consider the consequences of such an event and a strategy developed to direct flows towards the watercourse at the northern site boundary. It is currently anticipated that temporary storage will be provided in service yards and in the car park and will release storm water to the Birds Brook at a controlled rate.

Pollution Control

Pollution control measures should also be included to minimise the risk of contamination or pollution entering the receiving waterbody from surface water runoff from the development.

The drainage system for the car park, service yards and roof area should therefore be designed to comply with the requirements of the SUDS treatment train as laid out by CIRIA 697 'The SUDS Manual'. Drainage from roof areas requires only 1 stage of treatment, drainage from roads and car parking areas requires two treatment stages and drainage from service yard areas may require up to three treatment stages.

The inclusion of proprietary oil/silt and debris traps as part of the conventional drainage system will provide one level of treatment. Catchpits and trapped gullies within the service yards and car park area are also recommended as a secondary stage of treatment with bypass oil interceptors prior to outfalls. The provision of full interceptor separate system for service yards may be considered. Retention in sub base storage will provide an additional stage of treatment. Permeable paving could be used within some areas of the car park.

The petrol filling station will require specific pollution prevention measures as outlined in 'Pollution Prevention Guidelines (PPG7): The safe operation of refuelling facilities' (July 2011). The guidance recommends that a Class 1 full retention oil separator is the minimum level of protection for the environment. The system should also have a method to close the outlet from the separator – either an automatic or manually operated shut off valve. A full retention separator has the capacity to treat all the runoff from the drainage system. They are used where there is a risk of regular contamination with oil and a foreseeable risk of a significant spill. Additional spill control measures for road tanker delivery such as a dump tank to take the maximum volume of one tanker chamber may also be required.

The guidance also contains the following recommendations:

- Make sure storage containers, pipe work and dispensing equipment are all suitable and compatible for the products used
- Install appropriately sized secondary containment for the container and ancillary equipment
- Design the dispensing area drainage so that it is not connected to surface water drains
- Use trigger nozzles with an auto shut off to dispense products and make sure the nozzle cannot be left in the open position

Southam Road Retail Park, Banbury

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- Provide appropriate pollution control equipment to deal with large and small spills i.e. proprietary spill kits, drain mats, pipe blockers, or permanent valves in drainage systems to provide containment
- Develop an emergency response plan and train staff to deal with a spill or other accident.

7 Summary and Conclusions

This site specific FRA has been prepared for Barwood Developments Ltd to accompany an outline planning application for the proposed A2/A3 development on a 5.63 hectare (ha) site to the north west of the town centre in Banbury, Oxfordshire.

The site is indicated by the EA Flood Map and confirmed by the EA and other data to be located outside of an area at risk of flooding and is therefore indicated to lie in Flood Zone 1 as defined in Table D.1 in PPS25.

A tributary of the River Cherwell, the Birds Brook is culverted upstream of the site and discharges into open channel at the western site boundary, just downstream of Ruscote Avenue. The Brook flows through the north western and north eastern parts of the site passing through a number of culverts and beneath a building within the larger Kraft site area. The Brook enters a culvert at the eastern site boundary. This culvert turns sharply to the south and runs along the eastern site boundary and then passes underneath Southam Road. The EA Flood Map does not indicate a floodplain associated with the Birds Brook. Correspondence from Oxfordshire County Council confirms that Ruscote Avenue in the vicinity of the site has been affected by flooding from the Birds Brook due to faulty pipe work and maintenance works have since been carried out.

An assessment of the culvert capacities leading into, through and out of the site have been undertaken based on Thames Water sewer records and topographical survey data to confirm the flood risk from this watercourse to the site. There is sufficient capacity within the watercourse and culverts throughout the site so the likelihood of flooding at the site from the Birds Brook is confirmed to be low.

The key issue to be addressed by this FRA is therefore the management of surface water runoff from the site. The site is currently drained by a conventional pipe drainage system to the watercourse along the northern site boundary via multiple outfalls. The majority of the existing site is impermeable, although the eastern part of the site consists of a grassed area.

