

11 Drainage, Flooding and Water Resources

11.1 INTRODUCTION

11.1.1 This Chapter assesses the effect of the Proposed Development on drainage, flooding and water resources. In particular, it considers the potential effects on surface and foul drainage systems, potable water demand, water bodies and flood risk on-site, in the vicinity of and downstream of the Site during the site preparation, earthworks and construction and operational stages of the Proposed Development.

11.1.2 Potentially significant effects to groundwater and degradation to surface water quality due to chemical contamination are addressed within **Chapter 10 – Ground Conditions, Hydrogeology and Contamination**.

11.1.3 This Chapter is supported by three main documents prepared by WSP; a Land Quality Desk Study (**Appendix 10.1**), a Flood Risk Assessment (FRA) (**Appendix 11.1**) and a Drainage Strategy (**Appendix 11.2**). In addition, third party consultants have completed ground investigation works and these are summarised in the WSP Land Quality Desk Study.

11.1.4 This Chapter (and its associated figures and appendices) is not intended to be read as a stand alone assessment and reference should be made to the Front End of this **ES** along with **Chapter 16 - Cumulative Effects / Residual Impacts**.

11.2 LEGISLATION, POLICY AND GUIDANCE

Legislative Framework

11.2.1 The applicable legislative framework is summarised as follows:

- *Water Resources Act 1991 (Ref 11.1)* - This Act sets out the regulatory controls and restrictions that provide protection to the water environment through controls on abstraction, impounding and discharges as well as identifying water quality and drought provisions;
- *Water Industry Act, 1991 (Ref 11.2)* - This Act consolidates enactments relating to the supply of water and the provision of sewerage services;
- *Land Drainage Act 1991 (Ref 11.3)* - This Act consolidates enactments relating to internal drainage boards and the functions of these boards and of local authorities in relation to land drainage. Internal Drainage Boards (IDB) exercise a general supervision over all matters relating to the drainage of land within their district and they have powers to perform duties imposed on them within the Act;
- *Land Drainage Act 1994 (Ref 11.4)* - This Act adds new environmental duties to the *Land Drainage Act 1991*. It places a duty on the IDB and local authorities to further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological or physiographical features of special interest; and to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora, fauna or features;
- *Environment Act 1995 (Ref 11.5)* - This Act established basic terms of reference for the Environment Agency (EA). The principal aim of the EA is to protect or enhance the environment. The EA also exercises a general supervision over all matters relating to flood defence. The Act provides the EA with a duty to take action as it considers

necessary to conserve, redistribute or otherwise augment water resources in England and Wales and to secure the proper use of water resources in England and Wales;

- *Water Act 2003 (Ref 11.6)* - This Act amends the *Water Resources Act 1991* and the *Water Industry Act 1991* to formalise the Government's commitment to the sustainable management and use of water resources;
- *The Water Environment (Water Framework Directive) (England & Wales) Regulations, 2003 (Ref 11.7)* – These regulations establish a framework for protecting the water environment, with the aim of achieving chemical and ecological water quality targets by 2015; and
- *Building Regulations (Part G), draft amendments May 2009 (Ref 11.8)* - Changes have been made to these regulations to include targets for reducing water consumption.

Planning Policy

11.2.2 Planning policy at the national, regional, county and local level is discussed in **Chapter 5 - Relevant Policy**. A summary of the scheme's compliance with legislation and planning policy is included in Section 11.6 of this Chapter.

11.2.3 The National Planning Policy Framework (NPPF) was adopted in March 2012 (**Ref: 11.21**) replaces all previous Planning Policy Statements and technical notes, however, as the policy is in its infancy and remains untested, this chapter will provide further context by referring to the previous PPS documents where further clarity is required. In relation to flooding, the NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. However, the policy then discusses that where development is necessary the approach should be to make it safe without increasing flood risk elsewhere. The Local Plans should be supported by Strategic Flood Risk Assessment. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change.

