12.0 WATER AND DRAINAGE

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12.1 INTRODUCTION

12.1.1 This chapter has been prepared by Brookbanks Consulting Ltd and considers the effects of the Proposed Development on flood risk, surface water drainage and foul water infrastructure, drawing on the findings of the site Flood Risk Assessment (FRA) contained as **(Appendix 12.01)** of this Environmental Statement. The Chapter describes the policy context, baseline site situation with regards to hydrology, hydrogeology, water quality, surface water and foul water drainage at the site prior to development.

12.1.2 The assessment also considers the potential effects of both the construction and operational spans of the development and identifies both the risks and associated mitigation requirements.

12.1.3 The following sections will outline the baseline and proposed site conditions and seeks to provide confirmation of the appropriateness of the site for the nature of development proposed in accordance with local and national guidance.

12.2 METHODOLOGY

12.2.1 Baseline conditions at the site relating to hydrology, hydrogeology, flood risk and drainage have been established using both published information and detailed site investigations.

12.2.2 The scope of potentially significant effects included within the assessment is outlined below:

- Impact on the floodplain on the proposal in terms of the location of built development.
- The potential for flood compensation measures if any infrastructure or water related development is constructed.
- A surface water drainage strategy to minimise impacts on the watercourses and hydrology in the area, and

- Potential for contamination of nearby watercourses during the course of the construction work.

12.2.3 Published information has been obtained in the form of:

- BGS Published geology
- Environment Agency Flood Risk Mapping
- Environment Agency Hydrogeological Data
- Thames Water Asset Location Plans
- Regional Flood Risk Appraisal (RFRA) of the South East England
- RFRA Summary
- Cherwell District Council Strategic Flood Risk Assessment
- Thames Catchment Flood Management Plan

12.2.4 Additional guidance documents which are applicable to this assessment include:

- Planning Practice Guidance (2014)
- National Planning Policy Framework (2019)
- Cherwell Local Plan
- Technical Guide to the National Planning Policy Framework (2012)
- Floods and Water Management Act (2010)
- CIRIA C753 – The SuDS Manual (2015)
- CIRIA SP156 - Control of Water Pollution from Construction Sites (2002)
- CIRIA C697 - SuDS Design Manual for England & Wales (2007)
- CIRIA C609 - SuDS Hydraulic, Structural and Water Quality Advice
- EC Water Framework Directive (2000)

12.2.5 Whilst now archived, in the absence of alternative 'good practice' guidance, it is recognised that the Environment Agency Pollution Prevention Guidance (PPG) notes still provide up to

date and appropriate guidance for assessing contamination from Proposed Development sites. The guidance documents used in the production of this ES chapter include:

- PPG1: General Guidance to the Prevention of Pollution
- PPG6: Working at Construction and Demolition Sites
- PPG13: Use and Design of Oil Separators in Surface Water Drainage Systems

12.2.6 During the development of this chapter, the following statutory bodies and interested parties have been consulted regarding the proposals:

- Environment Agency
- Thames Water

12.2.7 The Flood Risk Assessment and associated drainage strategy follows the approach set out in the EA Flood Risk Assessment Guidance notes, the NPPF and the Technical Guide to the NPPF along with the recently published Planning Practice Guidance and the requirements of the District Council Strategic Flood Risk Assessment.

Study Area

12.2.8 For the purposes of this assessment the study area has been taken as the site boundary.

Surveys

12.2.9 An intrusive site investigation has been completed to confirm the underlying geology at the site and inform the site drainage requirements.

National Planning Context

12.2.10 Allocation and planning of development must be considered against a risk based search sequence, as provided by the National Planning Policy Framework. In terms of fluvial flooding, the guidance categorises flood zones in three principal levels of risk, as follows:

Table 12.01: NPPF Flood Risk Parameters

Flood Zone	Annual Probability of Flooding
Zone 1: Low Probability	<0.1%
Zone 2: Medium Probability	0.1% – 1.0%
Zone 3a / 3b: High Probability	>1.0%

12.2.11 According to the NPPF guidance, residential development at the proposed site, being designated as "More Vulnerable" classifications, should lie outside the envelope of the predicted 1 in 100 year (1%) flood, with preference given to sites lying outside the 1 in 1,000 (0.1%) year event and within Flood Zone 1.

