# 11. WATER ENVIRONMENT

## 11.1 Introduction

11.1.1 This Environmental Statement Chapter has been prepared by Enzygo Ltd and reports the likely significant effects of the Proposed Development and affected catchment during its construction and operational lifetime phases on the flood risk and drainage at the Site.

11.1.2 The Chapter (and its associated appendices) is not intended to be read as a standalone assessment and reference should be made to the whole Environmental Statement.

11.1.3 This Chapter should also be read in conjunction with the Flood Risk Assessment (FRA) report, included as Appendix 11.1.

## 11.2 Aims and Objectives

11.2.1 This Chapter describes the policy context, input data and methods used to assess the Proposed Development in terms of the baseline hydrology and flood risk at the Site, and the potential impacts of the Proposed Development; accounting for the measures that will be adopted to prevent, reduce, mitigate or offset the identified impacts. Potential impacts relate primarily to flood risk and to the management of surface water, which (in turn) requires consideration of water quality.

11.2.2 The assessment covers the construction and ongoing operation of the Proposed Development and identifies those aspects of the proposals that have the potential to affect the existing baseline conditions. It does not consider end-of-life decommissioning/demolition.

11.2.3 The assessment addresses the following:

- Changes to natural drainage patterns;
- Effects on runoff rates and volumes;
- Effects on erosion and sedimentation;
- Effects on surface and groundwater water quality;
- Effects on water resources (both private and public water supplies);
- Effects on flooding and impediments to flow; and
- Pollution risk.

11.2.4 This Chapter:

- Establishes the existing flood risk and drainage baseline from desk studies, dedicated surveys and consultation.
- Identifies the assumptions used and limitations encountered in compiling the environmental information. Identifies the potential direct and indirect environmental effects arising from the Proposed Development on both onsite and offsite flood risk and drainage.
- Identifies the mitigation measures required to prevent, reduce, or offset the resulting potential impacts.
- Assesses the residual impacts following mitigation, and the potential cumulative impacts with other developments; and
- Highlights any necessary monitoring required.

## 11.3 Legislation and Policy Context

11.3.1 The relevant legislation, policy and guidance are listed below.

***Legislative Framework***

- Flood and Water Management Act 2010.
- Freshwater Fish Directive 2006/44/EC.
- Land Drainage Act 1991.
- Nitrates Directive 91/676/EEC.
- Water Resources Act 1991.
- The Water Framework Directive (WFD), 200/60/EC.

***Planning Policy***

- Durham County Council Sustainable Drainage Systems (SuDS) Adoption Guide 2016[1].
- Durham County Council Strategic Flood Risk Assessment (SFRA) and associated flood mapping[2].

[1] https://www.durham.gov.uk/article/7363/Sustainable-drainage-systems
[2] https://www.durham.gov.uk/article/1953/Strategic-Flood-Risk-Assessment

- Durham County Council Local Flood Risk Management Strategy[3].

## 11.4 Assessment Methodology

### Relevant Guidance

11.4.1 The assessment has been conducted using the following relevant guidance including:

- BRE DG 365 (2016). Soakaway Design.
- BS 8582 (2013). Code of practice for surface water management for development sites.
- BS EN 752 (2008) Drain and Sewer Systems Outside Buildings.
- Building Regulations (2010). Drainage and Waste Disposal - Part H.
- British Water Code of Practice (2013). Flows and Loads - 4, 2013.
- CIRIA C624 (2004). Development and Flood Risk - Guidance for the Construction Industry.
- CIRIA (2004a). Interim Code of Practice for Sustainable Drainage Systems.
- CIRIA (2004b). Report C609B, Sustainable Drainage Systems - Hydraulic, Structural and Water Quality Advice.
- CIRIA (2004c). Funders Report CP/102 Development and Flood Risk - Guidance for the Construction Industry.
- CIRIA (2015). SUDS Manual (C753).
- CIRIA (1999). C502 Environmental Good Practice on Site.
- CIRIA (2001). C532 Control of Water Pollution from Construction Sites.
- CIRIA Control of Water Pollution from Construction Sites (C532) (2001).
- Environment Agency Pollution Prevention Guidelines.
- DEFRA (2015). Non-Statutory Technical Standards for Sustainable Drainage Systems. Department for Environment, Food & Rural Affairs.

