11.0 Water Resources

11.1 Introduction

This chapter has been prepared by Brookbanks Consulting Ltd and considers the effects of the proposed development on flood risk, surface water drainage and water quality (both surface water and groundwater).

The assessment has been informed by the findings of the site specific Flood Risk Assessment and Drainage Strategy (FRA) which is included as *Appendix K1*.

Water supply and foul water drainage for the proposed development has been reviewed and assessed within *Chapter 12 – Utilities* and further detailed within the Service Supply Statement contained in *Appendix L1*.

11.2 Scoping and Consultation

As well as formal EIA Scoping which is described in *Chapter* 2, the following statutory bodies and interested parties have been consulted during the assessment:

- The Environment Agency (EA)
- West Berkshire Council (WBC) - Lead Local Flood Authority (LLFA) and Local Planning Authority (LPA)
- Thames water - Local Water Authority (LWA)

Based on the scoping and consultation undertaken, this chapter includes an assessment of the following 'potential effects':

- Effects on existing and future population through changes to flood risk and surface water drainage;
- Potential for contamination of on site and nearby watercourses, springs/Issues and groundwater during both construction and occupation of the development.

11.3 Assessment Methodology

11.3.1 Planning Policy Context

National Policy

Table 11.1 - Key National Planning Policies	
National Policy	**Key Provisions**
National Planning Policy Framework (NPPF)	Allocation and planning of development must be considered against a risk based search sequence, as provided by the NPPF guidance.
Planning Practice Guidance (PPG)	The Government's new planning policy on sustainable drainage systems came into effect on 6 April 2015. It expects local planning policies and decisions on planning applications relating to major development (those of 10 dwellings or more; or equivalent non-residential or mixed development) to ensure that sustainable drainage systems for the management of run-off are put in place, unless demonstrated to be inappropriate. Lead Local Flood Authorities (LLFAs) have also been made statutory consultees and new non-statutory guidance has been published under the changes.
The Water Framework Directive (WFD)	The WFD established a framework for a European wide approach to action in the field of water policy with its aim to ensure all inland and near shore watercourses and water bodies (including groundwater) achieve 'good' status or better in terms of ecology and water quality characteristics.
The Flood and Water Management Act (FWMA)	The Flood and Water Management Act is the government's newest legislation to help improve flood risk management and ensure the security of water supplies in England and Wales. The Act updates legislation to ensure better protection from flooding, manage water more sustainably, improve public services and secure water resources during periods of drought. The Flood and Water Management Act imparts significant new roles and responsibilities on local authorities. County or unitary authorities are now classed as lead local flood authorities (LLFAs) who have responsibilities for managing local flood risk.

The National Planning Policy Framework (NPPF) (revised February 2019) advocates the steering of development away from areas at high risk of flooding. However, the document acknowledges that development is necessary and that a key aim should be to ensure that flood risk is not increased elsewhere.

The NPPF, paragraph 157 states that:

"All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change so as to avoid, where possible, flood risk to people and property. They should do this and manage any residual risk…."

The 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.

Planning Practice Guidance (PPG)

More detailed guidance on flood risk has been provided in the Government's Planning Practice Guidance (DCLG 2014). This guidance reiterates that allocation and planning of development must be considered against a risk based search sequence. In term of fluvial flooding, the guidance categorises flood zones into four levels of risk, as follows:

Table 11.2 - PPG Flood Risk Parameters

Flood Zone	Annual Probability of Flooding	Definition
Zone 1: Low probability	< 0.1 %	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2: Medium probability	0.1 – 1.0 %	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a: High probability	> 1.0 %	This zone comprises land where water must flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

The guidance sets out categories of flood risk vulnerability, using the above classifications: essential infrastructure, highly vulnerable, more vulnerable, less vulnerable and water compatible. According to this scale, residential and education development would fall within the 'more vulnerable' category, while buildings used for shops or non-residential institutions would be considered 'less vulnerable' and amenity open space, space for nature conservation, outdoor sports and recreation areas would fall into the 'water compatible' category.

National Context

Water Framework Directive, 2000[1]

The Water Framework Directive 2000/60/EC (WFD) applies to all European Union (EU) water bodies and aims to make sure they are protected from further deterioration, and that improvements in water quality are made. The assessment and protection of water bodies should be undertaken irrespective of political or administrative boundaries by implementing River Basin Management Plans to be prepared within a formal series of six year cycles, following the identification of River Basin Districts. In general terms, there is an onus on developers to protect and, if possible, enhance water bodies close to proposed developments.