12.2.12 Sites with the potential to flood during a 1 in 100 (1%) year flood event (Flood Zone 3a) are not normally considered appropriate for proposed residential or educational development unless on application of the "Sequential Test", the site is demonstrated to be the most appropriate for development and satisfactory flood mitigation can be provided. Additionally, "More Vulnerable" development or "Essential Infrastructure" proposed within Flood Zone 3a are required to pass the "Exception Test", which is discussed in the following paragraphs.

12.2.13 The guidance states that Planning Authorities should:

"apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change.''

12.2.14 NPPF requires that developments covering an area of greater than one hectare prepare a Flood Risk Assessment (FRA). The FRA is required to be proportionate to the risk and appropriate to the scale, nature and location of the development.

12.2.15 A comprehensive Flood Risk Assessment has been prepared. The FRA (Document Ref: BCL Report 10327 FRA02 Rv0) is contained in **Appendix 12.01**.

National Context: Water Framework Directive

12.2.16 To improve the quality of water bodies, European legislation known as the Water Framework Directive (WFD) has been introduced to promote a new approach to water management through river basin planning. One aim of the Water Framework Directive is to improve the ecological health of inland and coastal waters and to prevent further deterioration. Nearly all inland and coastal waters were to achieve 'Good Status' by 2015, with the second management cycle due to end in 2021.

Local Context: Strategic Flood Risk Assessment

12.2.17 To support local planning policy, NPPF guidance recommends that local planning authorities produce a Strategic Flood Risk Assessment (SFRA). The SFRA should be used to help define the Local Development Framework and associated policies; considering potential development zones in the context of the sequential test defined in the guidance.

12.2.18 Cherwell District Council & West Oxfordshire District Council published a Level 1 Strategic Flood Risk Assessment in April 2009. The document outlines the results of a review of available flood risk related policy and data across the region and sets out recommendations and guidance in terms of flood risk and drainage policy that generally underpin national guidance.

12.2.19 The document makes no specific reference to the site however assess the risk of flooding in Banbury, which forms one of three major urban centres in the district of Cherwell. The following sources will be discussed further in this document:

- Fluvial Flooding
- Sewer Flooding
- Pluvial Flooding
- Groundwater Flooding
- Artificial Sources.

Assessment Criteria and Assignment of Significance

12.2.20 The methods applied to this assessment are consistent with current guidance and recommendations in the form of statutory documents and recognised publications to ensure that the findings present a robust approach to the assessment.

12.2.21 The assessment determines the relative significance of water, hydrology and drainage issues resulting from the development set against the following assessment criteria.

Table 12.02: Sensitivity

Sensitivity	Typical Receptors
Very High	A source used for public or local potable water supply. Protected areas including designated bathing waters, shellfish and salmonid fisheries. Areas which are 'highly vulnerable' to flooding.
High	Water body of very good chemical or biological quality. Water dependent SSSI, SPA/SAC, Ramsar sites or highly sensitive aquatic ecosystem. Water body of high amenity value, including areas of bathing and where water emersion sports are regularly practised. Areas which are 'highly vulnerable' to flooding.

Medium	Water body of good or fairly good chemical and biological quality and/or non-public water supply. Water body of nature conservation importance at the regional level or a moderately sensitive aquatic ecosystem. Water body of a moderate amenity value including public parks, boating, non-contact water sports, popular footpaths adjacent to watercourses, or watercourses running through housing developments/town centres. Areas which are 'more vulnerable' to flooding.
Low	Water body of poor or fair chemical or biological quality. Water body of no or only local social interest. Water body of low amenity value with only casual access. Areas which are 'less vulnerable' to flooding or 'water compatible'.

Table 12.03: Magnitude

Magnitude	Typical Receptors
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse).