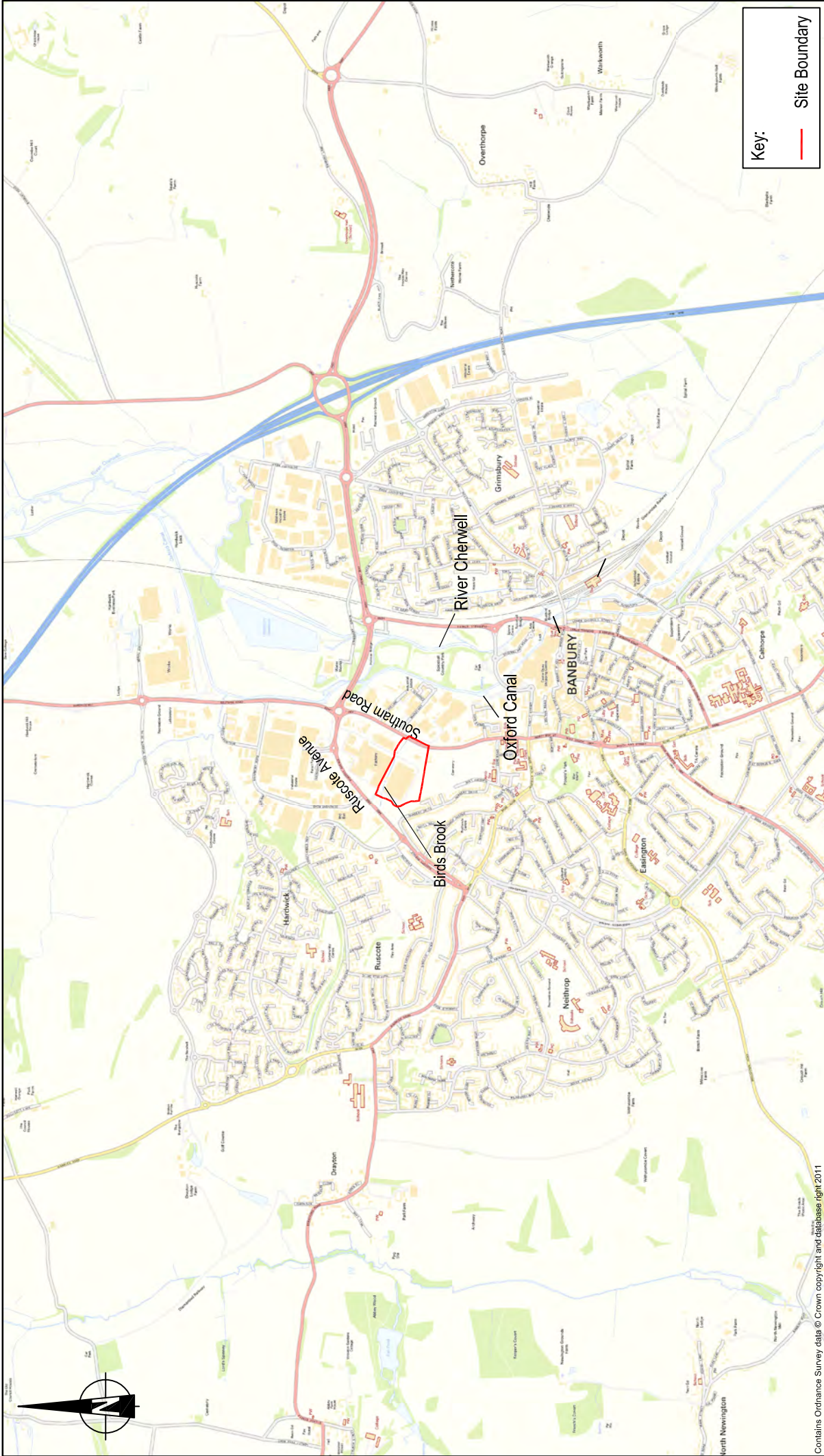
Assessment of the existing drainage system has been undertaken to determine an appropriate allowable discharge rate for the site and to confirm the area currently discharging unattenuated into the Birds Brook.

Currently, the 3.2ha impermeable area discharges to the Birds Brook unattenuated. The proposed scheme will continue to discharge 3.2ha unattenuated (surface water runoff will be intercepted and treated before discharging to the Birds Brook) and discharge the remainder of the development site at the Greenfield runoff rates with attenuation provided on site to achieve this. Attenuation will be provided in shallow sub base replacement storage beneath the car park to provide storage capacity for the system up to the 1% annual probability (1 in 100 year event) with climate change.