11.2.4 The following Planning Policy Statements were reviewed and referenced in the development of the proposed application and while these have subsequently been replaced by the NPPF they are referenced accordingly

- *PPS 1 – Delivering Sustainable Development (2005) (Ref 11.9)* confirms that good planning should deliver the right development in the right place and time, and protect the environment. A supplement to PPS1 (2007) requires that planning should help shape new homes, jobs and infrastructure to be resilient to climate change (e.g. changes in flood risk);
- *PPS 23 – Planning and Pollution Control (2004) (Ref 11.10)*. Annex 1 'Pollution Control, Air and Water Quality' and Annex 2 'Development on Land Affected by Contamination' set out policies for pollution control to be followed at all stages of planning; and
- *PPS 25 – Development and Flood Risk (March 2010) (Ref 11.11)* ensures that the Government's policies on avoiding flood risk and accommodating the effects of climate change in relation to drainage are implemented in the planning process. This includes the requirement for the preparation of an FRA for all significant developments over 1 hectare in size.

11.2.1 Relevant regional policies are contained within the Regional Spatial Strategies (*May 2008*) (**Ref 11.12**). The Regional Spatial Strategies (RSS) have recently been reinstated as part of the statutory development plan following a legal challenge to the Government's initial decision to revoke RSS. However, it is noted that the RSS is undergoing a period of review.

11.2.2 Relevant local policies are contained within the Barnsley Unitary Development Plan, adopted 2000 (**Ref 11.13**) and include the following:

- The Unitary Development Plan (UDP) is the statutory development plan for the borough along with the Barnsley Education Sites Development Plan Document.
- It considers how much development is required in the borough, where it is best located and how it should be designed and contains planning policies on a wide range of matters including, housing, the environment, transport, leisure and economic and community uses. The UDP will eventually be replaced by the Local Development Framework (LDF).

11.2.3 Barnsley Local Development Framework, Core Strategy, Adopted, September 2011 (Ref 11.14); the policies relevant to flood risk include the following:

- CSP 3 Sustainable Drainage Systems (SuDS) which states that:
 - All development will be expected to use Sustainable drainage systems (SuDS). Only in exceptional circumstances, where it can be demonstrated that all types of SuDS are impractical, will other drainage management systems be permitted;
 - Planning applications must include an assessment to show that SuDS will work and be maintained. Measures should be taken to avoid water contamination and safeguard groundwater supply; and,
 - Developers will be required to contribute to the maintenance of SuDS.
- CSP 4 Flood Risk which states that the extent and impact of flooding will be reduced by:
 - Not permitting new development where it would be at an unacceptable risk of flooding or would give rise to flooding elsewhere;
 - Requiring developers with proposals in Flood Zones 2 and 3 to provide evidence of the sequential test;
 - Requiring site-specific Flood Risk Assessments (FRAs) for proposals over 1 hectare in Flood Zone 1 and all development proposals in Flood Zones 2 and 3;
 - Requiring proposals over 1000 m² floor space or 0.4 hectares in Flood Zone 1 to demonstrate how the proposal will make a positive contribution to reducing or managing flood risk;
 - Requiring all development proposals on Brownfield sites to reduce surface water run-off by at least 30% and development on Greenfield sites to maintain or reduce existing run-off rates;
 - Requiring development proposals to use Sustainable Urban Drainage Systems (SuDS) in accordance with policy CSP 3;
 - Not culverting or building over watercourses and encouraging the removal of existing culverts wherever practicable;
 - Using flood resilient design in areas of high flood risk.

Guidance

11.2.4 The following Pollution Prevention Guidelines (PPG) have been issued by the EA that are considered to be relevant to this assessment:

- EA, pre 2007. *PPG1 'General Guide to the Prevention of Pollution'* (Ref 11.15);
- EA, October 2007. *PPG5 'Works or Maintenance in or Near Water'* (Ref 11.16);
- EA, pre 2007. *PPG6 'Working at Construction and Demolition Sites'* (Ref 11.17); and
- EA, March 2009. *PPG21 'Incident Response Planning'* (Ref 11.18).

