



LOTMEAD FARM VILLAGES

Environmental Statement

Volume 1 - Main Report

April 2019

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Environmental Statement

Land at Lotmead Farm, Swindon

April 2019

Turley

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Document Availability

Copies of the Environmental Statement, including technical figures (Volume 2) and appendices (Volume 3) are available by contacting:

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A charge will be applied (POA) for hard (paper) or soft (CD/USB drive) copies of the ES.

Additional copies of the Non-Technical Summary (NTS) may also be requested and provided free of charge using the contact details above.

Comment on the planning application and Environmental Statement should be issued to:

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At a time when the planning submission is validated, copies of the Environmental Statement will be available to view, download and comment upon online using Swindon Borough Council's Planning Portal:

https://www.swindon.gov.uk/info/20030/planning_and_regeneration/380/view_or_make_comment_on_a_planning_application

9. Water Resources

Purpose and Parameters of the Assessment

- 9.1 This chapter of the ES assesses the environmental impact of the Development on flood risk from fluvial and surface water sources, water quality and water supply and sewerage capacity.
- 9.2 This chapter has been prepared by Peter Brett Associates LLP, now part of Stantec, (PBA) and should be read in conjunction with the Flood Risk Assessment (FRA) (PBA, December 2018) (**Appendix 9.1**) and Surface Water Management Strategy Plan (**Figure 9.1**) for the Lotmead Farm Villages.
- 9.3 The assessment has been undertaken in consultation with the Environment Agency and the Council, including the Local Lead Flood Authority.
- 9.4 This Chapter aims to:
- Provide a summary of relevant legislation and planning policies against which the development will be considered;
 - Describe the existing hydrological environment;
 - Describe the existing water infrastructure;
 - Provide an overview of the baseline conditions currently present at the Site;
 - Provide details of the mitigation measures required to prevent, reduce, or offset the impacts of the Proposed Development on flood risk and drainage.

Legislative and Policy Framework

- 9.5 This section of the ES discusses the context of the development with regards to the relevant International, National, Regional and Local planning policy and legislation.

The Water Framework Directive (2000)

- 9.6 The Water Environment (Water Framework Directive (WFD)) (England and Wales Regulation (**Ref 9.1**)) transposes the European Union Water Framework Directive (**Ref 9.2**) into national law. It establishes a framework for a Europe-wide approach to action in the field of water policy. Its ultimate aim is to ensure all inland and near shore watercourses and water bodies (including groundwater) are of 'Good' status or better, in terms of ecology, chemical, biological and physical parameters, by the year 2015. Although this date has now passed, the legislation requiring all waterbodies to be of a 'Good' status remains with extensions to 2021 and 2027 for meeting this objective. Therefore, any activities or developments that could cause detriment to a nearby water resource, or prevent the future ability of a water resource to reach its potential status, must be mitigated so as to reduce the potential for harm and allow the aims of the Directive to be realised.

The European Floods Directive (2007)

- 9.7 The European Floods Directive (EFD) (2007/60/EC) (Commission of the European Communities 2007) (**Ref 9.2**) requires Member States to assess flood risk for all watercourses and coastlines. This required the mapping of flood extents and to take measures to reduce this flood risk.

Water Resources Act (1991)

- 9.8 The Water Resources Act (WRA) (**Ref 9.3**) relates to the control of the water environment. Aspects of the Act which are relevant to the Development include provisions concerning land drainage.

Water Industry Act (1991)

- 9.9 The Water Industry Act (WIA) (**Ref 9.4**) covers a wide-range of the activities of the privatised Water Companies that were created in 1989. The relevant provisions relate to trade effluent discharges made to sewers for which the privatised companies act as the regulatory authorities.

- 9.10 Under the Act discharge of effluent to the public sewer can only take place with the agreement or consent of the sewerage undertaker (that is, the water company). For the Development, this would be Thames Water Utilities Limited (TWUL). The water companies control the nature and composition of the effluent, the maximum daily volume permitted the maximum flow rate and the sewer into which the effluent is discharged.

- 9.11 Classifications for various water bodies are included as part of the River Basin Management Plan (RBMP) for the Thames River Basin District. The RBMP sets out a Programme of Measures (POM) which needs to be undertaken in order for each water body to maintain or reach 'Good' status by 2015 in accordance with the WFD (**Ref 9.1**). The plan also sets out the various standards that each waterbody has to meet in order to be classified as having 'good' status.

Pollution Prevention Guidelines (PPGs)

- 9.12 The Environment Agency (EA) produces Pollution Prevention Guidelines (PPGs) (**Ref 9.5**) targeted at a particular industrial sector or activity, giving advice on the law and good environmental practice. The Pollution Prevention Guidelines are 'guidance' rather than Policy, however they are widely adopted. The following guidance notes are considered relevant for the Development:

- PPG1 - General Guide to the Prevention of Pollution (EA, 2013) – a basic guidance and introduction to pollution prevention.
- PPG2 - Above Ground Oil Storage Tanks (EA, 2011) – guidance to help prevent pollution from above ground oil storage tanks and comply with the law (excludes oil refineries and distribution depots).
- PPG3 - Use and Design of Oil Separators in Surface Water Drainage Systems (EA, 2006) – guidance to help decide if an oil separator is required at the Site and, if so, what size and type of separator is appropriate
- PPG5 - Works In, Near or Liable to Affect Watercourses (EA, 2007) – guidance on pollution prevention planning, how to avoid pollution of the water environment, waste management and incident response for works near, in or over water.

- PPG6 - Working at Construction and Demolition Sites (EA, 2012) – guidance on pollution prevention measures for the construction and demolition industry.
- PPG8 - Safe Storage and Disposal of Used Oils (EA, 2004b) – guidance to help prevent pollution when storing and disposing of used oils from a single engine oil change to large industrial users.
- PPG13 - Vehicle Washing and Cleaning (EA, 2007) – guidance to help prevent pollution from vehicle washing and cleaning using automatic wash systems, high pressure or steam cleaners and washing by hand.
- PPG18 - Managing fire water and major spillages (EA, 2000) – guidance to help identify equipment and techniques available to prevent damage to the water environment caused by fires and major spillages.

Building Regulations H3 Hierarchy

9.13 The Building Regulation Rainwater Drainage H3 (3) (**Ref 9.6**) stipulates that;

‘rainwater from roofs and paved area is carried away from the surface to discharge to one of the following in order of priority:

- *An adequate soak away or some other infiltration system;*
- *A watercourse, or where that is not practicable; or*
- *A sewer.’*

Flood and Water Management Act (2010)

9.14 The Flood and Water Management Act (FWMA) (**Ref 9.7**) proposed the establishment of SuDS (Sustainable Drainage Systems) Approving Body (the “SAB”) at county or unitary local authority levels. The role of the SAB was envisaged as implementing the recommendations of the Pitt Review (2008) in promoting the use of SuDS for future development, into the planning process.

9.15 Following a period of consultation, the proposed role of the SAB in the planning process has been amended, with the promotion of SuDS being incorporated into the planning process. Ministerial Written Statement HCWS161 details this change in policy.

9.16 The Act gives the EA a strategic overview role for flood risk and gives local authorities (known as Lead Local Flood Authorities) (LLFAs)) responsibility for preparing and putting in places strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas. Swindon Borough Council (SBC) is the LLFA in this area.

9.17 The FWMA also amends Section 106 of the WIA with respect to the right of connection to a public sewer. In the future the automatic right of connection will be revoked and all new connections must be made via a Section 104 Agreement for foul sewers.

National Planning Policy Framework (Feb, 2019) & Planning Practice Guidance

9.18 The National Planning Policy Framework (NPPF), together with the National Planning Practice Guidance (NPPG) ‘Flood Risk and Coastal Change’ (**Refs 9.8**) provide guidance to local

planning authorities to ensure the effective implementation of the planning policy set out in the NPPF on development in areas at risk of flooding.

9.19 The NPPF advocates the use of the risk-based sequential test (which recognises that risk is a function of probability and consequence), in which new development is preferentially steered towards the areas at lowest probability of flooding. These areas are identified by Flood Zones, which are defined as follows:

- Flood Zone 1: Low probability of flooding - less than 0.1% (1 in 1,000) annual probability of river or sea flooding in any year;
- Flood Zone 2: Medium probability of flooding - between 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of river flooding and between 0.5% and 0.1% (1 in 200 and 1 in 1000) annual probability of sea flooding in any year;
- Flood Zone 3a: High probability - 1% (1 in 100) or greater annual probability of river flooding or 0.5% (1 in 200) or greater annual probability of sea flooding in any year;
- Flood Zone 3b: The functional floodplain - where water has to flow or be stored in times of flood, including flood conveyance routes and areas designed to flood as part of a flood defence scheme.