	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No Change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Table 12.04: Assessment Matrix

Sensitivity	**Scale of Impact upon Receptor**				
	High	**Medium**	**Low**	**Negligible**	**No Change**
Very High	Major	Major	Moderate	Minor	No Impact
High	Major	Moderate	Moderate or Minor	Minor	No Impact
Medium	Moderate	Moderate or Minor	Minor	Insignificant	No Impact
Low	Minor	Minor	Insignificant	Insignificant	No Impact

12.3 BASELINE CONDITIONS

12.3.1 Baseline geology and hydrogeology are covered in the Ground Conditions chapter (Chapter 13).

12.3.2 The following paragraphs are based upon the findings of the Flood Risk Assessment contained in **Appendix 12.01**.

Topography

12.3.3 The site is situated on a localised high point. The topography across the site is characterised by shallow gradients falling in an easterly direction towards the River Cherwell and a westerly direction towards Sor Brook. Ground levels on site range from approximately 118m AOD in the north-west to lower levels of 110m AOD in the north-east and 115m AOD in the south-west.

Flood Risk Hydrology

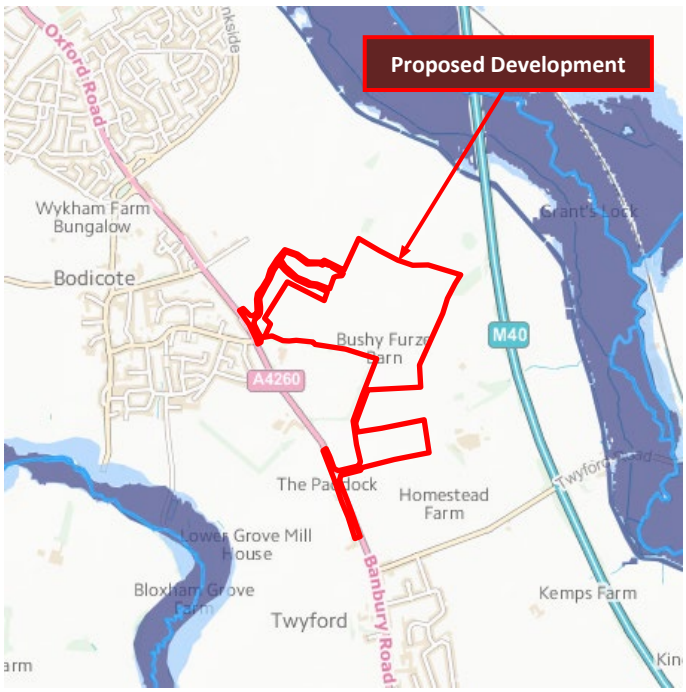
12.3.4 The following watercourses are within proximity of the site:

- River Cherwell - approximately 550m east of the site
- Sor Brook - approximately 760m south west of the site

12.3.5 The Flood Zone mapping identifies flooding on both the river and the brook, with flows seen to come out of bank during the 1 in 100 (1% AEP) and 1 in 1,000 year (0.1% AEP) events.

12.3.6 The mapping shows that the entire site lies within Flood Zone 1; being an area of Low Probability of flooding, outside both the 1 in 100 (1% AEP) and 1 in 1,000 (0.1% AEP) year flood events. The EA Flood Zone plan is reprinted as Figure 12.05.

Figure 12.05: Environment Agency Flood Zone Plan



12.3.7 The FRA also finds the land to lie in an area that has a Low Probability of flooding from other sources such as ground water, sewer and artificial water bodies. The FRA concludes that the site has a low flood risk and is therefore suitable for development.

Storm Water Hydrology

12.3.8 The land is presently not serviced by a positive storm water drainage network. It is believed that storm water currently discharges into the underlying strata through infiltration which is further supported by BRE365 testing, the results of which are included within the FRA.

12.3.9 There are thirteen Discharge Consents reported (five of which have since been revoked) within 1,000m of the site, further details of the existing eight are provided in Table 12.06:

Table 12.06: Discharge Consents

Property Type	Status	Receiving Water	Discharge Type	Distance (m)	Direction
Domestic	New*	Sor Tributary	Treated Effluent	179	North West
Domestic	New*	Sor Tributary	Treated Effluent	184	North West
Mixed Farming	Varied**	Groundwater	Process Water	271	East
Domestic	New*	Oxford Canal	Treated Effluent	857	South East
Domestic	New*	Oxford Canal	Treated Effluent	881	South East
Domestic	Modified	Land	Treated Effluent	888	South East
Not Supplied	Not Supplied	Not Supplied	Treated Effluent	888	South East
Industrial Estate	New*	River Cherwell	Treated Effluent	917	North East

* Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)

** Under EPR 2010

12.3.10 The Environment Agency currently monitor 40,000km of rivers across England. To help protect these areas each stretch of river is monitored and given a river quality grade. This is based upon the chemical quality of the water. The rivers are then graded from A to E with A representing a river with very good water quality and E, a river with very poor water quality.