11.2.5 Other guidance documents considered to be relevant to this assessment include the following:

- CIRIA 697, 2007: *The SuDS Manual* (Ref 11.9). This document provides best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SUDS) to facilitate their effective implementation within developments; and
- EA, 2009. *Flood Risk Standing Advice for England* (Ref 11.20). This advice reflects the policy contained in PPS25 and provides standard information on whether a development is suitable with regards to flood risk.

11.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Scope of the Assessment

11.3.1 The scope of this Chapter includes a review of the available baseline information on the Site setting with specific regards to current drainage, flooding and water resource conditions.

11.3.2 Site Preparation, Earthworks and Construction Phase (including Demolition)

- Increase in risk of physical contaminants (i.e. sedimentation) on the adjacent and on-site drainage channels, surface water sewers and ultimately the River Dearne from surface water run-off and dewatering activities;
- Increase in risk of surface water and drainage flooding on construction workers and construction activities;
- Increase in risk of fluvial flooding on construction workers; and
- Increase in risk of groundwater flooding on construction workers and construction activities (e.g. basement and foundation construction).

11.3.3 Operational Phase

- Increase in risk of physical contaminants (i.e. sedimentation) on the adjacent and on-site drains and ultimately the River Dearne from surface water run-off and site activities;
- Increase in foul drainage (and associated potential increase in flood risk) and associated demand on sewage network;
- Increase in, or change in patterns of, surface water drainage and associated flood risk;
- Increase in risk of fluvial flooding on future populations and third parties;
- Increase in risk of groundwater flooding; and
- Increase in demand on potable water supply.

11.3.4 Potentially significant effects to groundwater and degradation to surface water quality due to chemical contamination are addressed within **Chapter 10 – Ground Conditions, Hydrogeology and Contamination**.

Extent of the Study Area

11.3.5 The study area for water resources, flooding and drainage encompasses the Site and sensitive receptors within the influence of the Site including the River Dearne water body. The catchment area for foul water drainage and water supply is also considered within the study area.

Consultation

11.3.6 The relevant correspondence is presented in the FRA provided in **Appendix 11.2** and is summarised below.

11.3.7 Yorkshire Water have confirmed that the sewers that currently cross the Site will need to be diverted and that they would need to undertake a diversionary works feasibility assessment.

11.3.8 The EA has been consulted throughout the preparation of this Chapter and supporting appendices. The EA has confirmed that as the River Dearne is classed as a main river, any development with 8 m from the top of bank will require consent from them.

11.3.9 BMBC have been consulted throughout the preparation of this Chapter.

Method of Baseline Data Collation

11.3.10 This Chapter comprises a desk study which draws on the relevant findings of a number of documents. The most pertinent documents are as follows and other sources of desk study information are referenced throughout this Chapter where relevant:

- WSPE, September 2011, *Land Quality Desk Study. Old Mill Lane.* (**Appendix 10.1**);
- WSP, October 2011, *Flood Risk Assessment* (**Appendix 11.2**); and
- WSPE, October 2011, *Drainage Strategy, Old Mill Lane.* (**Appendix 11.3**).

11.3.11 Site walkovers were undertaken at the Site in September 2011 and August 2011. Information collected on the visits is utilised in the assessments below.

Assessment Modelling

11.3.12 The information contained in the baseline and mitigation techniques sections in the remainder of this Chapter was obtained from the sources referenced above and throughout the Chapter. The impact sections were based on professional judgement following review of the information available.

Significance Criteria

11.3.13 The assessments of potential effects as a result of the Proposed Development have taken into account both the site preparation, earthworks and construction and operational phases. The significance level attributed to each effect has been assessed based on the magnitude of change due to the development proposals, and the sensitivity of the affected receptor/receiving environment to change, as well as a number of other factors that are outlined in more detail in **Chapter 2 - Approach to the EIA**. Magnitude of change and the sensitivity of the affected receptor/receiving environment are both assessed on a scale of high, medium, low and negligible (as shown in **Chapter 2 - Approach to the EIA**).