[3] https://www.durham.gov.uk/media/20637/Local-Flood-Risk-Management-Strategy/pdf/LocalFloodRiskManagementStrategy.pdf?m=636735625812300000

- Design Manual for Roads and Bridges (DMRB 2020) CD 530 Design of Soakaways
- Design Manual for Roads and Bridges (DMRB 2019) LA 104 Revision 1. Environmental Assessment and Monitoring.
- Environment Agency (2016) .
- Environment Agency (2017). Protect Groundwater & Prevent Groundwater Pollution.
- Environment Agency Pollution Prevention Guidelines.
- LASOO (2016). Non-Statutory technical Standards for Sustainable Drainage - Practice Guidance Local Authority SUDS Officer Organisation.
- UKSuDS.com (2015). Sustainable Drainage Guidance .
- WRc (2012). Sewers for Adoption (7th Edition).

**Consultation**

11.4.2 Table 11.1 summarises the consultation activities undertaken to support the preparation of this Chapter. Copies of correspondence are appended to the Flood Risk Assessment (FRA) (Appendix 11.1).

**Table 11.1 - Water Regulator Consultation**

| Organisation | Outcome |
|---|---|
| Environment Agency | Standing Advice[4] and the NPPF/PPG ID: 7 and online flood mapping was consulted and reviewed. |
| Durham County Council - Lead Local Flood Authority (LLFA) | Online flood risk and drainage documentation was reviewed:<br>- Durham County Council Sustainable Drainage Systems (SuDS) Adoption Guide 2016[5].<br>- Durham County Council Strategic Flood Risk Assessment (SFRA) and associated flood mapping[6].<br>- Durham County Council Local Flood Risk Management Strategy[7]. |
| Northumbrian Water | Sewer records provision. |

[4] https://www.gov.uk/guidance/flood-risk-assessment-standing-advice
[5] https://www.durham.gov.uk/article/7363/Sustainable-drainage-systems
[6] https://www.durham.gov.uk/article/1953/Strategic-Flood-Risk-Assessment
[7] https://www.durham.gov.uk/media/20637/Local-Flood-Risk-Management-Strategy/pdf/LocalFloodRiskManagementStrategy.pdf?m=636735625812300000

**The Study Area**

11.4.3 The study area includes the Site and extends to the associated surface water and groundwater catchments both upstream and downstream, as well as below the Site.

**Baseline Assessment**

11.4.4 Baseline data collection and assessment has been undertaken in accordance with current guidance and industry best practice, as referenced within Section 11.3 of this chapter.

11.4.5 The approach to the assessment comprised the following four stages:

- Review of the Proposed Development and the potential impacts.
- Determine the importance of the water environment within the study area.
- Assess the potential impacts of the Proposed Development on any important (water environment) receptors and identify appropriate mitigation measures; and
- Determine significance (i.e. Significant or Not Significant) of final 'level of effect'.

**Assessment of Impact**

11.4.6 At the impact assessment stage, the potential beneficial and adverse impacts of the Proposed Development on the baseline environment were identified and assessed. This required consideration of:

- Sensitivity and / or value of the receptor.
- Magnitude of the impact / change.
- Impact duration (long, medium or short-term).
- Impact nature (direct and indirect; permanent or temporary).
- Whether impact occurs in isolation, is cumulative or interactive.
- Performance against environmental quality standards or other relevant thresholds.

11.4.7 The baseline characterisation enables the identification of the nature of likely significant effects from a range of worst-case assessment scenarios.