[1] EU Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

These Regulations make provision for the purpose of implementing legislation in the field of water-related environment and more generally water management-related issues. They, among other things, require the identification of river basin districts, and a number of other assessments to be carried out by the Environment Agency ("the EA") and Natural Resources Wales ("NRW") to classify the status of water bodies in river basin districts within England and Wales and outline the duties of regulators in relation to environmental permitting, abstraction and impoundment of water.

Other Guidance Documents

In addition to the legislation and policy identified above, the following documents provide relevant guidance on measures to control effects on hydrology and flood risk and have been considered in this assessment:

- CIRIA (2015) The SuDs Manual: C753;
- CIRIA (2010) Planning for SuDs Making it Happen: C687;
- CIRIA (2014) Site Handbook for the Construction of SUDS;
- Environment Agency Pollution Prevention Guidance: PPG1 Understanding Your Environmental Responsibilities – Good Environmental Practices (Environment Agency et al. 2013);
- Environment Agency Pollution Prevention Guidance: PPG3 Pollution Prevention Guidelines: Use and Design of Oil Separators in Surface Water Drainage Systems (Environment Agency et al. 2006);
- Environment Agency Pollution Prevention Guidance: PPG 5 Works and Maintenance in or Near Water (Environment Agency et al. 2007);
- Environment Agency Pollution Prevention Guidance: PPG6 Working at Construction and Demolition Sites (Environment Agency et al. 2012);
- Environment Agency Pollution Prevention Guidance: PPG21 Pollution Incident Response Planning (Environment Agency et al. 2009); and
- WRc (2012) Sewers for Adoption 7th Edition.

Regional & Local Policy

Strategic Flood Risk Assessment: 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.

West Berkshire Council published a district-wide Level 1 Strategic Flood Risk Assessment (SFRA) in 2008 and a Level 2 SFRA for specific areas in 2009. These documents outline the results of a review of available flood risk related policy and data across the region and set out recommendations and guidance in terms of flood risk and drainage policy that generally underpin national guidance.

The SFRA document makes no specific reference to the proposed development site however the document assesses the risk of flooding of the wider Newbury area from the following sources which will be discussed further in this document:

- Surface Water Flooding
- Sewer Flooding
- Overland flooding
- Groundwater Flooding

11.3.2 Study Area

In order to adequately assess the impact on drainage, the following study areas have been established:

- Within the redline application boundary
- Monks Lane, north of the site
- The wider storm water catchment for Sandleford Park, as defined within the Flood Risk Assessment.

11.3.3 Assessment Approach

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, as detailed within the comprehensive FRA contained in *Appendix K1*.

11.3.4 Assessment Criteria

Receptors to potential impact have been identified and their sensitivity defined based on the criteria in *Table 11.3*.

The magnitude of impact has then been assessed with mitigation measures implemented based on the descriptors included in *Table 11.4*.

The significance of effect is then determined by combining the sensitivity of the receptor and the impact magnitude in accordance with the matrix in *Table 11.5*.

Table 11.3 - Sensitivity Criteria	
Sensitivity	**Typical Descriptors**
Very High	• 'Essential Infrastructure' as defined in the Planning Practice Guidance (Reference ID: 7-066-20140306). • A source used for public or local potable water supply. • Water dependent SSSI, SPA/SAC, Ramsar sites or highly sensitive aquatic ecosystem. • Protected areas including designated bathing waters, shellfish and salmonid fisheries.
High	• Receptors which are considered 'highly vulnerable' to flooding, as defined in the Planning Practice Guidance (Reference ID: 7-066-20140306). • Water body of very good chemical or biological quality. • Water body of high amenity value, including areas of bathing and where water emersion sports are regularly practised.
Medium	• Receptors which are considered 'more vulnerable' to flooding, as defined in the Planning Practice Guidance (Reference ID: 7-066-20140306). • 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.
Low	• Receptors which are considered 'less vulnerable' to flooding, as defined in the Planning Practice Guidance (Reference ID: 7-066-20140306). • Water body of poor or fair chemical or biological quality.
Negligible	• Receptors which are considered to be 'water compatible', as defined in the Planning Practice Guidance (Reference ID: 7-066-20140306). • Water body of no or only local social interest. • Water body of low amenity value with only casual access.