9.20 It should be noted that Flood Zones 1, 2 and 3a ignore the presence of flood defences.

9.21 The Environment Agency (EA) released updated Climate Change Allowance in February 2016 'Flood Risk Assessments: Climate Change Allowances.' The peak river flow (fluvial) climate change allowances within the new guidance replace the 20% single allowance previously applied across England and Wales. Instead a range of allowances are provided, which take account of the findings from a series of different climate change models. Through a statistical analysis of the climate change impacts from these different models, estimates across a range of fluvial climate change impacts were provided; provided in a series of climate change 'bands' for different geographic river basins.

9.22 As well as varying geographically (the river basin district of the site) and for the lifetime of the development or 'epoch' of climate change (2015-2039, 2040-2069 and 2070-2115); the EA guidance for selecting the appropriate climate change band also depends on the current Flood Zone of the site (Flood zones are independent of climate change) and the flood risk vulnerability classification of any proposed development (e.g. more vulnerable use, less vulnerable use etc).

9.23 The updated climate change allowances have been applied to the baseline hydraulic model and the findings are reported in the FRA (**Appendix 9.1**).

9.24 Updated climate projections were presented as part of UKCP18 published on 26th November 2018. The EA have prepared a briefing note that confirms that the 2016 guidance is still the best national representation of how climate change is likely to affect flood risk for peak river flow and peak rainfall intensity. Further research is due to be published in 2019 that may result in changes to these allowances, however, at this stage it is considered reasonable to continue to use the 2016 guidance for planning decision making.

- 9.25 The EA is a statutory planning consultee on development and flood risk matters. Should the EA raise objections and the Local Planning Authority (LPA) still wish to approve a planning application for a major development (10 or more residential dwellings or 1,000 m² of non-residential floor space) the LPA must notify the Secretary of State.

Swindon Borough Local Plan 2026 (adopted March 2015)

- 9.26 The Site lies with the proposed Swindon New Eastern Villages (NEV) strategic allocation (NC3) in the Swindon Borough Local Plan 2026 (Local Plan) (**Ref 9.9**). Local Policies relevant to the development and water resources are summaries as follows:

- 'Policy EN6: Flood Risk' of the Local Plan details the specific policy regarding flood risk and the requirements for a site-specific Flood Risk Assessment in-line with national policy (the NPPF and NPPG).
- 'Policy IN2: Water Supply and Wastewater', of the Draft Local Plan details specific policy regarding water resource infrastructure. The policy identifies possible methods (new facilities, expansion of existing facilities etc.) for the provision of capacity to serve future development. Part d of the policy indicates that;

'Where necessary, the council will seek improvement to water and/or sewerage/ wastewater treatment infrastructure related and appropriate to the development so that the improvements are completed prior to occupation of the development.'

- Policy NC3, promotes the New Eastern Villages for 6,000 residential units, 40 ha of employment land, retail, community and other complementary uses, with associated infrastructure, open space and landscaping.

- 9.27 The policy requires the development to ensure;

'the risk of flooding from the development is minimised, both within the development and at existing neighbouring communities in accordance with policy EN6;' and includes provision for 'a sewage treatment works if required.'

New Eastern Villages Planning Obligations Supplementary Planning Document (October 2016)

- 9.28 The Council has also prepared and adopted a Supplementary Planning Document (SPD) for the New Eastern Villages (October 2016) (**Ref 9.10**).

- 9.29 The SPD identifies the infrastructure package required to serve the NEV, including utility provision, onsite flood mitigation works, and SuDS.

Sustainable Drainage Systems (SuDS) Vision for New Eastern Villages (NEV) Supplementary Planning Document (February 2017)

- 9.30 This SPD (**Ref 9.11**) was developed to support masterplanning within the NEV development area, which includes the Lotmead Farm Villages site. The guide sets out objectives and principles for drainage infrastructure within the NEV development. It also provides information on local considerations, interdependencies, opportunities and constraints.

Strategic Flood Risk Assessment SFRA (2008)

- 9.31 A Level 1 Strategic Flood Risk Assessment (SFRA) (**Ref 9.12**) was undertaken for the Council in 2008. The SFRA considered the New Eastern Villages site as a potential development option

as the Eastern Development Area in its assessment, identifying that improved data on the River Cole was required. The SFRA also sets out recommendations for any development within the borough with regard to flood risk.

Swindon Water Cycle Study – Phase 1 (2007)

9.32 The Swindon Water Cycle Study (WCS) (Ref 9.13) forms part of the Local Development Framework (LDF) with the SFRA. The study investigates the effects of future development on water resources, water quality and flooding. The WCS includes the Eastern Villages development as part of the future development used in the assessment and included consultants for the East Swindon Development group among the key stakeholders.

9.33 The WCS concludes that:

- *‘There is sufficient strategic water cycle capacity in Swindon to accommodate all of the development scenarios considered, however, this is subject to the recommendations outlined below.*
- *Development in Swindon can be accommodated without causing a failure of statutory environmental water quality objectives, subject to infrastructure being funded and delivered in the right place and at the right time.*
- *Development in Swindon up to 2025/26 need not be constrained by the uncertainties over the Upper Thames Reservoir, although the timely delivery of the reservoir will alleviate some water supply constraints.*
- *There is sufficient area within the study boundary that can be developed with or without mitigation without increasing flood risk, subject to confirmation by a strategic flood risk assessment (SFRA).*
- *The use of greater demand management techniques may be used to offset the requirement for some water cycle infrastructure, or delay the time by which it is needed.*
- *The exact location and phasing of development will need to be determined as part of the Swindon Borough local development framework (LDF) process to ensure that infrastructure is provided in the right place and at the right time.’*

9.34 Recommendations for a Phase 2 study included the re-evaluation of the water resources assessment in light of new data in Thames Water Resource Plan 06, when it is agreed with the Environment Agency and OFWAT.

Swindon Borough Council Water Cycle Study - Phase 2 (January, 2014)

9.35 The Swindon Borough Council Water Cycle Study - Phase 2 (Phase 2 WCS) (Ref 9.14) updates the WCS (Ref 9.13) to account for new policy and development forecasts. In particular the updated requirements for achieving the pollution targets set in the WFD (Ref 9.1).

9.36 The Phase 2 WCS indicates that the provision of additional Wastewater Treatment Works (WwTW), as recommended in the WCS to support future development, could prohibit the future aspirations to achieve ecological ‘Good’ status under the WFD for receiving watercourses. The Phase 2 WCS concludes that proposed options to support the NEV in the phase 1 WCS are not viable (i.e. improving existing WwTW or building a new WwTW).

9.37 With regard to the 2 options in the WCS for increasing wastewater treatment provision, the Phase 2 WCS states that;

- *'The 'no deterioration' requirement of the Water Framework Directive makes a new WwTW discharge to a waterbody that currently has no WwTW discharge unviable;*
- *The amended scale and profile of development make these options unviable.'*

9.38 The recommendations of the Phase 2 WCS with respect to future development in Swindon are;

'With respect to Swindon Borough Council and Swindon WwTW, assuming that infrastructure can be provided to maintain the current effluent quality (discussed in section 4), then development can proceed without causing any deterioration to Water Framework Directive classification status whilst this process is underway.'

9.39 On this basis, the NEV developments can proceed assuming that any increases of treated effluent discharge would not cause deterioration in the existing water quality of the receiving watercourses; and that current WwTW will treat to a standard to achieve the 'no deterioration' criteria currently in place in the interim.

9.40 The provision of any additional wastewater capacity to support development would be assessed by Thames Water. As the NEV development is a regionally strategic development (south-west) Local policy indicates that infrastructure will be provided in a timely fashion to support the development.

9.41 Wastewater treatment for other water quality indicators is described as being sufficient to achieve the 'no deterioration' criteria in the WFD, and development to be allowable on that basis. The improvements necessary to achieve the WFD targets should be achievable through the future upgrades to infrastructure to improve current treated effluent discharge quality.

Swindon Local Flood Risk Management Strategy (July 2014)

9.42 The Swindon Local Flood Risk Management Strategy (LFRMS (**Ref 9.15**);

'is a tool to help understand and manage flood risk across Swindon. Its primary focus is on local flooding arising from surface water, streams and ditches. The Strategy will assist the Council and their partners to better understand the risk of local flooding and how various agencies can work together to manage that risk.'

9.43 Policy EN6, (including the amendment as proposed in Appendix 1) provides that the LFRMS be considered to address flood risk at local level, including surface water management.