11.4.8 The significance of effects likely to occur during the construction and operational phases of the Proposed Development is determined by consideration of the value and sensitivity of the receptors that may be affected and of the predicted magnitude of impact (i.e. magnitude of change to the existing baseline conditions).

***Sensitivity of the Receptor***

11.4.9 The value or sensitivity of a receptor is largely determined by its quality, rarity and the scale at which the receptor is important. This can be at a local level (e.g. on the Site or immediately adjacent); district level (beyond the Study Area, but within the district); county level; regional/national level; or international level.

11.4.10 The sensitivity of the receptor is a function of its capacity to accommodate the potential form of change and to recover if it is affected.

11.4.11 The sensitivity of the receiving water environment is defined in Table 11.2. The definitions set out were followed in the consideration of sensitivity for this project and are based on guidance provided in the Design Manual for Roads and Bridges (DMRB) Report L104 (Highways Agency et al, 2019) and on the authors' professional judgement.

**Table 11.2 - Definition of Environmental Value (Sensitivity) of the Receiving Environment [Modified from Table 3.2N DMRB LA104 Revision 1 2019]**

| Sensitivity | Description |
|---|---|
| **Very High** | Very high importance and rarity, international scale and very limited potential for substitution.<br>• Site of Special Scientific Interest (SSSI) or Special Area of Conservation (SAC).<br>• Excellent water quality.<br>• Large scale industrial agricultural abstractions >1000m$^3$/day within 2km downstream, or abstractions for public drinking water supply.<br>• Designated salmonid fishery and/or salmonid spawning grounds present.<br>• Watercourse widely used for recreation, directly related to watercourse quality (e.g. swimming, salmon fishery etc.) within 2km downstream.<br>• Conveyance of flow and material, main river >10m wide.<br>• Active floodplain area (important in relation to flood defence). |
| **High** | Receptor with a High importance and rarity, national scale, and limited potential for substitution.<br>• Good water quality.<br>• Large scale industrial agricultural abstractions 500-1000m$^3$/day within 2km downstream.<br>• Surface water abstractions for private water supply for more than 15 people.<br>• Designated salmonid fishery and/or cyprinid fishery.<br>• Watercourse used for recreation, directly related to watercourse quality (e.g. swimming, salmon fishery etc.).<br>• Conveyance of flow and material, main river >10m wide.<br>• Active floodplain area (important in relation to flood defence). |

| Table 11.2 - Definition of Environmental Value (Sensitivity) of the Receiving Environment [Modified from Table 3.2N DMRB LA104 Revision 1 2019] | |
|---|---|
| **Sensitivity** | **Description** |
| **Medium** | Receptor with medium or high importance and rarity, regional scale, limited potential for substitution.<br>• Fair water quality.<br>• Industrial/agricultural abstractions 50-499m$^3$/day within 2km downstream.<br>• Designated cyprinid fishery or undesignated for fisheries - Occasional or local recreation (e.g. local angling clubs).<br>• Conveyance of flow and material, main river <10m wide or ordinary watercourse 5m wide.<br>• Existing flood defences, may be subject to improvement plans.<br>• Groundwater abstractions 50-499m$^3$/day - Private water supplies present.<br>• Designated cyprinid fishery, salmonid species may be present and catchment locally important for fisheries.<br>• Watercourse not widely used for recreation, or recreation use not directly related to watercourse quality. |
| **Low** | Receptor with Low or medium importance and rarity, local scale.<br>• Environmental equilibrium stable and resilient to changes that are greater than natural fluctuations, without detriment to its present character.<br>• Polluted/poor water quality.<br>• Industrial/agricultural abstractions < 50m$^3$/day within 2km downstream.<br>• Fish sporadically present or restricted, no designated fisheries; not used for recreation.<br>• Watercourse <5m wide.<br>• Area does not flood.<br>• Receptor heavily engineered or artificially modified and may dry up during summer months. |
| **Negligible** | Very low importance and rarity, local scale. |