Effect Significance

11.3.14 The following terms have been used to define the significance of the effects identified:

- **Major effect:** where the Proposed Development could be expected to have a very significant effect (either positive or negative) on drainage, flooding and water resources;
- **Moderate effect:** where the Proposed Development could be expected to have a noticeable effect (either positive or negative) on drainage, flooding and water resources;
- **Minor effect:** where the Proposed Development could be expected to result in a small, barely noticeable effect (either positive or negative) on drainage, flooding and water resources; and
- **Negligible:** where no discernible effect is expected as a result of the Proposed Development on drainage, flooding and water resources.

11.3.15 With regard to the duration of the effects, in the context of this assessment '*short term*' is defined as less than 6 months; '*medium term*' as more than 6 months but less than 10 years and '*long term*' is more than 10 years.

11.4 BASELINE CONDITIONS

Topography and Surface Cover

11.4.1 The Site is divided into the north and south by the River Dearne. Site levels generally slope down towards the River Dearne. The north of the River Dearne is impermeable, whilst the south of the River is currently hardstanding.

11.4.2 To the south of the river, levels range from approximately 50 m AOD adjacent to Twibell Street in the south to approximately 44 m AOD along the side of the River Dearne.

11.4.3 To the north of the river existing ground levels are approximately 44 to 45 m AOD.

11.4.4 The Site currently comprises an existing retail park containing existing retail warehouses (including Comet, MFI, Howdens and Powerhouse) as well as a depot/cash and carry. A decommissioned gas holder is also present on the Site to the south of the River Dearne. To the north of the river, the Site comprises a demolished depot site and an area of open space.

11.4.5 There is a rough vegetated area and tree lined corridor alongside both sides of the River Dearne.

Geology and Hydrogeology

11.4.6 British Geological Survey (BGS) geological map Sheet 87 1:50,000 scale (**Ref 11.22**) indicates that the Site is underlain by Alluvium deposits (Clay and Silt) in the vicinity of the River Dearne. The superficial deposits are shown to be underlain by the Carboniferous Coal Measures.

11.4.7 Several coal seams are identified to outcrop to the east of the Site including the Two Foot, Abdy, and Top Beamshaw Coal seams. The Low Beamshaw seam is identified to outcrop beneath the Site trending northwest to south east. Two faults are shown; one to the north and one to the south of the Site. Both faults trend in a northwest to southeast direction. The southern fault is shown to down throw to the north and the northern fault is shown to down throw to the south, which indicates that the Site is located on a down thrown block.

11.4.8 The EA classify the underlying Alluvium and Coal Measures at the Site as Secondary (A) Aquifers (permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers).

11.4.9 The Site is not located within a groundwater Source Protection Zone as defined by the EA and no active groundwater abstractions are identified within 1 km of the Site.

11.4.10 The previous reports for the northern area of the Site confirm that the groundwater flow direction is toward the River Dearne and is expected to be in continuity with the river. Shallow perched groundwater also exists on the northern area of the Site, anticipated to be held within the Alluvium deposits. At this stage limited information is available for the southern part of the Site and it is anticipated that the groundwater flow direction will be towards the River Dearne.

11.4.11 The current aquifer quantitative quality and chemical quality beneath the Site is classified as 'poor' by the EA under their Water Framework Directive River Basin Management Plans and is predicted to remain as such until at least 2015.

11.4.12 Further information on the geology and hydrogeology for the Site is provided in **Chapter 10 – Ground Conditions, Hydrogeology and Contamination**.

Surface Water Features

11.4.13 The Site is located within the catchment of the River Dearne which flows in an easterly direction through the Site. The EA classifies the River Dearne as Chemical Quality 'Good' and Ecological Quality 'Moderate' and the same quality is predicted for 2015. The flow rate is <0.62 cumecs approximately 208m east of the Site in 2000.

11.4.14 Two surface water abstractions are located within 500m of the Site. One is located upstream licensed to Yorkshire water for an unspecified use, the other is located downstream for make-up / top up water.