Consultation

9.44 The views of the EA were sought on flood risk. The EA confirmed they held no objection to the original proposals in letters dated August 2015 (Ref *WA/2015/120566/01-L01* and *WA/2015/120562/01-L01*) and October 2015 (Ref *WA/2015/120566/02-L01* and *WA/2015/120562/02-L02*). There have been no significant changes to the flood mitigation scheme proposed within the 2015 applications and the EA confirmed in October 2018 that the underlying modelling data is unchanged.

- 9.45 The views of the LLFA have been sought on flood risk, the safeguarded canal route, surface water management, and SuDS.
- 9.46 A meeting between the LLFA and PBA was held on 23rd October. **Table 9.1** summarises the consultee comments.

Table 9.1 Summary of Consultee Comments Received to Date Relating to Water Resources

Ref.	Consultee	Date	Summary of Main Points made by Consultee	Response
1	Swindon Borough Council	23 rd October 2018	Updating the hydraulic model	PBA will not be updating the hydraulic model. The EA River Cole EDA Model, 2011 with updated 2016 climate change runs is the most up to date model. The LLFA confirmed the EA should confirm the hydraulic model and flood mitigation scheme.
2	Swindon Borough Council	23 rd October 2018	Public Open Space (POS) and Allotments	PBA highlighted that these were located outside the floodplain and that they could be located inside the floodplain as they are considered Less Vulnerable or Water Compatible development. SBC confirmed that the POS is acceptable in the floodplain but the landscaping officer should be consulted in regards to the allotments. This firstly will be presented to the client to see if they would like to pursue the option.
3	Swindon Borough Council	23 rd October 2018	Canal corridor	PBA indicated that the minimum width for the canal corridor was set at 50m. SBC indicated that they knew the minimum width was 30m therefore 50m was sufficient. SBC stated that development should not prejudice future delivery of the canal. Discussion as to whether SuDS would be acceptable in the canal corridor, which may later be subsumed by the canal. Liaison with Wilts and Berks Canal Trust is needed to see if this is a possible option.
4	Swindon Borough Council	23 rd October 2018	SuDS features	The LLFA indicated their preference for linear SuDS features using the existing drainage ditches and features within the site. PBA indicated that is likely that strategic attenuation basins are likely to still be needed within each sub-catchment as swales provide limited value due to their restricted depth and width. SBC stated that using sports pitches to provide attenuation would need approval from their landscaping officer. There is the possibility of long term management issues with the land being owned and maintained by a third party, beyond the control of SBC. PBA suggested geo-circular cells to be used in the

				<p>school, sports pitches and local centre areas. These were not considered suitable SuDS by the LLFA.</p> <p>The benefits of standalone SuDS features at the schools were identified by the LLFA.</p>
5	Swindon Borough Council	23 rd October 2018	Draft Master Plan Comments	<p>SBC requested that existing and proposed drainage features were shown more predominantly on the Masterplan.</p> <p>The LLFA indicated that realignment of the central ditch would require the LLFA's consent.</p> <p>The Western attenuation basin is to be checked by the LLFA by the heritage officer given its proximity to the SAM.</p>
6	Swindon Borough Council	23 rd October 2018	Design Parameters	<p>The LLFA confirmed the following design principles were acceptable for the Surface Water Management Plan: it is considered preferential to assess the site as smaller sub-catchments.</p> <p>Swales can be 1m deep in landscaped areas and 0.6m deep adjacent to highways with a maximum water depth of 0.45m.</p> <p>Surface water run-off should be limited to the greenfield QBAR rate up to and including the 1 in 100 + 40% allowance for climate change. ~4.5l/s is considered acceptable.</p> <p>All attenuation features will need to be designed to accommodate surface water run-off up to and including the 1 in 100year + 40% allowance for climate change.</p> <p>The LLFA indicated that it would be acceptable to show a fixed volume of surface water attenuation for each sub-catchment within the strategic feature and state that any residual storage volume would need to be provided by on-plot source control measures at the detailed design stage. PBA indicated that there is a possible future risk if the residual volume within the development plots impacts the number and density of housing that could be delivered and compromises the number of dwellings originally proposed through the outline application.</p>

Study Area

9.47 The Study Area for water resources is the Application Site and the land surrounding it. The development must not exceed flood risk to the surrounding land, cause a deterioration in the water quality or compromise the ability of the waterbodies to achieve a 'Good' WFD status.

Baseline Conditions

Existing Conditions

9.48 The baseline conditions have been established from;

- PBA Flood Risk Assessment (2018) (**Appendix 9.1**),
- The Environment Agency online maps.

9.49 **Figure 3.1** of the FRA shows the existing EA Flood Zones on site.

Receptors

9.50 The main receptors affected by potential changes to water resources have been identified as follows:

- Secondary A Aquifers of the Superficial deposits and the bedrock underlying the site.
- The River Cole.
- The Other Watercourses (Dorcan Stream, Liden Brook, Lenta Brook and the existing Land drains on the Site.) Refer to Figure 2.2 in **Appendix 9.1** for a location plan of these watercourse.
- Future Occupants.
- Offsite Land.
- Existing Commercial and Residential Development (the converted farm buildings as commercial offices and Lotmead Cottages, which are assumed to be retained within the Application Site).
- The Occupants of the Existing Commercial and Residential Development.

Application Site

9.51 The Site is largely open farmland, albeit it also comprises – inter alia –:

- Lotmead Farmstead, including dairy farm buildings;
- Lotmead ‘Pick Your Own’, which comprises various fruit and vegetables, a farm shop/café with outside seating area, animal and bird sanctuary/farm and children play area;
- Lotmead Business Village – renovated farm buildings offering business accommodation, and Lotmead cottages.

9.52 The Site also includes a Scheduled Ancient Monument in its south west corner along Wanborough Road, which comprises a former Roman settlement, now largely below ground. The Site is bordered to the north by open countryside and the River Cole, to the south and east by open countryside and to the west by Wanborough Road, from which both the main pedestrian and vehicular access are located.

9.53 In terms of topography, the Site is predominantly flat open landscape. The Site includes a network of watercourses including the River Cole, Dorcan Stream and a number of ponds. The Site falls within all three Flood Zones, as indicated on the Environment Agency’s flood maps.

- 9.54 The EA Flood Zone map shows the Development site to contain Flood Zones 1, 2 and 3 inside the site. The existing use of the site is agricultural and is mostly considered undeveloped with the existing cattle shed/ hay barns/ converted offices on-site being a less vulnerable use in the NPPF.

Fluvial Flooding

- 9.55 As part of the FRA, hydraulic modelling of the River Cole was obtained from the Environment Agency. This model was reviewed and refined with topographic survey and improved hydrology (corrections to the 1 in 1000 year hydrology) to establish the baseline Fluvial Flooding conditions.
- 9.56 The refinement of the model also looked at the future climate change scenario for the 1 in 100 year event and considers the updated EA guidance for Flood Risk Assessments relating to climate change allowances. The results of the modelling confirm the proposals are safe with regards to flood risk, do not increase flood risk to third parties and comply with all national and local policy.

Surface Water Flooding

- 9.57 The EA Surface Water flood mapping for the area shows the Site is at risk from surface water flooding. The flood risk on-site is classified between 'High' and 'Medium'. The surface water flooding follows the flow paths for fluvial flooding from the Liden Brook, and located over the existing fluvial Flood Zones. There are narrow corridors of higher risk following the Dorcan Stream and the ditch which drains from the south-east into it. Consequently the flood risk from surface water is similar to the fluvial flood risk on-site but is considered to be less significant than the fluvial flood risk. There may however, be local instances of ponding in local depressions etc. where surface water flood risk exceeds the fluvial flood risk.
- 9.58 Surface water is potentially more significant as a pollutant vector, providing a means for mobilising pollutants into the surrounding watercourses. The current Site is agricultural so there is a potential for solid particulates (soil particles/ silt/ animal waste) in the existing surface water run off to form part of the baseline conditions for surface water.

Water Quality

- 9.59 The reach of the River Cole from upstream of the Site, through the Site to the confluence of the Liden Brook is classified as having a 'Good Potential Ecological Status' as defined by the EA. The reach of the River Cole and Liden Brook downstream of the Site is described as being of a 'Moderate Potential Ecological Status'.
- 9.60 The River Cole, Dorcan Stream and Liden Brook are shown in the EA Water Framework Directive - 2009 River Basin Management Plans - Rivers online map, as not requiring assessment in terms of ecology. However, as these watercourses drain to the River Cole they will be included in the Water Quality assessment as the Water Quality in these watercourses will affect the River Cole, which is Water Quality -sensitive.
- 9.61 The River Cole, Dorcan Stream and Liden Brook are indicated as not requiring assessment in the EA Water Framework Directive - 2009 River Basin Management Plans - Rivers online map, in terms of chemical quality. Consequently an assessment of the Chemical Water Quality is not considered necessary in this ES chapter.