Table 11.4 - Magnitude Criteria	
Magnitude	**Typical Descriptors**
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Areas which are 'highly vulnerable' to flooding.
	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).
	Areas which are 'more vulnerable' to flooding.
	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).
	Areas which are 'less vulnerable' to flooding or 'water compatible'.
	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).
	Areas with 'negligible' to flooding.
	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 11.5 - Significance Criteria					
Sensitivity	**Magnitude**				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No change	Negligible	Negligible	Negligible	Negligible
Low	No change	Negligible	Minor	Minor	Moderate
Medium	No change	Negligible	Minor	Moderate	Substantial
High	No change	Negligible	Moderate	Substantial	Substantial
Very high	No change	Negligible	Substantial	Substantial	Substantial

The terms in the matrix in *Table 11.5* have the following definitions within this assessment:

- **Substantial:** These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category;
- **Moderate:** These beneficial or adverse effects may be important. The cumulative effects of such factors lead to an increase in the overall adverse effect on a particular resource or receptor;
- **Minor:** These beneficial or adverse effects may be raised as local factors; and
- **Negligible:** No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

11.4 Baseline Conditions

Baseline conditions at the site relating to hydrology, hydrogeology, flood risk and drainage have been established using both published information and detailed site investigations, which include the following:

- Site walkover observations;
- Published digital BGS geology and EA data mapping;
- Flood mapping;
- Environmental statutory registers; and
- Preliminary ground investigations and infiltration test results - contained within the Appendix of the FRA (*Appendix K1*).

An intrusive site investigation, completed by GEG Ltd is included within the Appendix of the FRA (*Appendix K1*). This broadly confirms the underlying geology at the site to be as described from the published records.

Infiltration testing was carried out to inform the site drainage requirements and it was concluded that the soils on site were typically of low permeability. Therefore, it was considered that the site is unsuitable for soakaway drainage.

A topographical survey has also been completed to inform the topographical features and levels across the proposed development areas.

11.4.1 Topography

The site is characterised by relatively shallow falls from the sides to an ordinary watercourse flowing from north to south through the centre of the site, and generally falls from the north towards the River Enborne to the south of the site.

11.4.2 Watercourses

The site includes an unnamed ordinary watercourse, a tributary to the River Enbourne, which runs in a southerly direction from the north west of the site through the centre. The River Enbourne is designated as a ‘Main River’ by the EA and is situated along the southern boundary of the site.

There are two existing detention/balancing ponds situated in the north east of the site (adjacent to the rear of West Berkshire Recycling Centre) and one outside of the redline boundary (to the south of Newbury College).

The MAGIC website indicates that the site includes an 'Issue' (spring) in the north of the site which drains to the centre, where it traverses into the unnamed watercourse. There are also 2 'spreads' shown in the south of the site.

The Ordnance Survey provides the following definitions for the above terms:

Issues: "The start of a flowing watercourse which is a natural emission from an agricultural drain, or where the stream re-emerges from underground".

Spreads: "A place where a stream spreads into a marsh or onto a sand or shingle beach or an area of rough grass".

11.4.3 Flood Risk

The EA's National Generalised Modelling (NGM) Flood Zones Plan indicates predicted flood envelopes of Main Rivers across the UK. The mapping indicates that apart from a narrow strip along the River Enbourne, the majority of the site is shown to lie within Flood Zone 1; being an area of Low Probability of flooding, outside both the 1 in 100 (1% Annual Exceedance Probability) year and 1 in 1,000 (0.1% Annual Exceedance Probability) year flood events.

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.

11.4.4 Published Geology

British Geological Survey digital mapping indicates that the site is underlain by the solid geology of the London Clay Formation which varies between predominately 'sand', over the majority of the site with a tongue of 'clay, silt and sand' exposed along the valley sides in the southern section of the site.

The solid geology is overlain by superficial deposits of the Silchester Gravel Member over the majority of the northern and eastern central sections of the site.

11.4.5 Hydrogeology

In accordance with the British Geological Survey digital mapping, the EA mapping indicates that the underlying solid geology forms a 'Secondary A Aquifer'. The superficial deposits shown to the north, north east and north west of the site and along the River Enbourne to the south, also form a 'Secondary A Aquifer'.

11.4.6 Water Quality

The site contains a spring/Issue in the north and a natural watercourse which runs through the centre of the site, in a largely southerly direction. It is also believed that storm water currently discharges into the underlying strata through natural infiltration.

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.

To improve the quality of water bodies, European legislation known as the Water Framework Directive (WFD) was 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.