The FRA confirms that the proposed development is an appropriate use for the site on the basis of flood risk. Furthermore, it is demonstrated that suitable flood risk mitigation measures and a surface water management strategy can be incorporated into the scheme to ensure that the proposed development does not result in an adverse impact elsewhere on the basis of flood risk.

Appendix A PBA Drawings

Southam Road Retail Park, Banbury
Flood Risk Assessment



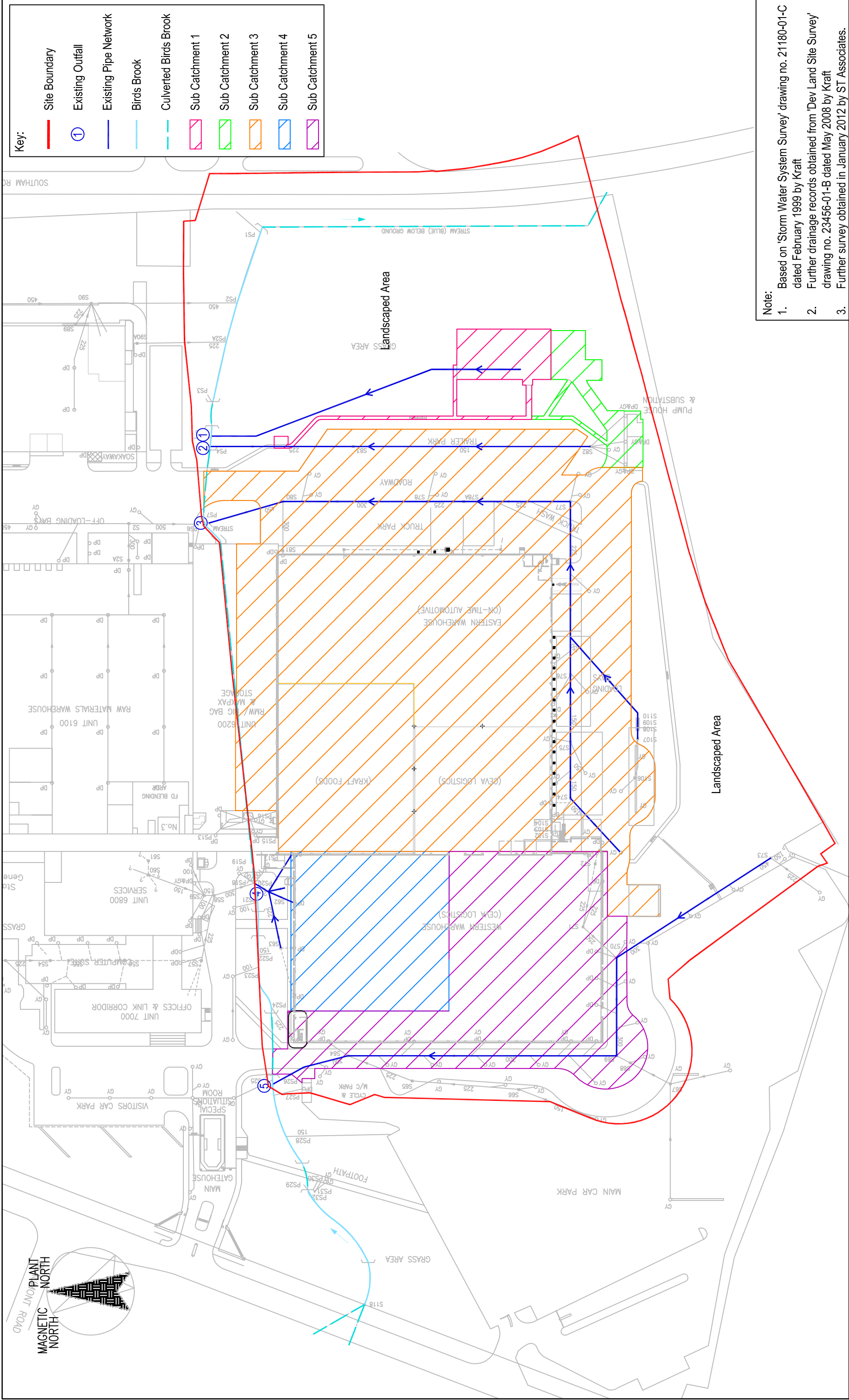
Key:
— Site Boundary

		Client		Barwood Developments Ltd											
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								A4 Scale		NTS		26004/005/001		-	
								Drawn by		SK					
								Checked by		ES					
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Note:

- Based on 'Storm Water System Survey' drawing no. 21180-01-C dated February 1999 by Kraft
- Further drainage records obtained from 'Dev Land Site Survey' drawing no. 23456-01-B dated May 2008 by Kraft
- Further survey obtained in January 2012 by ST Associates.