Water Supply and Sewer Capacity

- 9.62 The Water Cycle Study for Swindon indicated potential issues in the Water Supply and Sewer Capacity for the NEV development and increases in Sewer Capacity could have an adverse effect to the Treated Effluent Discharge to the River Cole. The WCS (**Ref 9.13**) recommended that a more detailed assessment be carried out for the Phase 2 Water Cycle Study (**Ref 9.14**).
- 9.63 The Phase 2 Water Cycle Study identified that the current Water Supply Provision will have capacity for the NEV without needing additional supply infrastructure. However, Thames Water has identified that the existing potable water network will need to be upgraded to provide a new trunk main to the NEV development.
- 9.64 The Phase 2 WCS (**Ref 9.14**) did identify a shortfall in wastewater treatment provision. The SPD (**Ref 9.10**) and Local Plan (**Ref 9.9**) assume that additional infrastructure would be provided by Thames Water to support the NEV development. Thames Water has confirmed that the existing foul water network does not have sufficient capacity and will be providing a new terminal pumping station for the NEV development, in which Lotmead Farm Villages will discharge to.
- 9.65 Further details regarding Utility capacity, including water supply and sewer capacity, are provided in the Utility Supply and Foul Water Sewerage Technical Note (**Appendix 9.2**), which should be read in conjunction with this document.
- 9.66 Based on the new supply enquiries undertaken and detailed in the Technical Note, it is considered that appropriate infrastructure is, or will be, in place to serve the proposed development.

Scope and Methodology

- 9.67 This section of ES chapter discusses the methodology used to determine the Environmental impact on;
- Fluvial Flood Risk,
 - Surface Water Flood Risk,
 - Water Quality,
 - Water Supply and Sewer Capacity.

Scoping

- 9.68 The scope of assessment has been determined through a scoping exercise submitted to the Council. Consultation has been undertaken with statutory regulators (including EA, TWUL, and the Council as the local planning authority. Details of this is provided in **Section 9.45**, 'Consultation'.

Determining the Sensitivity to Potential Change

- 9.69 Determination of the sensitivity (or value) of the receptors has been undertaken based upon defining the quality of condition of each receptor and determining their sensitivity to potential change.
- 9.70 The assessment of sensitivity (or value) of the receptors has been based on the criteria in **Table 9.2**.

Table 9.2: Sensitivity/value of receptor

Sensitivity/value of a Receptor	Description	Example
Very High	Attribute with a high quality and rarity, regional or national scale and limited potential for substitution.	<p>Examples include;</p> <p>Receiving watercourse classified as High Ecological status / potential under WFD</p> <p>Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI)</p> <p>Site located within a groundwater Source Protection Zone (SPZ) inner protection zone (Zone 1), defined by a 50 day travel time from any point below the water table to the source</p> <p>NPPF Flood Risk Vulnerability Classification “Essential Infrastructure”</p>
High	<p>Attribute with a high quality and rarity, local scale and limited potential for substitution.</p> <p>Attribute with a medium quality and rarity, regional or national scale and limited potential for substitution.</p>	<p>Examples include;</p> <p>EA current river ecological and chemical qualities defined as Good</p> <p>EA current groundwater quantitative and chemical qualities defined as Good</p> <p>Human receptors (construction workers and future residents)</p> <p>Receiving watercourse classified as Good Ecological status / potential under WFD Species protected under EU or UK wildlife legislation</p> <p>Site located within a groundwater Source Protection Zone (SPZ) outer protection zone (Zone 1), defined by a 400 day travel time from any point below the water table to the source</p> <p>NPPF Flood Risk Vulnerability Classification “Highly Vulnerable”</p> <p>New water supply source required</p> <p>New waste water treatment plant required</p>
Medium	<p>Attribute with a medium quality and rarity, local scale and limited potential for substitution.</p> <p>Attribute with a low quality and rarity, regional or national scale and limited potential for substitution.</p>	<p>Examples include;</p> <p>Floodplain providing a moderate volume of storage</p> <p>Receiving watercourse classified as Moderate Ecological status/potential under WFD</p> <p>NPPF Flood Risk Vulnerability Classification “More Vulnerable”</p> <p>A requirement for substantial works to existing water supply infrastructure</p> <p>A requirement for substantial works to existing waste water treatment plant required</p>

Sensitivity/value of a Receptor	Description	Example
Low	Attribute with a low quality and rarity, local scale and limited potential for substitution	<p>Examples include;</p> <p>EA current river ecological quality defined as Poor / Bad and chemical quality defined as Fail</p> <p>Floodplain with limited existing development.</p> <p>Receiving watercourse classified as Poor Ecological status/ potential under WFD</p> <p>NPPF Flood Risk Vulnerability Classification “Less Vulnerable”</p> <p>A requirement for limited works to existing water supply infrastructure</p> <p>A requirement for limited works to existing waste water treatment plant</p>

9.71 Determination of the magnitude of change to the receptors as a result of the development has been undertaken based upon the criteria in **Table 9.3**.

Table 9.3: Magnitude of impact

Magnitude of Impact	Description	Example
High	Results in a loss of attribute and/or quality and integrity of the attribute	<p>Examples include;</p> <p>Change in ecological and / or chemical qualities of the surface water</p> <p>Loss of flood storage/increased flood risk</p> <p>Large change in:</p> <p>water quality of receiving watercourse</p> <p>NPPF Flood Risk Vulnerability Classification</p> <p>surface water flood risk</p> <p>fluvial flood risk</p> <p>water supply volume</p> <p>foul drainage volume</p>
Medium	Results in impact on integrity of attribute, or loss of part of attribute	<p>Examples include;</p> <p>Contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its qualities</p> <p>Moderate change in:</p> <p>water quality of receiving watercourse</p> <p>NPPF Flood Risk Vulnerability Classification</p> <p>surface water flood risk</p> <p>fluvial flood risk</p>

Magnitude of Impact	Description	Example
		water supply volume foul drainage volume
Low	Results in some measurable change in attribute's quality or vulnerability	Examples include; Measurable changes in attribute, but of limited size and/or proportion Small change in: water quality of receiving watercourse NPPF Flood Risk Vulnerability Classification surface water flood risk fluvial flood risk water supply volume foul drainage volume
Negligible	No discernible change in environmental conditions.	Examples include; Discharges to watercourse but no significant loss in quality or biodiversity no significant impact on the economic value of the feature No increase in flood risk No change or barely perceptible change in: water quality of receiving watercourse NPPF Flood Risk Vulnerability Classification surface water flood risk fluvial flood risk water supply volume foul drainage volume

9.72 The significance of a potential effect upon a sensitive receptor is derived from both the level of sensitivity of that receptor and the magnitude of the change/impact arising from the Proposed Development. The significance of a potential effect is then determined using the matrix presented in **Table 9.4**. The significance of a potential effect can be either adverse or beneficial. The significance of a potential effect should also be qualified based on the likelihood of an impact occurring (using a scale of certain, likely or unlikely) and the confidence in the accuracy of the assessment. The result of this assessment is presented as "residual effects," which take into account the likely effects on a sensitive receptor following proposed mitigation and the likelihood of that effect occurring.

Table 9.4: Significance of Potential Effects Matrix

Sensitivity / value of a Receptor	Magnitude of Impact			
	High	Medium	Low	Negligible
Very High	Major	Major	Moderate	Slight
High	Major	Moderate	Slight	Negligible
Medium	Moderate	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible

- 9.73 Temporary effects are considered to occur in the construction phase, and permanent effects in the occupational phase (albeit that the impact may first occur during construction i.e. change of surface material).
- 9.74 In all cases, where the level of overall effects are predicted to be moderate or substantial (shaded yellow), this will result in a significant effect. All other effects will be not significant.
- 9.75 The residual effects of the Development upon sensitive receptors, following the implementation of any proposed mitigation measures, have been assessed based on the standardised significance criteria. These have been based on a qualitative appraisal of the magnitude of the impact and the sensitivity of the affected receptor in relation to the assessed element (Flood risk apart from groundwater, water quality and, water supply and sewage capacity. The significance criteria are set out in Table 9.5).