12.3.11 An assessment of the water quality of a number of water courses within proximity of the site has been made by the EA in the year 2000, these are outlined below in Table 12.07.

Table 12.07: Water Quality Assessment

Name	Reach	River Quality	Ecological Quality	Chemical Quality	Distance (m)	Direction
Oxford Canal	Alcan – Cherwell	D - Poor	B – Good	N. R*	375	East
River Cherwell	STW – Kings Sutton	D – Poor	D – Poor	B – Good	550	East
Farthinghoe Stream	Martson St Lawrence – Cherwell	A – High	C - Moderate	B – Good	758	North
Sor Brook	Source – Bloxham Brook	B - Good	B – Good	N. R*	911	South West

* Not required at the time of assessment

12.3.12 Three surface water abstraction licenses recorded within 2,000m of the site and are detailed in Table 12.08.

Table 12.08: Surface water Abstraction Licences

Operator	Start Date	End Date	Location	Use	Distance (m)	Direction
Thames Water	Feb 1994	Not Supplied	Bodicote P.S	Potable Supply	1007	West
H. Colgrave	July 1984	Not Supplied	Wykham Park Farm	Spray Irrigation	1531	West
Martin Jacomb	June 2010	Not Supplied	Manor House	Energy Production	1864	South

12.3.13 The hydrology of the area is outlined in more detail within the FRA.

Foul Drainage Hydrology

12.3.14 Thames Water (TW) has been consulted regarding the location and capacity of their existing sewerage network within the vicinity of the Site.

12.3.15 TW operate foul Water Sewers and foul Rising Mains within the vicinity of the Proposed Development. A 500mm foul Rising Main is shown to cross the Proposed Development through the centre of the Site and a 300mm foul sewer approximately 600m to the south west of the site and Banbury Road.

12.3.16 The Proposed Development lies within the catchment of the Banbury Sewage Treatment Works (STW), which receives foul flows from the wider Banbury settlement.

12.4 IMPACTS

During Construction

12.4.1 The duration of an effect is a key consideration in determining its significance. Construction phase activities give rise to potential impacts that are widely regarded as short term or temporary as the working practices do not remain for the lifetime of the development and the resultant effects generally disappear due to natural recovery of the environment or mitigation measures implemented as part of the operational phases.

12.4.2 Three potential construction phase environmental effects have been identified relating to hydrology and hydrogeology. These are as follows:

- Silt and earth wash-off into watercourses
- Spillage of oils and the like from construction plant
- Changes to baseline drainage hydrology due to disturbance of the ground during construction

Post Construction

12.4.3 The key post construction phase environmental effects can be summarised as follows:

- Increased Flood Risk
- Contamination of surrounding surface and ground water
- Flooding of the foul drainage network

12.4.4 No watercourses are identified within an influencing distance of the site and the published Environment Agency mapping confirms the site lies in Flood Zone 1 and downstream of any existing properties. Flood Risk at the Proposed Development site is assessed to remain unchanged.

12.4.5 At the proposed site, storm water currently discharges to the underlying strata through infiltration. Full details of the underlying geology and subsequent infiltration rates are contained in the Flood Risk Assessment in **Appendix 12.01**.

12.4.6 One of the key principles of Sustainable Drainage Systems (SuDS) is that the management of flows should be as close, as reasonably practicable, to the baseline conditions and their location as close as possible to the source.

12.4.7 Throughout the development there is the potential for increased risk of pollution, arising from the development process itself and the potential activities of end users and residents. As such the importance of protecting the quality of the water environment is an important issue and methods of control will therefore need to be incorporated within the scheme.