An assessment of the water quality of the River Enbourne to the south of the site has been completed by the Environment Agency with the results identifying the watercourse to be "good" with regards to ecological quality and to pass the chemical quality assessment.

The site is shown to lie within Zone 3 (Total catchment) of a Groundwater Source Protection Zone. The EA defines this as, '*an area around a source within which all groundwater recharge is presumed to be discharges at the source*'.

11.5 Mitigation Measures

11.5.1 Inherent Mitigation Measures

A surface water drainage strategy has been prepared based on the principles of sustainable drainage (SuDS) and this is described further in the FRA in *Appendix K1*.

The surface water drainage scheme will manage surface water runoff through the provision of source control, conveyance and attenuation storage. Indicative storage volumes have been determined to restrict peak surface water runoff rates from impermeable areas of the developed site to existing Greenfield rates and to store the 1 in 100-year storm event including a 40% increase in rainfall intensity to allow for the effects of climate change during the lifetime of the development.

The proposed surface water drainage scheme will ensure that runoff from the site will not increase following development and that betterment is provided through an overall reduction in peak runoff rates post development. This will ensure that the proposed development would not increase flood risk elsewhere and could reduce off-site flood risk.

11.5.2 Standard Mitigation Measures

To prevent localised flooding associated with extreme rainfall events during the construction phase a temporary localised run-off management system will be employed by the contractor. This will comprise of temporary surface water runoff facilities such as storage tanks, ditches or ponds and provide on-site attenuation for surface water flows and thereby reducing flood risk.

Disturbance of the ground during construction operations has the potential to contaminate both ground and surface waters due to discharge of solids into water or by the short-term mobilisation of any potential background contaminants within the soil matrix.

The discharge of suspended solids to watercourses and ground waters will be avoided by prohibiting temporary construction discharge without the prior approval of the Environment Agency. Discharges of waters resulting from construction activities will generally be directed to foul sewers, subject to approval of the drainage authority.

Site topography is such that limited, if any, earthworks will be required to provide gravity surface water drainage. Filling of the land 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 land. These works will be completed in a manner that protects the water quality environment and ecological interest of the watercourse. The nature of the works and the proposed implementation methods will be agreed with the Environment Agency in advance and all works will accord with the recommendations of EA Pollution Prevention Guidance for Works in, Near or Liable to Affect Watercourses.

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 potential impact 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.

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. All works will be completed in accordance with the Environment Agency documents, PPG 6 Working at Construction and Demolition Sites and PPG21 Pollution Incident Response Planning together with current best practice measures for the management of construction activities.

Proposed implementation methods will be developed with the Environment Agency in advance of all works, with appropriate construction phase method statements developed to ensure that no impact on the Site hydrology or hydrogeology results from the construction activities.

A Construction Environmental Management Plan (CEMP) will be prepared and agreed with the LPA. The CEMP will set out the methods by which construction will be managed to avoid, minimise and mitigate adverse effects on the water environment and a draft version is included in *Appendix D1*.

11.5.3 Actionable Mitigation Measures

A private maintenance company will be responsible for maintenance and operation procedures for the stormwater management features to ensure the successful operation of the drainage systems. This is discussed further within the FRA (*Appendix K1*).

The site includes an ordinary watercourse, the maintenance and ownership of which will also need to be established and included within the site management plans.

Delivery of actionable mitigation will be secured through a Section 106 Agreement.

11.6 Assessment of Environmental Impacts

11.6.1 Impact Assessment

Construction Phase

Flood Risk and Surface Water Drainage

Flooding and changes to the baseline hydrology can occur due to various construction related activities, such as; soil compaction, deposition of materials within the floodplain, temporary diversion of watercourse, infilling of land altering preferential drainage flow paths and flood routes, and dewatering of excavations.

Where a temporary diversion of a watercourse is necessary, the contractor shall implement an alternative flow route, as close to the source as possible, which will be designed to have no lesser capacity than the original feature. The proposals for such diversions shall be agreed with the regulatory bodies and implemented for the shortest possible time to progress the works.

The contractor will not be permitted to temporarily store materials or introduce ‘borrow pits’ or equivalent in areas that may affect drainage flow paths.

Proposed dewatering will be designed to have no material impact on potential receptors such as local watercourses and points of ground water abstraction. Where necessary, the contractor will be required to implement ground water recharge as mitigation.

It is assessed that with mitigation measures implemented, construction of the proposed development would have a **negligible** effect on the flood risk of local watercourses and water resources.