Mark	Revision	Drawn	Date	Chkd

INFORMATION

Date of 1st Issue	Drawing Number
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A3 Scale	DS	ET
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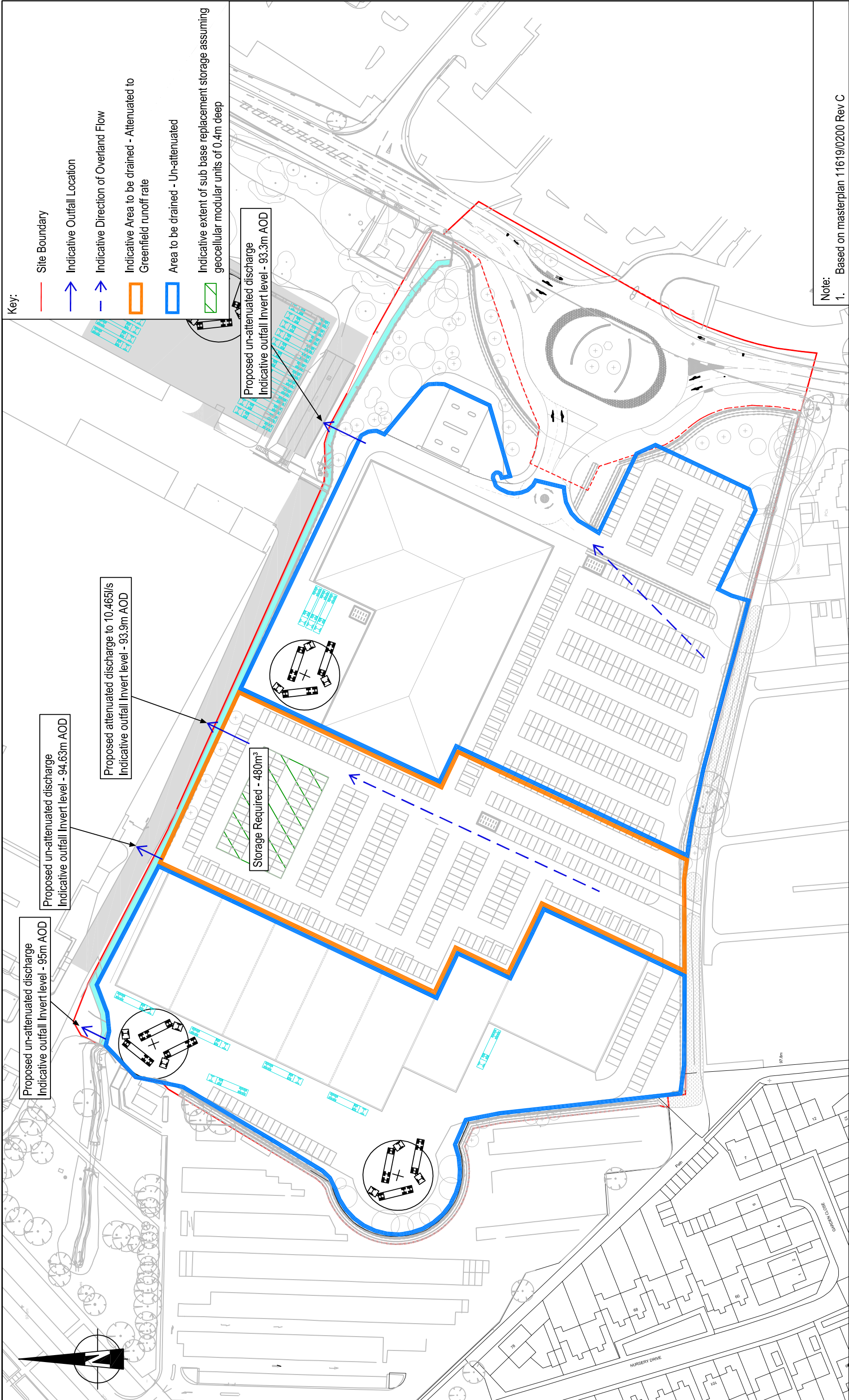
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Southam Road Retail Park, Banbury
Flood Risk Assessment
Existing Surface Water Drainage System