Table 9.5: Water Resources Significance Criteria

Significance Level	Criteria	Typical Examples
Substantial Beneficial	Key improvements at district scale	<p>Fundamental changes to the regional hydrological regime</p> <p>Fundamental reduction in volume and/or peak discharge of surface water runoff from the Site</p> <p>Fundamental improvement in ground or surface water quality</p> <p>Fundamental changes to flow conveyance and flood plain storage</p>
Moderate Beneficial	Improvements at local scale	<p>Material changes to the local hydrological regime;</p> <p>Material reduction in volume and/or peak discharge of surface water runoff from the Site</p> <p>Material improvement in ground or surface water quality</p> <p>Material changes to flow conveyance and flood plain storage</p>
Slight Beneficial	Limited improvements	Some noticeable changes to the local hydrological regime;

Significance Level	Criteria	Typical Examples
	at local scale	<p>Some noticeable reduction in volume and/or peak discharge of surface water runoff from the Site</p> <p>Some noticeable improvement in ground or surface water quality</p> <p>Some noticeable changes to flow conveyance and flood plain storage</p>
Negligible	No effect	<p>No noticeable changes to the local hydrological regime;</p> <p>No noticeable change in volume and/or peak discharge of surface water runoff from the Site</p> <p>No noticeable changes in ground or surface water quality</p> <p>No noticeable changes to flow conveyance and flood plain storage</p>
Slight Adverse	Limited detrimental effects at local scale	<p>Some noticeable changes to the local hydrological regime;</p> <p>Some noticeable increase in volume and/or peak discharge of surface water runoff from the Site</p> <p>Some noticeable deterioration in ground or surface water quality</p> <p>Some noticeable changes to flow conveyance and flood plain storage</p>
Moderate Adverse	Detrimental effects at local scale	<p>Material changes to the local hydrological regime;</p> <p>Material increase in volume and/or peak discharge of surface water runoff from the Site</p> <p>Material deterioration in ground or surface water quality</p> <p>Material changes to flow conveyance and flood plain storage</p>
Substantial Adverse	Important detrimental effects at district scale which may become key factors in the decision-making process	<p>Fundamental changes to the regional hydrological regime</p> <p>Pollution of potable sources of water abstraction</p> <p>Fundamental increase in volume and/or peak discharge of surface water runoff from the Site</p> <p>Fundamental deterioration in ground or surface water quality</p> <p>Fundamental changes to flow conveyance and flood plain storage</p>

- 9.76 The magnitude of flood risk and severity of the effect upon people and property for the 'baseline' and 'with development' scenarios has been considered as part of the accompanying FRA (**Appendix 9.1, Section 6.4**)

Mitigation

- 9.77 Mitigation measures have been recommended where potential impacts are identified.
- 9.78 A Floodplain Restoration Scheme, as set out in the FRA (Appendix 9.1, Section 6.3) is proposed. This would be constructed in advance of any development within the current Flood Zones and would be classed as Primary Mitigation.
- 9.79 Additionally, there are further mitigation measures recommended; secondary mitigation measures such as sustainable drainage components will be incorporated within the surface water drainage strategy and tertiary mitigation measures such as a Construction Environmental Management Plan (CEMP) would be secured through the environmental permit applications.

Limitations and Assumptions

- 9.80 This assessment is based on the FRA, the drainage strategy and the hydraulic modelling. The limitations stated in these documents also apply to this document.
- 9.81 This assessment also relies upon the EA online maps, and the limitations and conditions stated for the use of these maps also apply to their use in this document.
- 9.82 It is assumed that any additional supply or capacity needed for the development will be provided by Thames Water in a timely fashion, to support development.

Environmental Assessment: Construction Phase

- 9.83 This section identifies the likely significant effects resulting from the Construction and Operation of the Proposed Development, having had regard to the sensitivity of a particular receptor and the magnitude of impact that will result from the development.

Fluvial Flooding

River Cole (Medium sensitivity)

- 9.84 There are no developments along the River Cole which would be affected during the construction phase of the Development. The only potential impact is to the A420 at Acorn Bridge downstream of the Site. Consequently the River Cole is considered a **Medium** sensitivity receptor for fluvial flooding.
- 9.85 The surface cover on the Site will change during the construction work as the grass cover is removed. This will increase the surface water runoff rate from the Site. As surface water runoff drains to the River Cole this will increase the fluvial flood risk in the River Cole. This increase in surface water runoff will increase the risk to Acorn Bridge.
- 9.86 The Site is adjacent to the River Cole so the drainage path for runoff into the River Cole could be short, but this impact will only occur during the construction of temporary works/SuDS. The actual change in surface cover during the construction of the (temporary works) Development will be relatively small compared to the catchment of the River Cole so the magnitude of effect is expected to be **Negligible/ Low Adverse**.

9.87 The Fluvial Flooding impact during the construction of the temporary works or SuDS is considered to be of a **Negligible Adverse** effect as the area of changed surface cover is minor.

Other Watercourses (Medium sensitivity)

9.88 There are no developments in the floodplain of the Other Watercourses (all in Flood Zone 1) which would be affected during the construction of the Development. As the Other Watercourses drain to the River Cole there is a potential impact to the A420 at Acorn Bridge downstream of the Site, consequently the Other Watercourses are considered a **Medium** sensitivity Receptor for fluvial flooding.

9.89 The surface cover on the Site will change during the construction work as the grass cover is removed. This will temporarily increase the surface water runoff rate from the Site. As surface water runoff from the Other Watercourses on-site drain to the River Cole, this will increase the fluvial flooding impact to the River Cole. This increase in surface water runoff will increase the risk to Acorn Bridge.

9.90 This impact will only occur during the construction of temporary works/SuDS, and the actual change in surface cover during the construction of the Development will be relatively small compared to the catchment of the River Cole so the impact is expected to be **Negligible/ Low Adverse**.

9.91 The significance of the Fluvial Flooding impact, due to change of surface cover in the construction of the Site is considered **Negligible/low Adverse**. Once temporary works/SuDS are in place to control surface water runoff, the significance of the effect is considered to be **Negligible**.

Occupants on-site (High sensitivity)

9.92 Workers on the Site are considered a **High** sensitivity receptor. The only work in Flood Zones 2 and 3 for the Site will be for the Floodplain Restoration scheme and the crossings of the River Cole, once the floodplain restoration scheme is constructed the area of for the green infrastructure and SuDS will become Flood Zone 1. This is considered a **Medium/Low** impact. Consequently, the effects of fluvial flooding upon the workers operating on the Development Site during the construction phase is considered to be of **Moderate/Slight Adverse** significance.

Surface Water Flooding

River Cole (Medium sensitivity)

9.93 There are no developments along the River Cole which would be affected during the construction phase of the Development. There is a potential Surface Water Flooding impact to the A420 at Acorn Bridge downstream of the site. Consequently the River Cole is considered to be a **Medium** sensitivity receptor.

9.94 The surface cover on the Site will change during the construction work as the grass cover is removed. This will increase the surface water runoff rate from the Site. As surface water runoff from the site drains to the River Cole, this will increase the surface water flooding to the River Cole.

9.95 This impact upon the River Cole will only occur during the construction of temporary works/SuDS. The actual change in surface cover during the construction of the Development

will be relatively small compared to the catchment of the River Cole so the impact is expected to be **Negligible/ Low Adverse**.

- 9.96 The impact during the construction of the temporary work or SuDS is considered to be of a **Negligible/Low Adverse**, as the area of changed surface cover is minor. Consequently the significance of the Surface Water Flooding impact upon the River Cole, due to change of surface cover during the construction of the Site is considered to have a **Negligible Adverse** effect.

Other Watercourses (Medium sensitivity)

- 9.97 There are no developments in the Surface Water Flood route in the EA Flooding from Surface Water online maps, which would be affected during the construction of the Development. As Surface Water Flooding along the Other Watercourses drains to the River Cole, the Surface Water Flooding impact is to the A420 at Acorn Bridge downstream of the site. Consequently, the Other Watercourses are considered a **Medium** sensitivity Receptor for surface water flooding.
- 9.98 The surface cover on the Site will change during the construction work as the grass cover is removed. This will increase the surface water runoff rate from the Site. This increase in surface water runoff will increase the risk to Acorn Bridge.
- 9.99 This impact will only occur during the construction of temporary works/SuDS, and the actual change in surface cover during the construction of the Development will be relatively small compared to the catchment of the River Cole so the Surface Water Flooding impact is expected to be **Negligible/ Low Adverse**.
- 9.100 The significance of the Surface Water Flooding effects, due to change of surface cover during the construction of Development is considered **Negligible Adverse**. Once temporary works/SuDS are in place to control surface water runoff, the effect is considered to be **Negligible**.

Occupants on site (High sensitivity)

- 9.101 Workers on site are considered a **High** sensitivity receptor. The only work in Flood Zones 2 and 3 for the Site will be for the Floodplain Restoration scheme and the crossings of the River Cole. The construction of the Floodplain restoration scheme will remove the surface water flow routes for the SuDS and green infrastructure corridors. This increase in surface water runoff is considered a **Medium/Low** impact. Consequently, the Surface Water Flooding effects during the construction of the Development to the workers on-site are considered to be of **Moderate/Slight Adverse** significance.