***Magnitude of Impacts***

11.4.12 The magnitude of any predicted impact is dependent upon its size, duration, timing (e.g. seasonality) and frequency (e.g. temporary, permanent, etc.). A qualitative appraisal of the likely magnitude of the predicted impact is provided within this assessment, considering the measures proposed to be adopted to control such impacts. The magnitude of the predicted impact has been described using the criteria outlined in Table 11.3. The appraisal is undertaken considering guidance provided in the Design Manual for Roads and Bridges (DMRB) Report L104 (Highways Agency et al, 2019) and on the authors' professional judgement.

| Table 11.3 - Definition of Terms Relating to the Magnitude of an Impact on Hydrology and Flood Risk [Modified from Table 3.4N DMRB LA104 Revision1 2019] | | |
|---|---|---|
| **Magnitude of Impact (Change)** | **Criteria** | **Description and Example** |
| **Major** | 1. Adverse: Results in loss of attribute.<br>2. Beneficial results in improvement | 1. Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.<br>2. Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.<br>J EC designated Salmonid fishery<br>J Designated species/habitats<br>J Change in water quality status of river reach<br>J flood storage flood risk<br>J Water quality of potable source of abstraction |
| **Moderate** | | 1. Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.<br>2. Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.<br>J Productivity of a fishery<br>J Change in the economic value of the feature |
| **Minor** | | 1. Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.<br>2. Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on an attribute or a reduced risk of negative impact occurring.<br>J Detectable but non-material and transitory changes to the hydrology or water quality. |
| **Negligible** | | 1. Very minor loss or detrimental alteration to one or more characteristics, features or elements.<br>2. Very minor benefit to or positive addition of one or more characteristics, features or elements.<br>J Discharges to watercourse but no loss in quality, fishery productivity or biodiversity<br>J No significant effect on the economic value of the receptor<br>J No increase in flood risk |
| **No Change** | | No loss or alteration of characteristics, features or elements; no observable impact in either direction. |

***Significance of Effects***

11.4.13 The significance of effects was determined as a function of the magnitude and sensitivity (in Table 11.4) and is based on guidance within the DMRB Report L104 (Highways Agency et al., 2019) and on the Authors' professional judgement. Any effect that is assessed as being moderate or higher is 'Significant' in EIA terms and needs to be considered further for mitigation. The assessment identifies whether, following mitigation, the residual effect(s) of the construction and operation of the Site would be Major, Moderate, Minor, Negligible or No Change (relying on professional judgment).

11.4.14 Short to medium-term impacts are normally associated with the physical construction phase of a development, whereas long-term impacts are normally associated with a fully occupied and operational scheme. Several potential impacts could have a direct or indirect effect on flood risk and water quality. These effects may be transitional but may also be permanent.

**Table 11.4 - Significance Categories and Typical Descriptions [DMRB 2019 LA104 Table 3.7]**

| Significance Category | Typical Description |
|---|---|
| Very Large | Effects at this level are material in the decision-making process. |
| Large | Effects at this level are likely to be material in the decision-making process |
| Moderate | Effects at this level can be considered as material decision-making factors. |
| Slight | Effects at this level are not material in the decision-making process. |
| Neutral | No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. |

***Mitigation Measures***

11.4.15 If an adverse effect is assessed as being 'Significant', mitigation measures intended to avoid, reduce or remedy the effect to acceptable levels are required. Mitigation measures are not considered for impacts assessed as Not Significant.

11.4.16 The hierarchy of mitigation is:

- Prevention: avoid, relocate, modify the design.
- Reduction: modify the design, change technology, reduce size/scale of the Proposed Development.
- Compensation/Remediation: Compensation to provide like for like replacement for lost environmental elements.

***Significance Criteria***

Effects that are deemed to be Significant for the purposes of this assessment are those that are described as being of a moderate or higher (Table 11.5).