Surface Water Quality

The operation of construction vehicles and general construction activities can potentially give rise to the contamination of surface water run-off from the site by pollutants such as hydrocarbons, suspended solids and construction materials. This may lead to deterioration of surface water quality.

The sensitivity of local watercourses which could be affected is medium and the magnitude of change following the implementation of proposed standard mitigation is negligible.

The significance of effect is therefore, **negligible**.

Groundwater Quality

It is anticipated that the development will necessitate earthworks comprising of shallow to deep excavations to construct building foundations, sewers and utility trenches. These excavations may lead to deterioration of ground water quality as direct pathways to the groundwater could occur.

The sensitivity of groundwater onsite is medium and the magnitude of change following the implementation of proposed standard mitigation is negligible.

The significance of effect is therefore, **negligible**.

Table 11.6 - Summary of Impact Assessment – Construction Phase						
Receptor	**Sensitivity**	**Description of Impact**	**Inherent & Standard Mitigation Measures**	**Magnitude of Effect**	**Type of Effect**	**Significance of Effect**
Population and Waterbodies (Flood Risk and Surface Water Drainage)	Medium	Direct and indirect flooding and changes to baseline drainage hydrology due to disturbance of the ground during construction works.	Implementation of standard mitigation measures (see *Section 11.5.2*)	Negligible	Temporary	Negligible
Surface Water Quality	Medium	Direct and indirect contamination of surface water due to mobilisation of soils, existing contamination and spillage of oils from construction plant.	Implementation of standard mitigation measures (see *Section 11.5.2*)	Negligible	Temporary	Negligible
Groundwater Quality	Medium	Direct and indirect contamination of groundwater due to mobilisation of soils, existing contamination and spillage of oils from construction plant.	Implementation of standard mitigation measures (see *Section 11.5.2*)	Negligible	Temporary	Negligible

Occupation Phase

Flood Risk and Surface Water Drainage

Environment Agency flood maps show that the site lies within Flood Zone 1 and assessment of other potential flooding mechanisms shows the land to have a low probability of flooding.

The proposed development has been designed to avoid significant hydrological effects resulting from changes in the catchment drainage characteristics and provides for site run off to be controlled to the baseline rate assessed using the IoH124 methodology. The incorporation of SuDS as part of the surface water management proposals will reduce the effects of accelerated run-off and reduced times of concentration associated with hard paved areas to avoid increasing peak storm water discharge and consequential flood risk.

The FRA outlines a proposed SuDS-based surface water management system that will provide a combination of source control, conveyance and attenuation features within the site.

A Hydrology Appraisal of the proposed valley crossing is included in the FRA and this has determined that the culvert can accommodate a 1 in 1000 year storm event without overtopping.

Current best practice guidance will be adhered to in the design of proposed site levels to ensure the safe conveyance of flows towards attenuation features and away from proposed dwellings, should blockages or/and exceedance events lead to runoff exceeding the design flows. In addition, adequate space has been provided between built development and the existing watercourse and spring, all of which are to be retained with the development site.

It is assessed that the proposals will result in **minor beneficial** effects on flood risk and surface water drainage following the implementation of the appropriate mitigation measures.

Water Quality

The prime water receptors at risk are groundwater and the nearby watercourses and water quality in the surrounding area is reported to be moderate.

In residential development the direct discharge of surface water to adjacent watercourses can potentially lead to a degradation of water quality with associated ecological effects.

The FRA outlines a proposed SuDS based storm water management system providing source control, conveyance and attenuation features in compliance with current guidance. This will provide appropriate sustainable drainage features to encourage passive treatment of discharged flows and to improve the water quality by removing the low-level silts, oils and metal associated with urban run-off.

Recently published research and procedures, outlined in CIRIA C753, show 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.

Environment Agency Groundwater Maps indicate a groundwater abstraction licence exists within the site. Extraction will cease with the redevelopment of the site resulting in a minor benefit to local water supplies.

The proposed site comprises development parcels situated adjacent to existing woodland and Country Park areas which include a number of spring locations.

The underlying geology is shown to consist of sand bedrock in the north and clay, silt and sand in the south (belonging to the London Clay Formation). Superficial sand and gravel deposits are shown in the north and north west of the site.

The underlying geology is classed as a Secondary A Aquifer described as permeable layers capable of supporting water supplies at a local rather than a strategic scale and there are no groundwater abstractions within the vicinity of the site.