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Note:		1. Based on masterplan 16/19/0200 Rev C	
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INFORMATION			
Date of 1st Issue	17/01/12	Drawing Number	
A3 Scale	1:1250	26004/005/003	
Drawn by	DS	Revision	
Checked by	ET	-	

SOUTHAM ROAD RETAIL PARK, BANBURY

Flood Risk Assessment

Proposed Surface Water Drainage Strategy

Client

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Appendix B Topographical Survey

Southam Road Retail Park, Banbury
Flood Risk Assessment

ABBREVIATIONS (WHERE APPLICABLE)

- BS BULLSLOP
BIC BRITISH TELECOM INSPECTION COVER
CATV CABLE TELEVISION
CBF COLORED BRICKED FENCE
CPS CONCRETE PAVING SLABS
DK DOWN KEYS
EIP EAVES LEVEL
EIP ELECTRICITY POLE
FH FIRE HYDRANT
FW FLOWER BED
FW FLOW WATER
GV GAS VALVE
H HAZARD
HIC HAZARD HEAD LEVEL
IC INSPECTION COVER
IIS ILLUMINATED ROAD SIGN
JB JUNCTION BOX
JIB JUNCTION BOX
MAN MANHOLE
MAN MANHOLE
NB NOTICE BOARD
O/H OVERHEAD
O/H OVERHEAD TELEPHONE
PB POST BOX
P&W POST & WIRE FENCE
R RIDE LEVEL
RL ROAD LEVEL
RW RAW WATER PIPE
SBS SITE BENCH MARK
SP SITE POST
SV WATER STOP VALVE
SW WATER STOP VALVE
TP TELEGRAPH POLE
UTL UTILITY
V VENT
V.P. WATER LEVEL
WM WATER METER