**Table 11.5 - Significance Matrix for determining significance of effect from magnitude of impact and Environmental Value. Modified from Table 3.8.1 DMRB 2019 L104]**

| Environmental Value (Sensitivity) | Magnitude of Impact (Degree of Change) | | | | |
|---|---|---|---|---|---|
| | **No Change** | **Negligible** | **Minor** | **Moderate** | **Major** |
| **Very High** | Neutral | Slight | Moderate or Large | Large or very large | Very Large |
| **High** | Neutral | Slight | Slight or Moderate | Moderate or Large | Large or Very Large |
| **Medium** | Neutral | Neutral or Slight | Slight | Moderate | Moderate or Large |
| **Low** | Neutral | Neutral or Slight | Neutral or Slight | Slight | Slight or Moderate |
| **Negligible** | Neutral | Neutral | Neutral or Slight | Neutral or Slight | Slight |

**Cumulative**

11.4.17 Other sites may potentially discharge surface water to the same catchment as the Proposed Development Site and, if so, may impact on water quality and runoff within the catchment if surface water was managed ineffectively. A summary of the residual and cumulative effects is included in Chapter 15 of this ES , along with the other committed developments considered within cumulative impact assessment.

11.4.18 All new approved developments will comply with DEFRA non-statutory guidance, the NPPF and PPG ID7 Guidance and CIRIA C753 guidance on surface water discharge rates, volume control and water quality control to minimise individual impacts on the aquatic environment.

11.4.19 The Proposed Development incorporates its own drainage strategy and flood risk abatement techniques and it can be expected that the Development will be constructed in-line with the requirements of the NPPF and Technical Guidance to the NPPF, requiring that new developments attenuate surface water run-off to pre-development run-off rates. It is, therefore, expected there will not be any cumulative impacts as any new developments would also need to meet national policy and attenuate surface water run-off to pre-development run-off rates and minimise impacts from the developments.

### Limitations

11.4.20 This Chapter is based on best available data at the time it was written, including desktop study of mapping and consultation responses. It is assumed the available information is correct.

## 11.5 Baseline Conditions

### Introduction

11.5.1 Baseline conditions describe the state of the environment, including the Proposed Development Site and potential receptors, and are the basis on which impacts arising from the Proposed Development are compared and assessed.

### The Site

11.5.2 A full description of the existing Site is provided in Chapter 3 of this ES. This section describes the current physical parameters of the Proposed Development Site that influence its hydrology and response to rainfall.

### Topography

11.5.3 The Site is relatively level, falling in a south-east direction from 246.27 metres Above Ordnance Datum (m AOD) in the northern corner, to 244.36m AOD at the Site entrance. The fall of 1.91m over 157m gives a gradient of 1:82.

### Rainfall

11.5.4 HR Wallingford's online 'Greenfield Runoff Rate Estimation Tool' indicates that the Standard Average Annual Rainfall (SAAR) for the Site is 766mm.

### Soils & Geology

11.5.5 The Soilscapes online soils map viewer shows that the Site is underlain by slowly permeable, seasonally wet, loamy and clayey soils.

11.5.6 The Geology of Britain online map viewer shows the superficial deposits beneath the southern extent is Till, Devensian - Diamicton. There are no superficial deposits beneath the northern extent. The underlying bedrock geology is Pennine Lower Coal Measures Formation - Mudstone, siltstone and sandstone.

11.5.7 The Geology of Britain online map viewer shows there are numerous borehole records located in the Site boundary and immediate vicinity. The borehole records confirm the mapped geology and furthermore, that Made Ground is present.

### Hydrology: Surface Water and Groundwater

11.5.8 Ordnance Survey (OS) mapping and the Environment Agency online Main River Map show there are no watercourses located in the immediate vicinity of the Site.

11.5.9 The Site is in the Smallhope Burn from Source to Browney, Stocke Catchment, which is in the Browney Operational Catchment, the Wear Management Catchment, and Northumbria River Basin District.

11.5.10 The infiltration potential of the bedrock is likely to be low based on the low-permeability clay-dominant geology.