11.4.15 Dearne Valley Park Local Nature Reserve is located adjacent to the eastern boundary of the Site adjacent to the river. The reserve has primarily been designated for its woodland, grassland and pond habitats. It is assumed that the reserve will have a low sensitivity to river quality. No internationally or nationally designated sites are present within 2km of the Site.

11.4.16 There are two culverted watercourses within the Site boundary, one to the south of the river and the other to the north. These ultimately discharge to the River Dearne.

11.4.17 The Fleets is located approximately 0.2 km northwest (up gradient) of the Site and is an artificial lake which historically supplied water to the local mills.

Surface Water Drainage

11.4.18 The majority of the Site is currently impermeable. It is assumed that the existing hard standing areas drain into the private drainage onsite which discharges into public sewer network and / or culverted watercourses within the Site boundary which ultimately drain into the River Dearne. This will be confirmed at detailed design stage following completion of a CCTV survey.

11.4.19 WSP have obtained record drawings from Yorkshire Water which indicate the following public surface water sewers south of the river within the Site boundary (**Appendix 11.3**):

- 450 mm diameter surface water sewer flowing west to east along Twibell Street and then north towards the River Dearne along the eastern boundary of the Site; and,
- 1200 mm surface water sewer connecting into the culverted watercourse.

11.4.20 It is estimated that, using a rainfall intensity of 50mm/hr, the maximum surface water runoff rate from the entire Site is currently 700 l/s and the existing runoff from the southern portion of the Site alone is approximately 420 l/s.

Foul Water Drainage

11.4.21 WSP have obtained record drawings from Yorkshire Water for the Site (**Appendix 11.3**). The drawings indicate the following public sewers and combined sewers south of the river within the Site boundary and are recorded in the FRA:

- 225 mm combined sewer flowing from west to east along Twibell Street;
- 300 mm combined sewer flowing north along the eastern boundary of the Site and connecting into the 750 mm combined sewer running west to east;
- Combined sewer overflow adjacent to the A61 road bridge;
- Combined sewer overflow to the west of the gas holder; and,
- 300 mm combined public sewer flowing south along the A61. This increases in size to 750 mm and then 1200 mm and flows from west to east across the Site. After the Combined Sewer Overflow (CSO), the size increases from 375 mm to 750 mm diameter.

11.4.22 The current foul dry weather flows have been estimated at 0.8l/s and it is assumed that the foul drainage drains by gravity. The current foul drainage system is presented on **Appendix 11.3**.

Flood Risk

11.4.23 Information presented in this section is primarily sourced from the **FRA (Appendix 11.2)**.

Risk of Surface Water and Foul Drainage Flooding

11.4.24 There is potential for overland flow paths for floodwater emanating from existing developed areas to pose a possible degree of flood risk to the Site.

11.4.25 The EA has provided a copy of the Flood Map for Surface Water (2010), which provides a general indication of areas that may be at risk of surface water flooding. It takes broad account of underground drainage and typical storms which are likely to cause flooding. These maps indicate that small areas are susceptible to surface water flooding during a 1 in 200 year storm.

11.4.26 The surrounding roads have associated surface water drains that will help to minimise surface water flooding. Any flows resulting from surcharging of the drainage or sewer system during extreme rainfall events are unlikely to impact the Proposed Development due to the topography of the land. In the event that surcharging did occur, it is considered that this would be short term, relatively shallow in depth and would pass through the Site following the natural topography.

11.4.27 Management of the adopted storm/foul water sewer network is the responsibility of Yorkshire Water. They have confirmed that no properties in the vicinity have records of sewer flooding events and no reported incidents of sewer flooding in the area on the Yorkshire Water Operations Database. In addition, BMBC, has confirmed that there are no records of flooding from the culverted watercourses that cross the Site.

11.4.28 The EA website indicates that only the river channel that flows through the Site is located in a reservoir flood risk area. The Reservoir Flood Map shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst case scenario and is only intended as a guide.