Water Quality

River Cole (High sensitivity)

- 9.102 The River Cole is located in a surface water Safeguard Zone in the EA Drinking Water Safeguard Zones online map. The River Cole past the site is also designated as 'good potential status in the EA Water Framework Directive 2009 - River Basin Management Plans online map. The EA Catchment Data Explorer classified the River Cole as 'Poor' status in 2016. Consequently the River Cole is a **High** sensitivity receptor for Water Quality.
- 9.103 The construction work will increase the storage of potential contaminant materials on site which could potentially contaminate the surrounding watercourses through accidental

spillage/leakage. The movement of construction vehicles will also mobilise soil particulates which could be mobilised by surface water flows into the surrounding Watercourses. The potential Water Quality impact during the construction of the Development to the River Cole is considered to be **High/Medium adverse**.

- 9.104 Consequently the effect on Water Quality during construction of the Development to the River Cole is considered to be of **Major/Moderate Adverse** significance.

Other Watercourses (High sensitivity)

- 9.105 The other watercourses on-site are located in a surface water Safeguard Zone in the EA Drinking Water Safeguard Zones online map. The Other Watercourses on-site drain to the River Cole which is a High sensitivity receptor. Consequently the Other Watercourses are considered to be a **High** sensitivity receptor.

- 9.106 The construction work will increase the storage of potential contaminant materials on site which could potentially contaminate surrounding watercourses through accidental spillage/leakage. The movement of construction vehicles will also mobilise soil particulates which could be mobilised by surface water flows into the surrounding Watercourses. The potential Water Quality impact during the construction of the Development to the Other Watercourses is considered to be **High/Medium Adverse**.

- 9.107 Consequently the effects on Water Quality during the construction of the Development to in the Other Watercourses is considered to be **Substantial/Moderate Adverse** significance.

Water Supply and Sewer Capacity

- 9.108 The construction of the Development may make use of any new wastewater treatment infrastructure to be constructed on site in earlier phases of the NEV development. The WCS (**Ref 9.11**) and Phase 2 WCS (**Ref 9.12**) indicate that there may be capacity issues for foul sewerage, but the Local Plan (**Ref 9.9**) and SPD (**Ref 9.10**) indicate that potential capacity issues should be addressed by Thames Water (through additional provision) in a 'timely' fashion.

- 9.109 The WCS and Phase 2 WCS indicate that sufficient water supply is available to development to 2026; it is thought that the construction works would not represent an increase in demand beyond the assessments of the WCS documents.

- 9.110 The resolution of this issue in the SPD references the Local Plan (Policy IN2), stating;

'Future wastewater treatment and improvements in related river quality will be addressed through the timely expansion of the Rodbourne Sewage Treatment Works and / or an additional Sewage Treatment Works to the east of Swindon to serve the New Eastern Villages developments, if proven to be the most sustainable option, particularly to ensure delivery of the housing trajectory.'

- 9.111 The Phase 2 WCS discounts these options but recommends that;

'With respect to Swindon Borough Council and Swindon WwTW, assuming that infrastructure can be provided to maintain the current effluent quality (discussed in section 4), then development can proceed without causing any deterioration to Water Framework Directive classification status whilst this process is underway.'

9.112 On the understanding that additional sewer capacity will not contravene the WFD (**Ref 9.1**) requirements to the River Cole additional Sewer capacity can be provided. The Local Plan and SPD consider that this provision is the responsibility of Thames Water. Paragraph 4.235 of the Local Plan states that:

‘Thames Water has plans in place to provide the necessary sewerage infrastructure to increase capacity in line with proposed new developments, and to fulfil requirements identified by Ofwat. However, sewerage plans will not be finalised until the details of the proposal are submitted for approval.’

9.113 The provision of Thames Water infrastructure is assumed to be provided in a timely manner in the Local Plan and SPD.

9.114 Consequently, in the event that a new wastewater treatment works is necessary to support the Development, the construction of the treatment works would be separate to the Development and should not be included in the impact of these Developments.

9.115 On the basis that the Phase 2 WCS assessment of the impact to water supply and Sewer Capacity from further development in Swindon is **Negligible** the effect upon all identified receptors are considered to be of **Negligible significance**.

Occupants of Existing Commercial Development (High sensitivity)

9.116 The Occupants of the Existing Commercial Development on site are considered to be a **High** sensitivity receptor. It is assumed that sufficient capacity exists for the construction of the Development; this is supported by the WCS (**Ref 9.11**). On this basis it has been assessed that there is a **Negligible** Water Supply and Sewerage Capacity impact from the construction of the Development to the Occupants of the Existing Commercial Development on-site. Consequently the significance of this Water Supply and Sewer Capacity impact is considered to be **Negligible**.

Offsite land (Low sensitivity)

9.117 Offsite land will be unoccupied during the construction of the Development and is considered to be of a **Low** sensitivity for Water Supply and Sewer Capacity.

9.118 The WCS (ref 9.11) indicates that there is capacity in the current Water Supply and Sewer Capacity infrastructure such that there will be a **Negligible** impact from the construction of the Phase 1 Development to Water Supply and Sewerage Capacity that will affect Offsite land including other development.

9.119 Consequently this impact is considered to be of **Negligible** significance.

Existing Commercial Development (High sensitivity)

9.120 The Existing Commercial Development on site is considered to be a **High** sensitivity Receptor for Water Supply and Sewer Capacity.

9.121 The WCS (Ref 9.11) indicates that there is capacity in the current Water Supply and Sewer Capacity infrastructure such that there will be a **Negligible** Water Supply and Sewerage Capacity impact from the construction of the Development to the Existing Commercial Development on-site. Consequently the Water Supply and Sewer Capacity impact during the construction of the Development is considered to be of **Negligible** significance.

Occupants of Offsite Development (High)

- 9.122 The Occupants of Offsite Development are considered to be of a **High** sensitivity to Water Supply and Sewer Capacity.
- 9.123 The WCS (Ref 9.11) indicates that there is sufficient capacity to support the Wider NEV development in Swindon. The Construction of the Development will therefore have a **Negligible** Water Supply and Sewer Capacity impact to the Occupants of Offsite Development. Consequently, the Water Supply and Sewer Capacity impact of the Phase 1 Development during the construction of the Development to Occupants of Offsite Development is considered to be of **Negligible** significance.

Environmental Assessment: Operational Phase

Fluvial Flooding

River Cole (Medium sensitivity)

- 9.124 There are no developments in the River Cole floodplain which would be affected during the operation of the Development. There is a potential impact to the A420 at Acorn Bridge downstream of the Site. Therefore the River Cole is considered to be a **Medium** sensitivity receptor.
- 9.125 Through the use of SuDS and the Floodplain Restoration scheme, the operation of the Development will reduce the fluvial flooding impact to the River Cole by reducing the surface water runoff from the Site. The Floodplain Restoration scheme provides a minor benefit at Acorn Bridge of around 0.1 m. The impact of the operation of the Development is considered to be **Medium/Low Beneficial**.
- 9.126 Fluvial modelling has been undertaken to assess climate change effects on the proposed Flood Restoration Scheme. The modelling shows that the flood extents as a result of the climate change allowances are no greater than the 1 in 1,000 annual probability fluvial flood extents, and therefore the developed areas of the site will remain at low risk of fluvial flooding.
- 9.127 The significance of the effect upon Fluvial Flooding, during the Operation of the Development is considered **Slight/Negligible Beneficial**.

Other Watercourses (Medium sensitivity)

- 9.128 There are no developments in the floodplain of the watercourses (all in Flood Zone 1) which would be affected during the Operation of the Development. As the Other Watercourses drain to the River Cole, there is a potential impact to the A420 at Acorn Bridge downstream of the site, Consequently the Other Watercourses on-site are considered a **Medium** sensitivity Receptor for fluvial flooding.
- 9.129 The use of SuDS and the Floodplain Restoration scheme will reduce the surface water runoff from the Other Watercourses on-site, which drain to the River Cole; this will reduce the fluvial flooding impact to the River Cole. This reduction in surface water runoff will decrease the fluvial flooding impact to Acorn Bridge. This impact is therefore considered to be **Medium/Low Beneficial**.
- 9.130 The significance of the effect on fluvial flooding to Other Watercourses during the operation of the Development is considered **Slight/Negligible Beneficial**.