LEGEND

- Photo Station
SBM
Survey Station
Level Position & Value
Overhead Level & Value

DRAWING ISSUE STATUS		
ISSUE	DETAILS	DATE
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BANBURY
OX16 2QU

CLIENT
BARWOOD DEVELOPMENTS LTD
GRANGE PARK COURT
ROMAN WAY
GRANGE PARK
NORTHAMPTON NN4 5EA

EXISTING SURVEY

SITE SURVEY

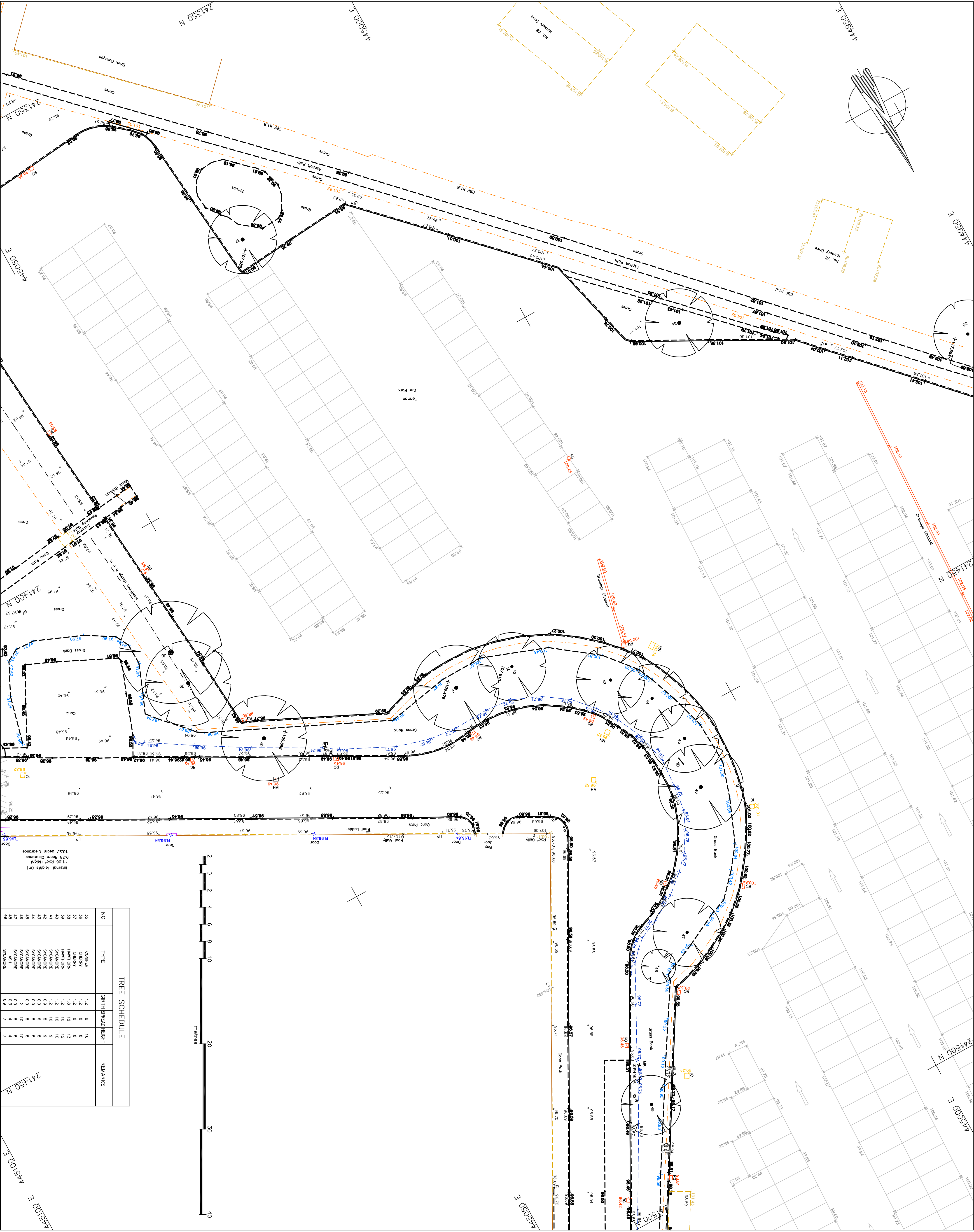
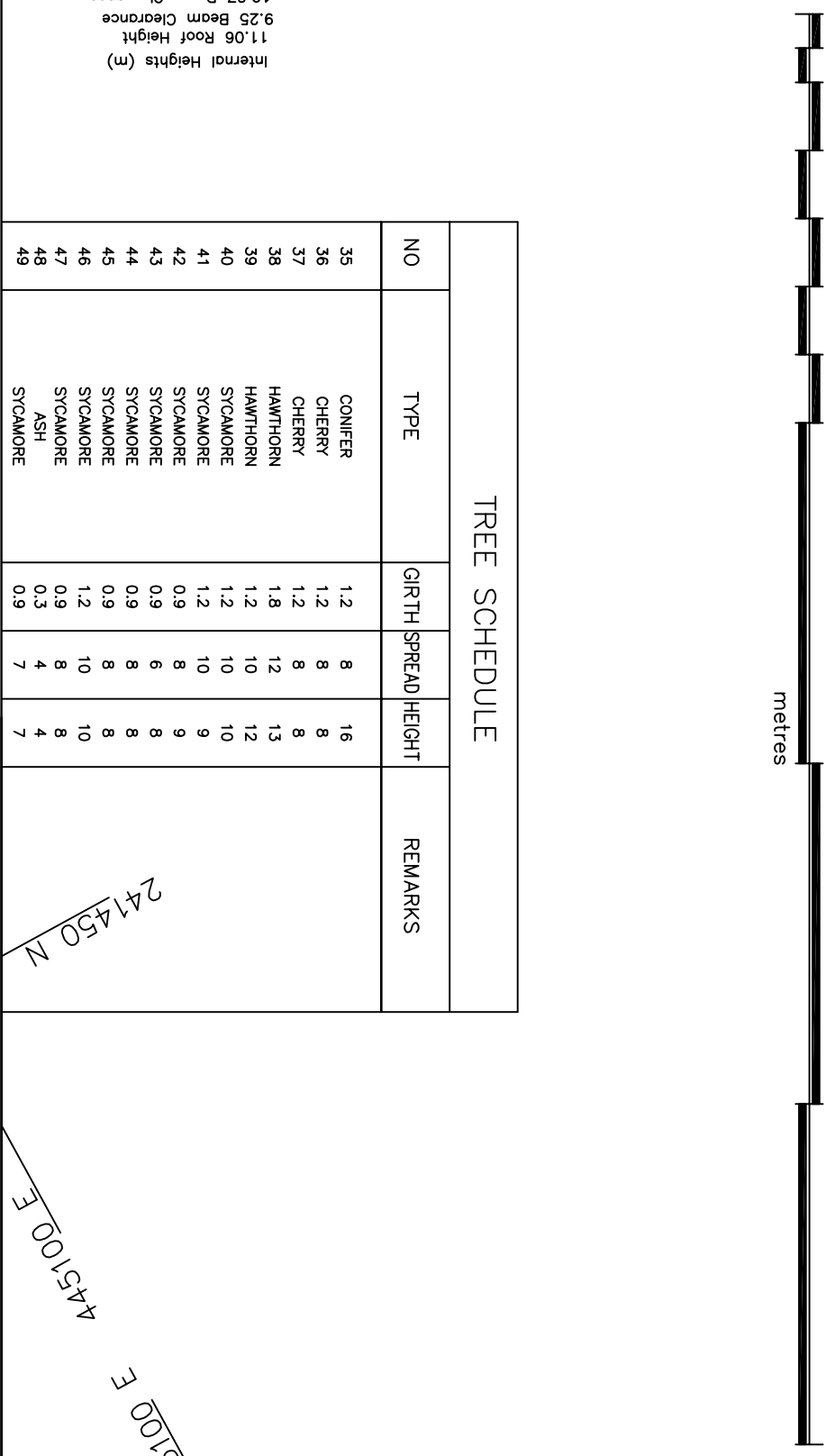
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DATE OF ISSUE	January 2012	CHECKED	IST
SCALE	1:200@A1	DRAWING NO.	11/1097-3
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TREE SCHEDULE		
NO	TYPE	REMARKS
36	CHERRY	
37	CHERRY	
38	CHERRY	
39	CHERRY	
40	CHERRY	
41	CHERRY	
42	CHERRY	
43	CHERRY	
44	CHERRY	
45	CHERRY	
46	CHERRY	
47	CHERRY	
48	CHERRY	