11.5.11 Defra Magic Map online mapping shows the Site is not located in a groundwater Source Protection Zone (SPZ).

11.5.12 The Environment Agency online mapping shows the Site is not located in a Drinking Water Safeguard Zone for groundwater or surface water.

11.5.13 The Site is located above a Secondary A (bedrock) and Secondary undifferentiated (superficial drift) Aquifer.

**Designated Sites**

11.5.14 The DEFRA Magic Map (England and Wales) shows there are no designated sites in or close to the Site including downstream from a flood risk and drainage perspective.

**Sewerage Assets**

11.5.15 Northumbrian Water asset plans show there is a Ø375mm S102 surface water sewer and Ø150mm S102 foul sewer, beneath Knitsley Lane to the east of the Site.

**Flood Risk Assessment (FRA)**

11.5.16 An FRA was carried out by Enzygo Ltd and reported in May 2020. A copy is included as Appendix 11.1.

11.5.17 The risk of surface water flooding is assessed as negligible for the Site but medium for the access/egress.

11.5.18 The risk of flooding from all other sources (fluvial [river], tidal [sea], groundwater and infrastructure failure [including reservoir failure]) is assessed as negligible.

**Water Quality**

11.5.19 There are no surface watercourses in the immediate vicinity of the Site, and there is no data on groundwater quality.

### Sensitive Receptors

11.5.20 The Proposed Development will be served by a surface water and foul drainage strategy. The drainage strategy is included in Section 6 of the FRA report (Appendix 11.1).

11.5.21 Surface water runoff from the Proposed Development would be attenuated onsite up to and including the 1 in 100-year event, plus 40% climate change. A SuDS drainage scheme is proposed to manage excess runoff from the development using cellular storage, with a connection to the adjacent private surface water sewer. The restricted discharge rates offer a betterment to existing conditions with uncontrolled runoff across all return periods. Water quality will be managed through the use of an oil interceptor.

11.5.22 It is proposed that foul flows will discharge to the adjacent private foul sewer, which will ultimately be directed to a wastewater treatment works.

11.5.23 A Maintenance and Management Plan is included as Appendix 5 in the FRA report (Appendix 11.1). The purpose of the Maintenance and Management Plan is to ensure the ongoing monitoring and maintenance to ensure the effectiveness of the drainage strategy for the lifetime of development.

11.5.24 Table 11.6 lists the identified potential receptors and their importance as assessed using the sensitivity criteria in Table 11.2. These receptors would only be impacted where the drainage strategy either fails or becomes surcharged as a result of a storm event greater than the design standard.

11.5.25 When assessed against the sensitivity criteria in Table 11.2, the receptors are of Low sensitivity.

**Table 11.6 – Identified Development Receptors**

| Receptors | Receptor Sensitivity |
|---|---|
| Aquifer/Groundwater (Water Quality, Flood Risk) | Low |
| Surface Water (Water Quality, Flood Risk) | Low |

## 11.6 Identification and Evaluation of Key Impacts

### Design Solutions and Assumptions

11.6.1 The assessment scenarios listed in Table 11.6 are based on the Proposed Development details provided in Chapter 5'Development Description' and are those considered likely to result in significant effects on the identified receptor. The effects described are worst-case and, as such effects of higher (adverse or beneficial) level are unlikely to arise. Developing

the Site using industry best practice, including a Construction Environment Management Plan or equivalent represents embedded risk mitigation.

**Assessment of Effect**

11.6.2 This section outlines the parameters on hydrology, surface water drainage and surface and groundwater that have been assessed; and summarises the likely effects of the Proposed Development during the construction and operational phases. Receptor sensitivity, magnitude of impact and significance of (unmitigated) effect, as shown in Table 11.7, were assessed using the methodology outlined in Section 11.4.