Occupants on site (High sensitivity)

- 9.131 The Occupants of Development are a **High** sensitivity receptor. The Development will be located in Flood Zone 1. The SuDS and Floodplain Restoration scheme will reduce the surface water runoff rate and the impact of fluvial flooding to the Development. The operation of the Development will have a **Medium/Low Beneficial** impact to fluvial flooding to the Occupants of development. Therefore the effect upon the occupants of the development from fluvial flooding during the operation of the Development is of **Moderate/Slight Beneficial** significance.

Offsite Land (Medium sensitivity)

- 9.132 The Offsite land is expected to contain the wider NEV development during the operational phase. The NPPF requires that development does not increase flood risk offsite. On this basis the Offsite Land is considered to be a **High** sensitivity receptor. The SuDS and floodplain restoration scheme will have a **Negligible/Low Beneficial** impact to fluvial flooding offsite.
- 9.133 Consequently, the effects on offsite land from fluvial flooding during the operation of the Development are considered to be of **Negligible Beneficial** significance.

Occupants of Offsite Development (High sensitivity)

- 9.134 The Occupants of Offsite Development will be the occupants of the wider NEV developments and are considered to be a **High** sensitivity receptor. The operation of the Development will have a **Negligible** fluvial impact to the Occupants of the Offsite Development. Consequently, the fluvial flooding effects during the operation of the Development upon Occupants of the Offsite Development are considered to be of **Negligible** significance.

Surface Water Flooding

River Cole (Medium sensitivity)

- 9.135 There are no developments along the surface water flow routes along the River Cole on the EA online Flood Risk from Surface Water maps. There is a potential impact to the A420 at Acorn Bridge downstream of the site. Consequently, the River Cole is considered to be a **Medium** sensitivity receptor.
- 9.136 The operation of the Development will reduce the Surface Water Flooding impact to the River Cole by reducing the surface water runoff from the Site, through SuDS and the Floodplain Restoration scheme. The Surface Water Flooding impact of the operation of the Development is considered to be **Moderate/Low Beneficial**.
- 9.137 The significance of the Surface Water Flooding effects on the River Cole during the operation of the Development is considered **Slight/Negligible Beneficial**.

Other Watercourses (Medium sensitivity)

- 9.138 There are no developments along the surface water flow routes along the Other Watercourses, which connect to the River Cole on the EA online Flood Risk from Surface Water map. As the surface water flooding from Other Watercourses connects to the River Cole there is a potential Surface Water Flooding impact to the A420 at Acorn Bridge downstream of the site. Consequently the Other Watercourses are considered a **Medium** sensitivity Receptor for Surface Water Flooding.
- 9.139 The use of SuDS and the Floodplain Restoration Scheme will reduce the surface water runoff affecting the Other Watercourses. This reduction in surface water runoff will reduce the

Surface Water Flooding impact to Acorn Bridge. This impact is expected to be **Medium/Low Beneficial**.

- 9.140 The significance of the Surface Water Flooding impact to Other Watercourses during to the operation of the Development is considered **Moderate/Slight Beneficial**.

Occupants on site (High sensitivity)

- 9.141 The Occupants of on site are a **High** sensitivity receptor. As the surface water flow routes on site follow the fluvial flow routes, the SuDS and Floodplain Restoration scheme will have a **Medium/Low Beneficial** Surface Water Flooding impact, therefore the Surface Water Flooding effects to the occupants of the site during the operation of the Development is of **Moderate/Slight Beneficial** significance to the Occupants of the Development.

Water Quality

River Cole (High sensitivity)

- 9.142 The River Cole is located in a surface water Safeguard Zone in the EA Drinking Water Safeguard Zones online map. The River Cole past the Site is also designated as 'good potential status in the EA Water Framework Directive 2009 - River Basin Management Plans online map. The EA Catchment Data Explorer classified the River Cole as 'Poor' status in 2016. Consequently the River Cole is a **High** sensitivity receptor for Water Quality.
- 9.143 The operation of the Development will improve the Water Quality to the River Cole, through SuDS and the green infrastructure. The impact is of the operation of the Development is considered to be **Medium/Low Beneficial**.
- 9.144 The significance of effects on Water Quality, during the operation of the Development is considered to be **Moderate/Slight Beneficial**

Other Watercourses (High sensitivity)

- 9.145 The other watercourses on-site are located in a surface water Safeguard Zone in the EA Drinking Water Safeguard Zones online map. The Other Watercourses on-site drain to the River Cole which is a High sensitivity receptor. Consequently the Other Watercourses are considered to be a **High** sensitivity receptor.
- 9.146 The use of SuDS and green infrastructure will improve the Water Quality of the surface water runoff from the Other Watercourses. This Water Quality impact is considered to be **Medium/Low Beneficial**.
- 9.147 The significance of effects on Water Quality to Other Watercourses due to the operation of the Development Site is considered **Moderate/Slight Beneficial**.

Environmental Impact: Cumulative Impact

- 9.148 As the impacts of the Development have already been set out in the earlier sections, they are not repeated here.
- 9.149 Cumulative impact in relation to the Application is considered in the context of the whole of then NEV, including the 'Projects for Assessment' identified within **Appendix 2** of the ES.

Fluvial Flooding

- 9.150 The Site lies downstream of other NEV sites on the Liden Brook. Development along the Liden Brook upstream of the Site could increase the flood risk from the Liden Brook to the Site. The NPPF requires that the NEV needs to demonstrate that it creates no impact on the fluvial flood risk for the Development.
- 9.151 The use of SuDS for the remaining NEV, including those upstream could result in a reduction to runoff to below greenfield rates.
- 9.152 Consequently the cumulative impact on the fluvial risk to the Development is considered **Negligible**.

Surface Water and Drainage

- 9.153 The use of SuDs and the reduction in discharge to green field or lower rates is required throughout the NEV. Consequently it is expected that the cumulative developments could provide no change or an improvement to the surface water runoff from the Site.
- 9.154 The cumulative effects arising from the NEV Developments in respect of surface water drainage are considered to be **Negligible/Slight Beneficial**.

Water Quality

- 9.155 The WFD (Ref 9.1) requirements for at least 'no deterioration' in water quality require that the cumulative effects arising from the NEV developments on water quality are anticipated to be Negligible.

Water Supply and Sewerage Capacity

- 9.156 The cumulative impact of the NEV on the Development has been considered in the relevant local planning policy documents such that there is provision made to support the increase in demand from the NEV for both Water supply and wastewater treatment. Any additional infrastructure is needed to support the water supply demand from the NEV it should be provided in a 'timely' fashion.
- 9.157 Consequently the cumulative effects of the NEV developments on water supply and sewerage are considered to be **Negligible**.

Mitigation and Monitoring

- 9.158 This section of the ES chapter describes the secondary and tertiary mitigation to be applied to address any adverse impacts.

Construction Mitigation

Fluvial Flooding

- 9.159 No development will be located in higher risk Flood Zones (Flood Zones 2 and 3) apart from the Floodplain Restoration scheme and the road crossings of the River Cole. These are considered as 'essential infrastructure' or 'water compatible' uses and considered appropriate development subject to producing no increases to offsite flood risk.
- 9.160 The construction of the Floodplain Restoration scheme will involve works along the River Liden, in Flood Zone 3. Appropriate site management (CEMP) and flood evacuation (Flood Warning Plan) will be provided.

- 9.161 A flood defence consent would also be required for the road crossings or any temporary works close to the River Cole, Dorcan Stream and Liden Brook on site.
- 9.162 A Construction Environmental Management Plan (CEMP) will be undertaken for the Development, providing details of the appropriate measures being undertaken to mitigate the impacts of the Development build out.
- 9.163 A Flood Warning Plan and site management procedures in the CEMP (i.e. ensure no storing of plant or materials in Flood Zone 3 etc.) will be provided to Workers.
- 9.164 The likelihood of an extreme fluvial flooding event during the construction of the Floodplain Restoration scheme is considered to be low. The likely depth and velocity experienced on site and extent of flooding would indicate that construction workers should be able to safely evacuate.
- 9.165 The Floodplain Restoration scheme does not affect the proposed crossings of the River Cole. The CEMP and Flood Warning Plan will mitigate these risks as well.
- 9.166 Once constructed, the Floodplain Restoration scheme (a primary mitigation measure, integrated into the design of the Proposed Development) will improve flood risk for the green infrastructure corridors and for the SuDS. Consequently the Floodplain Restoration scheme should be constructed ahead of any construction work in the baseline Flood Zones on site (*i.e.* green infrastructure corridor, road connections between villages etc.); to reduce any risk during the construction phase.

Surface Water Flooding

- 9.167 The construction of the SuDS should occur before the Development to mitigate Fluvial Flooding impacts for the construction of the Development. Alternatively, temporary works (surface water storage) could be installed as mitigation if this is not possible. Site management procedures in the CEMP would also mitigate any impacts.
- 9.168 The phased development of the Site creates the potential for blockage of infrastructure built for earlier phases of the development. This will be mitigated through site management measures and potential temporary works outlined in the CEMP.
- 9.169 Once constructed, the SuDS attenuation will reduce the surface water runoff during the later phases of construction work.