[illegible]

LEGEND	
	Photo Position
	SBM
	Survey Station
	Level Position & Value
	Overhead Level & Value

DRAWING ISSUE STATUS		
ISSUE	DETAILS	DATE
A	Advanced Issue	-/-/-

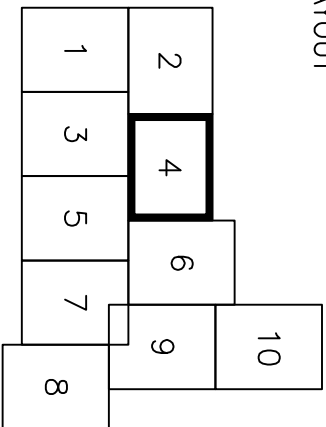
THE SURVEY SHED SHOWN ON THIS DRAWING IS POSITIONED 4450.04 510E, 241.927 007D AND IS ORIENTED TO OS GRID NORTH, BASED ON DATA PROVIDED FROM THE OS REFERENCE STATION THROUGH THE LEICA SMARTEN CORRECTION SERVICE.

THIS SURVEY HAS BEEN CARRIED OUT TO AN ACCURACY OF 1:10000. THEREFORE, DIMENSIONS OF 100 METRES OR GREATER INTERRELATED DIMENSIONS WILL BE WITHIN THE TOLERANCE ASSOCIATED WITH THIS AND SMALLER SCALES ONLY.

ALL LEVELS IN METRES, RELATED TO ORDNANCE SURVEY DATUM (NEWL), BASED UPON STN SP7111111 SITUATED IN PLAT ADJACENT TO BENERGY SOUTHW RAIL, VALUE 94.6, 724M POSITION UNDERGROUND.

UNDERGROUND SERVICES HAVE BEEN SHOWN AS CONNECTIONS TO, AND ARE NOT A TRUE INDICATION OF THE PIPES POSITION UNDERGROUND.