12.4.8 When assessing potential effects of the foul drainage, it is important that the proposed system is designed to convey foul waters safely from the site to a suitable treatment facility, without overloading the existing sewerage systems. Furthermore, it is also important that the treatment facility is designed to accommodate the load from the Proposed Development and that this achieves a discharge quality that does not impact on water quality standards in the receiving watercourse.

12.4.9 Thames Water are in the process of carrying out a pre-development enquiry. This will assess and confirm capacity within the existing sewerage network and provide appropriate reinforcement/upgrade works where necessary. The pre-development enquiry will also confirm capacity within Banbury Sewage Treatment Works to accept the flows from the Proposed Development and thus accept a requisition from the site directly to the works.

12.4.10 Ofwat has recently instigated significant changes into the charging regimes of the water companies. Whereas prior to April 2018, the water companies would charge developers for any

reinforcement works to the existing network directly attributable to the new demand, under the new charging rules the developer has to only fund infrastructure works to the nearest practicable point of connection (defined as network of an equal or greater size to the infrastructure supplying the site). As such any reinforcement works are covered by the Infrastructure Charge, payable per plot for all new connections.

12.4.11 From the changes introduced by Ofwat, it is anticipated that the nearest point of connection to the site may be the 300mm foul sewer approximately 600m to the south west of the site.

12.4.12 The potential installation of an offsite foul water drainage connection is not considered likely to create significant effects during construction and no environmental effects will be caused during operation.

12.5 MITIGATION AND MONITORING

During Construction

12.5.1 The procedures for managing the water resource implications of the construction of the Proposed Development will be set out in a Construction Environmental Management Plan.

12.5.2 Site topography is such that limited, if any, earthworks will be required to provide gravity surface water drainage. Filling of the Site where necessary will be by way of 'cut and fill' earthworks and imported inert material to trim building levels and highway infrastructure to provide gravity drainage across the Site.

12.5.3 Other potential effects relate to the contractor's working practices. For example, there is the potential for fuel oil spillage from stored materials supplying site plant. This will be controlled by storing such materials within bunded tanks. The works will be completed in a manner that is consistent with the need to protect the surface and ground water quality environment.

12.5.4 It will be incumbent on the selected contractor to assess working practice related risks and effects before implementation and control such by employing industry good practice techniques. Furthermore, the contractor will be required to develop emergency spillage, flood, fire and contamination control procedures such that any inadvertent incidents are immediately controlled to minimise the potential impact.

12.5.5 The following general mitigation measures will also be adopted as part of the site construction phase to minimise the potential impacts arising from the Proposed Development:

Material Storage

- Storage compounds will be located away from any identified water features
- Designated bunded "safe" areas will be provided within the compound for storage of oils and other such potentially contaminative materials

Silt and Earthworking

- Soil mounding to be kept to a minimum to reduce run-off
- Haul roads to receive regular cleaning to prevent mud build up
- Careful regulation of wash down processes to avoid washing significant quantities of silt into drains

Accidental Spillage

- Emergency response requirements to be included in the construction contract requirements
- Spill kits to be located in all site compounds and near any identified water features

12.5.6 All construction phase operations will be carried out in accordance with guidance contained within the Environment Agency Pollution Prevention Guidelines. All necessary consents and approvals shall be sought from the Environment Agency, Lead Local Flood Authority and any other regulating and permitting body prior to relevant construction activities.

Post Construction

12.5.7 To minimise the potential adverse environmental effects on Flood Risk and Drainage related matters, the following specific measures are being incorporated into the Proposed Development

- Compliance with guidance in terms of flood routing and resilience for new developments
- Provision of a storm water SuDS management system
- An adequate offsite foul water drainage connection as agreed with by Thames Water
- Provision of ongoing maintenance for SuDS features, ordinary watercourse and existing artificial water bodies
- Adoption and associated ongoing maintenance of development storm and foul drainage systems

12.5.8 The Proposed Development has been designed to avoid significant adverse effects resulting during post construction phase operation. Particular design measures are also described in further detail below.

12.5.9 Guidance published in CIRIA C697, SuDS Design Manual for England & Wales, recommends that surface waters from development being primarily of a residential nature have at least one stage of treatment through an appropriately sized sustainable drainage feature. Similarly, at least one treatment stage should be provided on a non-trunk road. Two levels of treatment are recommended for higher risk commercial and industrial areas.