Water Quality

- 9.170 The phased construction of the Proposed Development has the potential to increase the amount of soil particulates that could be mobilised by surface water flows which could decrease the water quality of receiving watercourses etc.
- 9.171 The presence of plant and other construction material on site, including fuels/ hydrocarbons, also represent a potential source of contamination.
- 9.172 Construction work, including cleaning, would also increase the likelihood of surface water contaminants becoming mobilised and entering the surface water drainage ditches.
- 9.173 A CEMP will be created for the Development, with instructions as to the management and mitigation of any on-site water quality impacts in the construction phase. This will included

the safe storage of plant or contaminants on site and refer to EA Pollution Prevention Guidance notes.

- 9.174 Details of any potential temporary works on site to prevent surface water runoff entering the River Cole may also be included in the CEMP for the construction phase if considered appropriate.
- 9.175 The construction of SuDS and green infrastructure on site will improve the water quality once finished so the potential adverse impact is only considered to be temporary.

Operational Mitigation

Fluvial Flooding

- 9.176 The proposed Development locates all 'less vulnerable', 'more vulnerable' and 'highly vulnerable' uses in Flood Zone 1. The construction of the Floodplain Restoration scheme increases the area of Flood Zone 1 on-site, reducing the risk to on-site occupants.
- 9.177 The crossings of the River Cole floodplain will encroach into Flood Zone 2 and 3. It is recommended that these be constructed as clear span structures with 600mm freeboard on the 1 in 100 year plus climate change flood level. If the Road crossings need to be designed to have an impact on the River Cole floodplain (i.e. as an embankment with culverts) then hydraulic modelling is expected to be necessary to demonstrate that no offsite impact is created and appropriate mitigation would be required.

Surface Water Flooding

- 9.178 A Floodplain Restoration Scheme to remove surface water flow routes through the Development will be created. In addition to SuDS to attenuation surface water runoff.

Water Quality

- 9.179 This increase in treated effluent as a result of the development is considered to have a negligible effect upon water quality. This is on the basis of that the increase in effluent discharge will meet the 'no deterioration' described in the Phase 2 WCS (**Ref 9.12**) and so would represent no change from the current baseline condition. Any new infrastructure required for the Development is to be provided in a timely fashion by Thames Water.
- 9.180 The potential significance of effect on Water Quality during the operation of the Development has been assessed as being **Negligible/Slight Beneficial**. Consequently no additional mitigation is required and residual effects are not considered further.

Water Supply and Sewer Capacity

- 9.181 The effects upon Water Supply and Sewer Capacity during the construction and operation phases of the Development are considered to be **Negligible**. This is on the basis that additional capacity is to be provided by Thames Water in a timely fashion to support the NEV development. The impact of the additional treated wastewater effluent from an increase in Sewer Capacity is assessed as satisfying the WFD (**Ref 9.1**) 'no deterioration' criteria such that the provision of additional sewer capacity is considered to have a **Negligible** effect.
- 9.182 The Water Supply and Sewer Capacity effects relating to the construction and operations phases of the development are discussed in further detail in the Utility Supply and Foul Sewerage Technical Note, which should be read in conjunction with this document.

Summary of Residual Effects

9.183 Where ‘Moderate’ or ‘Substantial’ effects have been identified during the construction and operation phases of Development, this section considers the residual effects following the implementation of specific mitigation measures.

Construction Phase

9.184 Effects upon on-site workers from fluvial flooding during construction were identified to be **Moderate/ Slight**. Whilst the sensitivity of this receptor is **High**,

9.185 The CEMP will identify and mitigate any short term, low probability risks during the construction of the Floodplain Restoration scheme and as a result, the residual effects upon this sensitivity receptor will be **Negligible**.

Water Quality

9.186 The potential significance of effects on the Water Quality during construction, following mitigation, is now assessed as being **Negligible**. The receptors are of **High** sensitivity and the impacts are **Negligible** through the use of mitigation in the CEMP during the construction of SuDS and green infrastructure.

9.187 The assessment is summarised in **Table 9.5**

Table 9.5: Summary Table

Description of impact	Stage (C /O)	Significant effect	Mitigation	Residual Effect
Impact on fluvial flooding	C	Moderate/ Slight	CEMP/ Flood warning and evacuation plan and temporary works to control construction impacts.	Negligible
Impact on surface water flooding	C	Moderate/ Slight	CEMP/ Flood warning and evacuation plan and temporary works to control construction impacts.	Negligible
Impact on Water Quality	C	Significant/ Moderate	CEMP/ Flood warning and evacuation plan and temporary works to control construction impacts.	Negligible
Impact on Water Supply and Sewer Capacity	C	Negligible	Provision of Water supply and sewer capacity as necessary for development (Local Plan and SPD).	Negligible
Impact on fluvial flooding	O	Moderate/ Substantial	Floodplain Restoration scheme and SuDS to mitigate rainfall runoff into channel and flood risk.	Moderate/ Substantial
Impact on	O	Slight/ Moderate	SuDS to reduce surface	Slight/

Description of impact	Stage (C /O)	Significant effect	Mitigation	Residual Effect
surface water flooding			water discharge to greenfield or lower rates. Floodplain Restoration scheme to mitigate surface water risk.	Moderate
Impact on Water Quality	O	Negligible/ Slight	Green infrastructure corridors as specific improve water quality. SuDS	Negligible/ Slight
Impact on Water Supply and Sewer Capacity	O	Negligible	Provision of Water supply and sewer capacity as necessary for development (Local Plan and SPD).	Negligible

Summary

- 9.188 This ES chapter has assessed the impact of the proposed Development; in relation to fluvial flood risk, surface water and drainage, water quality and, water supply and sewer capacity (collectively referred to as Water Resources).
- 9.189 A separate Flood Risk Assessment (FRA) has been prepared in accordance with the NPPF. The FRA demonstrates that future occupants of the Site will be safe from flooding, and the Proposed Development will not increase flood risk elsewhere.

Construction Phase

- 9.190 The construction impacts of the Development will be controlled and mitigated through on-site management and temporary works. A Construction Environmental Management Plan (CEMP) will be prepared for the Site which will serve to mitigate against the potential impacts associated with the construction work through site management procedures.
- 9.191 The Floodplain Restoration scheme will mitigate the fluvial and surface water flood risks on site and. The Floodplain Restoration scheme will be constructed prior to any works in the existing Flood Zone 2 and 3 areas to reduce flood risk during the construction phase.
- 9.192 The result of the proposed mitigation works is considered to ensure that the environmental impacts during the construction phase are **Negligible**.

Operational Phase

- 9.193 The use of SuDS, the creation of a green infrastructure corridor and the Floodplain Restoration Scheme mitigate the environmental impact during the operational phase of the Development.
- 9.194 The result of the proposed Floodplain Restoration works is that the Development should have a **Slight Beneficial** impact on water resources during the operational phase of the Development. The Development will create slight improvements to surface water runoff, fluvial flood risk and water quality through the on-site green infrastructure and the Floodplain Restoration scheme.

- 9.195 The issue of sewerage capacity was raised in the initial scoping by Thames Water and the Environment Agency in reference to WFD (ref 9.1) requirements.
- 9.196 From The Water Cycle Study (ref 9.11) and also the Water Cycle Study Phase 2 (Ref 9.12) document which is cited by the EA in the scoping response; it is understood that the wider NEV development can continue on the basis that the increase in treated effluent discharge from the NEV development would maintain the existing water quality and achieve the 'no deterioration' criteria of the WFD.
- 9.197 The Phase 2 Water Cycle Study identifies a need for a national scale improvement in existing wastewater treatment works. The existing standards for treated effluent discharge is not considered sufficient to be able to achieve the WFD targets by 2027, particularly with regards the criteria for phosphates.
- 9.198 This issue is considered outside of the remit of the NEV Development and should be resolved by Thames Water Utilities such that this Development; which has been assessed as being regionally significant for growth across the southwest of England, can continue.
- 9.199 The assumption that the 'timely' provision of additional capacity in both water supply and wastewater treatment has been assumed by the Council in the Local Plan (ref 9.9) and SPD (ref 9.10).

Residual Impacts

- 9.200 On the basis of the proposed mitigation works, the residual environmental impact has been reduced to a **Negligible** level. Risks still remain with regards to rare events such as accidental pollution incidences or flood events greater than the 1 in 1000 year occurring on site but these events are considered to be unlikely and represent a **Negligible** risk.