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LOCATION
KRAFT FOODS
BANBURY
OX16 2QU

BARWOOD DEVELOPMENTS LTD
GRANGE PARK COURT
ROMAN WAY
GRANGE PARK
NORTHAMPTON NN4 5EA

PROJECT _____

EXISTING SURVEY _____

SITE SURVEY _____

SURVEYED AND DRAWN BY _____



ST ASSOCIATES
LAND AND ENGINEERING SURVEYORS

WEB HOUSE
4 SOMERSET STREET
NORTHAMPTON
NN1 3LW

Tel: (01604) 603 595
Fax: (01604) 628 364
email: post@stassociates.co.uk

SIA JOB No.	11/1097	SHEET SIZE	A1
DATE OF ISSUE	January 2012	CHECKED	IST
SCALE	1:200@A1	DRAWING NO.	11/1097-4
		ISSUE	A

[illegible]

LEGEND		
	Photo Position	
	SBM	
A	Survey Station	
+ 0.00	Level Position & Value	
+ (xxxx)	Overhead Level & Value	

DRAWING ISSUE STATUS		
ISSUE	DETAILS	DATE
A	Advanced Issue	--/--/--

THE GRID SHOWN ON THIS PLANNING IS POSITIONED ON THE SURROUNDING SURVEY(20) NATIONAL GRID AT LOCATION 100 000 000. THE GRID IS 100 000 METRES BY 100 000 METRES. THE GRID IS NOT A TRUE REFERENCE SURVEY THROUGH THE LEICA SMARTWIRE CORRECTION SERVICE.

THIS SURVEY HAS BEEN CARRIED OUT TO AN ACCURACY OF 1:100 000. THE SURVEY IS NOT A TRUE REFERENCE SURVEY. INTERCORRELATED DIMENSIONS WILL BE WITHIN THE TOLERANCE ASSOCIATED WITH THIS AND SMALLER SCALES ONLY.

ALL LEVELS IN METRES, RELATED TO ORDNANCE SURVEY, WILL BE TAKEN TO BE 100 000 000 METRES. THE SURVEY IS NOT A TRUE REFERENCE SURVEY THROUGH THE LEICA SMARTWIRE CORRECTION SERVICE.

UNDERGROUND SERVICES HAVE BEEN SHOWN AS CONNECTIONS ONLY AND ARE NOT A TRUE INDICATION OF THE PIPES POSITION UNDERGROUND.

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[illegible]

LOCATION
KRAFT FOODS
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BARWOOD DEVELOPMENTS LTD
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EXISTING SURVEY

3116 301VCI

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STA JOB NO.	11/1097	SHEET SIZE	A1
DATE OF ISSUE	January 2012	CHECKED	IST
SCALE	DRAWING NO.	ISSUE	
1:200@A1	11/1097-6	A	

241500 N

445350
E

241550 N

241600 N

241600 N
445400 E



LEGEND

Level	Position & Value
0.00	

⁺(xx.xx) Overhead Level & Value

ISSUE	DETAIL
A	Advance

ISSUE	DETAILS	DATE
A	Advanced Issue	-/-/-

THE SURVEY GRID SHOWN ON THIS DRAWING IS POSITIONED ON ORDNANCE SURVEY(OS) NATIONAL GRID AT LOCATION 445304.510E, 241307.207N AND IS ORIENTATED TO OS GRID NORTH, BASED ON DATA PROVIDED FROM THE OS NET REFERENCE STATION THROUGH THE LEICA SMARTNET CORRECTION SERVICE.

THIS SURVEY HAS BEEN CARRIED OUT TO AN ACCURACY CONSISTENT WITH A PRESENTATION SCALE OF 1:200. INTERGATED DIMENSIONS WILL BE WITHIN THE TOLERANCE ASSOCIATED WITH THIS AND SMALLER SCALES ONLY.

ALL LEVELS IN METRES, RELATED TO ORDNANCE SURVEY DATUM (NEWLYN), BASED UPON STN SP112711) SITUATED IN PATH ADJACENT TO CEMENTRY SOUTHAM ROAD, VALUE 94.124m

A diagram of a 10-cell grid. The cells are arranged in a staircase pattern: the first row has 4 cells (1-4), the second row has 3 cells (5-7), and the third row has 3 cells (8-10). The cell containing the number 10 is highlighted with a thick black border.

BARWOOD DEVELOPMENTS LTD
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EXISTING SURVEY

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SIA JOB No. 11/1097 SHEET

DATE OF ISSUE	January 2012	CHECKED	IST
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1:200@A1 11/109/-10 A

Appendix C Masterplan

Southam Road Retail Park, Banbury
Flood Risk Assessment