11.6.3 Changes in sediment / chemical / pollutant run off from the Proposed Development are limited to a 'local' scale.

| Table 11.7 Flood Risk and Drainage Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Impact** | **Description of Potential Impact** | **Direct / Indirect** | **Receptor Sensitivity** | **Magnitude of Impact** | **Level of (Unmitigated) Effect (but with embedded mitigation)** | **Significance of Effect** |
| **Construction Phase** | | | | | | |
| The impacts of construction that may affect surface water quality. | • Incidents through spillage of pollutants to the ground surface.<br>• Loss of chemicals and fuels stored on Site. Incidents that result in the loss of pollutants to surface water from vehicles transporting construction materials or products or waste materials to and from the Site. | Indirect | Low | Low Adverse | Negligible | **Not Significant** |
| The impacts of construction that may affect temporary flood risk. | • The construction of temporary or permanent structures introduces impermeable areas and increases runoff volumes. Soil permeability may also decrease due to soil compaction.<br>• Regrading of the ground profile/topography could remove/introduce flow paths and direct flood water to areas previously not at risk of flooding. | Direct / Indirect | Low | Low Adverse | Negligible | **Not Significant** |
| The impacts of construction that may affect surface water flood risk and temporary surface water flood risk. | • The creation of temporary structures and construction phase of permanent structures introduces impermeable areas and increases run off volumes.<br>• Regrading of the ground profile/topography could remove/introduce flow paths and direct flood water to areas previously not at risk of flooding. | Direct | Low | Low Adverse | Negligible | **Not Significant** |

| Table 11.7 Flood Risk and Drainage Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Impact** | **Description of Potential Impact** | **Direct / Indirect** | **Receptor Sensitivity** | **Magnitude of Impact** | **Level of (Unmitigated) Effect (but with embedded mitigation)** | **Significance of Effect** |
| The impacts of construction that may cause disturbance or contamination of groundwater in the Secondary A (bedrock) and Secondary undifferentiated (superficial drift) Aquifer. | • Spillage of pollutants to the ground surface could infiltrate into superficial deposits.<br>• Loss of chemicals and fuels stored on Site. Incidents that result in the loss of pollutants to groundwater from vehicles transporting construction materials or products or waste materials to and from the Site.<br>• Construction activities such as piling, and excavation could create new pathways for pollutants to move from the surface to the aquifer. | Direct | Medium | Medium Adverse | Negligible | **Not Significant** |
| Impacts of construction that may affect groundwater levels and flood risk. | • Regrading of the ground surface could lower the elevation of some areas resulting in a reduced unsaturated zone thickness. | Direct | Medium | Medium Adverse | Negligible | **Not Significant** |
| **Operational Phase** | | | | | | |
| Impacts of the developed Site that may affect surface water flood risk. | • Low permeability areas such as roads, car parks and roof structures reduce the ability of the Site to accept rainfall volumes.<br>• Efficient Site drainage reducing the response time for rainwater to reach the point of outfall.<br>• The Site layout removes/introduces flow paths and directs floodwater to areas not previously at risk of flooding.<br>• The Site drainage removes surface water pathways and so reduces flooding off-Site | Direct / indirect | Medium | Medium Adverse/ Medium Beneficial | Negligible | **Not Significant** |

| Table 11.7 Flood Risk and Drainage Assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Impact** | **Description of Potential Impact** | **Direct / Indirect** | **Receptor Sensitivity** | **Magnitude of Impact** | **Level of (Unmitigated) Effect (but with embedded mitigation)** | **Significance of Effect** |
| Impacts of the Proposed Development that may affect surface water quality. | ) Incidents from spillage of pollutants to the ground surface.<br>) Loss of chemicals and fuels stored within the Proposed Development. Incidents that result in the loss of pollutants to surface water from vehicles, in the form of oil/fuel and household chemicals such as detergents. | Direct | Medium | Minor Adverse | Minor Adverse | **Not Significant** |
| Impacts of the Proposed Development that may cause disturbance or contamination of groundwater. | ) Incidents because of spillage of pollutants to the ground surface.<br>) Spillage of chemicals and fuels stored within the Proposed Development. Incidents that result in the spillage of pollutants to groundwater from vehicles, in the form of oil/fuel and other chemicals such as detergents etc. | Indirect | Medium | Medium Adverse | Negligible | **Not Significant** |