The proposed development parcels mostly comprise residential development with a number of commercial units. The residential areas allow for 55% impermeability and the commercial areas allow for 85% impermeability.

Direct and indirect reduction in groundwater recharge and watercourse base flows can occur due to changes to the baseline hydrology and groundwater regime resulting from increasing impermeable surfaces and reducing permeable areas.

On the basis that there is no evidence of positive drainage in the area it is likely that the springs are fed from a combination of surface run off and infiltration to ground.

The immediate areas surrounding the spring locations as well as the existing downstream streams will be un-affected by development and surface run off from these areas will be maintained, similarly feeds from the wider catchment beyond the development will also be unaffected.

Permeable areas within the development area will continue to allow infiltration to ground and those areas where infiltration is not feasible will still direct flows to the existing streams, via attenuation features, and therefore reduction in watercourse base flows is unlikely.

To mitigate against these effects of increased impermeable areas the surface water management proposals will incorporate unlined source control, secondary and tertiary SUDS drainage features to allow infiltration of run off wherever possible to maximise infiltration and recharge.

Pipes or culverts to convey stream flows beneath road crossing points will be adequately sized with capacity to convey unrestricted flows downstream.

In summary, the surface water management proposals will minimise the hydrological impacts to existing springs and streams as well as mitigating the effects on groundwater recharge.

Overall, it is assessed that the proposals will result in a **minor beneficial** effect on water quality following the implementation of the proposed mitigation measures.

Table 11.7 - Summary of Impact Assessment – Occupation Phase						
Receptor	**Sensitivity**	**Description of Impact**	**Inherent & Standard Mitigation Measures**	**Magnitude of Effect**	**Type of Effect**	**Significance of Effect**
Population and Waterbodies (Flood Risk and Surface Water Drainage)	Medium	Direct and indirect flooding of surrounding watercourses, the spring, the wider catchment area, adjacent land and property due to increases in surface water runoff from positively drained hard areas.	Development located within Flood Zone 1. Implementation of SuDS-based surface water drainage scheme.	Low Beneficial	Permanent	Minor Beneficial
Surface and Groundwater Quality	Medium	Direct and indirect contamination of surface water, the spring and groundwater from the development.	Implementation of SuDS-based surface water drainage scheme.	Low Beneficial	Permanent	Minor Beneficial

11.6.2 Residual Impact Assessment

The residual effects are as set out in *Section 11.6.1*.

11.7 Cumulative Impact Assessment

11.7.1 Sandleford Park West

The proposals for Sandleford Park West have been assessed. The site contains localised, on plot SuDS which wholly capture, and attenuate storm water generated by the respective developments. These attenuation features drain locally to nearby watercourses at a restricted rate.

The site is not dependent on the Sandleford Park development's storm water drainage regime in order to attenuate flows. Conversely, the Sandleford Park development does not depend on the SuDS infrastructure being delivered in the adjoining site. Each site's catchments for storm drainage are managed, attenuated and discharged within their respective development boundaries.

To that end, it is considered that the cumulative impact with the Sandleford Park West development is **negligible**.

11.7.2 Cumulative Impact Assessment

This chapter has demonstrated that the proposed development will not result in adverse cumulative effects on off-site flood risk, drainage, or water quality.

Planning applications for the developments listed in *Chapter 2* will all be required to include a FRA and drainage strategy. Accordingly, each development will need to include mitigation measures regarding flood risk, surface water discharge and water quality to ensure there are no cumulative adverse effects on local water resources.

On this basis, it is considered that the development of Sandleford Park and the adjacent Sandleford Park West development, in conjunction with other committed development schemes, will not result in cumulative effects within the River Enbourne catchment.

11.8 Summary

The site includes an unnamed ordinary watercourse, a tributary to the River Enbourne, which runs in a southerly direction from the north west of the site through the centre. An Issue/spring is situated in the north of the site.

In terms of fluvial flood risk, the 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. Assessments completed within the FRA also find the land to lie in an area that has a Low Probability of flooding from most other sources from mechanisms such as ground water, sewer and artificial water bodies.

Standard mitigation measures employed during the construction period will ensure that potential effects on flood risk, drainage and water quality are **negligible**.

The proposed development includes for a SuDS-based surface water drainage scheme as set out in the FRA in *Appendix K1*.

Implementation of the SuDS-based surface water drainage scheme will ensure that the proposed development, once occupied, results in **minor beneficial** effects on flood risk, drainage and water quality.