12.5.10 In any higher polluting areas, two stages of treatment will be employed by implementing a management train approach of pre-treatment prior to discharge to the underlying strata.

12.5.11 Published research and procedures, outlined in CIRIA C609, shows that the incorporation of a treatment train as part of a sustainable urban drainage system provides the most effective method of removing polluting materials from surface water. Removal of between 80 - 95% of the suspended solids, heavy metals and oils can be achieved. Corresponding reductions in Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) can also be achieved.

12.5.12 The Flood Risk Assessment (FRA) outlines a proposed storm water management system providing a SuDS management train, incorporating source control measures and infiltration drainage systems.

12.5.13 The SuDS scheme will incorporate permeable paving (where applicable) and an infiltration basin. These form part of the development's Green Infrastructure framework providing both a drainage and ecological function.

12.5.14 The drainage proposals contained within the FRA demonstrate compliance with current guidance by providing appropriate sustainable drainage features that passively treat storm water from the site ensuring no deterioration in water quality.

12.5.15 In areas where source control are not implemented, the surface water run-off from all hardstanding areas will be collected in a piped drainage system and conveyed via gravity through the internal road network before outfalling to the proposed infiltration basin in the north eastern corner of the proposed site.

12.5.16 By introducing Sustainable Drainage measures, the design takes account of the potential accelerated run-off and reduced times of concentration associated with hard paved areas to avoid increasing peak storm water discharge and consequential flood risk.

12.5.17 The outline SuDS scheme has had regard to sustainable methods that are readily accepted for adoption by the relevant authorities in discharging their maintenance responsibilities. The SuDS system will be maintained by way of an appropriate management scheme operated by the Local Authority or private management company. The below ground drainage system will be adopted and maintained by the drainage authority, Thames Water. Maintenance will ensure that the storm water management system remains functional for the lifetime of the Proposed Development and protect the catchment from increased flood risk.

12.5.18 The implementation of an adoptable foul drainage network within the site coupled with the potential upgrading to the existing infrastructure network surrounding the site will ensure that the scheme has no adverse effect on the existing area.

12.6 CUMULATIVE IMPACTS

12.6.1 No significant effects have been identified in either the construction or operational phases of the development. It is therefore not anticipated that any cumulative impacts will arise. In addition, it is anticipated that reference to current guidance will ensure all developments in the area achieve the appropriate baseline standard for dealing with flood risk and drainage, ensuring there are no negative off-site or on-site impacts.

12.7 RESIDUAL IMPACTS

During Construction

12.7.1 With appropriate mitigation and regulation through a Construction Environmental Management Plan, no residual impacts are anticipated at the construction stage.

Post Construction

12.7.2 The measures implemented will ensure that following construction, the baseline site situation is not detrimentally altered and as such, no residual impacts are expected.

12.8 CONCLUSIONS

12.8.1 The significance of the effects in relation to hydrology, hydrogeology, water quality, surface water and foul water drainage at the site have been assessed using Tables 12.02 – 12.04 and are summarised in Table 12.09.

12.8.2 The potential significance of the effects assumes that the mitigation measures outlined above have been implemented and are fully in accordance with current guidance and the requirements of the regulating authorities.

Table 12.09 Summary of Effects

Impact	Sensitivity	Magnitude	Significance	Comments
<u>During Construction</u>				
Silt Wash Off	Low	Negligible	Insignificant	All construction phase operations will be carried out in

Spillage	Medium	Negligible	Insignificant	accordance with guidance contained within the Environment Agency Pollution Prevention Guidelines.
Disturbance	Low	Negligible	Insignificant	
Post Construction				
Flood Risk	Low	No Change	No Impact	The provision of attenuation will reduce flood risk on site and elsewhere
Water Quality	Medium	Negligible	Insignificant	The introduction of sustainable drainage systems and other such features will ensure there is no detriment to water quality
Foul Drainage	Medium	Negligible	Insignificant	Assessments completed with Thames Water will ensure that the development connects to a point of adequacy and that downstream impacts are not exacerbated.

12.8.3 It can be concluded therefore that from a hydrological perspective, there will be no adverse environmental impacts resulting from this scheme.