## 11.7 Design Response and Mitigation

11.7.1 Embedded mitigation measures are designed-in to reduce the potential for impacts on hydrology, flood risk and water quality. These measures are considered standard industry practice for this type of development and include the following:

- Good environmental practice based on legal responsibilities and guidance in accordance with the general overarching guidance on good environmental management in PPG1 (Environment Agency, 2013) and more specific guidance including:
  - CIRIA C650 (2005) Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors.
  - CIRIA C648 (2006) Control of Water Pollution from Linear Construction Projects; and
  - PPG21: Pollution Prevention Guidelines. Incident Response Planning.
- Minimise where practicable the production of silt and contaminated water by minimising:
  - Dewatering and pumping of excavations and subsequent disposal of water.
  - Runoff from exposed ground and stockpiles.
  - Plant and wheel washing.
  - Site roads.
  - Fuel spillages.
- Waste storage and disposal. Mitigation in accordance with PPG5 guidance on works and maintenance in or near water (Environment Agency, 2014) and CIRIA C650 and as set out in the project Code of Construction Practice (CoCP).
- Surface Water Management (SuDS) Scheme. The Proposed Development will result in the construction of low permeability surfacing, increasing the rate of surface water run-off from the Site. A surface water drainage scheme is required to ensure the runoff rates to the surrounding water environment are maintained at pre- development greenfield rates incorporating the effects of climate change.

11.7.2 The maintenance and management of the Site works during the construction phase will be essential in managing runoff on and from the Site.

11.7.3 To control environmental issues during the construction process, a Construction Environmental Management Plan (CEMP) will be developed. The CEMP will form part of the Project Management Plan, which will integrate the core arrangements for health and safety, quality and environmental management for the construction phase. This integrated approach ensures that environmental aspects are considered at all stages of the design and construction process.

11.7.4 The construction phase will be undertaken in accordance with the following good practice guidelines:

- CIRIA Environmental Good Practice on Site (C502) (1999).
- CIRIA Control of Water Pollution from Construction Sites (C532) (2001).
- Environment Agency Pollution Prevention Guidelines.

11.7.5 These provide guidance on hydrology, flood risk and water quality for consultants and contractors.

## 11.8 Residual Impact

11.8.1 Residual effects are those effects remaining after the proposed mitigation (risk reduction) measures have been implemented. No significant impacts have been identified (Table 11.7), therefore there will be no significant residual effects'.

## 11.9 Conclusions

11.9.1 The impacts on hydrology and flood risk for the Proposed Development have been assessed in-line with the NPPF, UKCP09 and all other relevant legislation, guidance, planning policy and technical documentation. The assessment has shown that, following the implementation of the embedded mitigation measures, the effects that may occur as a result of the Proposed Development are considered Not Significant.

11.9.1 Table 11.8 below contains a summary of the likely impacts of the proposed development.

**Table 11.8 Summary of Impacts**

| Phase | Nature of Effect | Significance of Impact | Magnitude of Impact | Duration | Mitigation | Residual | Level |
|---|---|---|---|---|---|---|---|
| Construction | Aquifer/Groundwater (Water Quality, Flood Risk) | Not Significant | Low to Medium Adverse | Temporary | Follow good practice guidelines.<br>Implement good environmental practice.<br>Consideration of waste storage and disposal.<br>Adoption of a Surface Water Management (SuDS) scheme.<br>Develop a Construction Environmental Management Plan (CEMP). | No significant impacts | No significant residual effects |
| Operational | Surface Water (Water Quality, Flood Risk) | Not Significant | Low to Medium Adverse | Temporary | | No significant impacts | No significant residual effects |