11.4.29 Flood risk from the culverted watercourses is considered to be low as there are no open sections in the immediate vicinity of the Site and Barnsley Council are unaware of any flooding issues associated with them.

11.4.30 Considering all of the available information at this stage, the risk of flooding from surface water and foul drainage is considered to be low to medium. However, residual risk still remains for extreme rainfall events.

Risk of Fluvial Flooding

11.4.31 The proposed development site is located in Flood Zones 1, 2 and 3 on the EA Flood Zone Map and within the Strategic Flood Risk Assessment (2010). The Flood Zone Map also indicates a flood storage area within the Site boundary.

11.4.32 Flood Zone 1 is land designated as having less than a 1 in 1000 annual probability of river or sea flooding in any year (<0.1%). Flood Zone 2 is land designated as having between 1 in 1000 and 1 in 100 annual probability of river flooding (between 0.1% and a 1%) or between a 1 in 1000 year and 1 in 200 year annual probability of flooding from the sea (between 0.1% and 0.5 %) in any year. Flood Zone 3 is land designated as having a 1 in 100 or greater annual probability of river flooding (>1%) in any year.

11.4.33 The EA has confirmed that there are no formal flood defences or structures in the immediate area that contributes towards reducing flood risk. However, the EA Flood Zone Map indicates that there is a flood storage area upstream of the Site and also within the Site boundary.

11.4.34 According to information provided by the EA (presented in the **FRA**), The EA have confirmed that they do not have any historical flood records for the Site. Areas upstream and downstream of the Site were affected during a flood event which occurred in June 2007.

11.4.35 The EA has supplied modelling results for the River Dearne from two hydraulic modelling studies. The results from the 2010 model are more recent and are higher than those predicted from the 2004 model, the results from the 2010 hydraulic model have been used to consider fluvial flood risk in the **FRA** as it represents a worst case scenario. The actual flood levels through the Site are expected to be lower due to the hydraulic gradient of the river.

11.4.36 The **FRA** plots the 2010 model results onto the topographic survey to determine flood zones and this shows that the area of Flood Zone 3 (i.e. the Site area within the 1 in 100 year flood outline), is less than that indicated on the EA Flood Zone Map. It also shows that the flood storage indicated to the north of the river, is far less extensive.

11.4.37 The Level 1 Strategic Flood Risk Assessment (SFRA)(2010) (information obtained from the **FRA**) includes a series of flood risk maps and shows the following:

- Fluvial flood extent and depth maps that show the potential scale of flood inundation during overtopping of different standards of flood defence during a range of flood events. These indicate that parts of the Site could be inundated up to 1 m depth;
- Climate change maps that show fluvial flood extent and depths from Main Rivers and extent and depths variations, for an undefended floodplain with a 1% (1 in 100 year) fluvial flood flow plus a 20% increase in volume of flood flows. This allows for the effects of climate change over the next 100 years. These indicate that parts of the Site could be inundated up to 1 m depth; and,

- Areas naturally vulnerable to surface water flooding, which provide an indication of surface water flood extent and variation in depths for particular geographical areas, resulting from a 1% (1 in 100 year) rainfall event; and assuming a 10% (1 in 10 year) rainfall event theoretically being 'lost' due to the sewer capacity. These indicate that only a very small area of the Site would potentially be affected by pluvial flooding during a 100 year rainstorm with depths up to 0.5m.

11.4.38 Based on the available information, it is considered that fluvial flood risk is low to medium for the majority of the Site but is high in areas immediately adjacent to the River Dearne.

Risk of Groundwater Flooding

11.4.39 The EA has confirmed that they have no information relating to groundwater levels of groundwater flooding in the area.

11.4.40 The British Geological Survey Groundwater Flooding Susceptibility Map indicates that the southern area of the Site has a 'high' susceptibility to flooding from groundwater, as shown in the FRA. The groundwater flooding susceptibility data shows the degree to which areas are susceptible to groundwater flooding on the basis of geological and hydrogeological conditions. It does not show the likelihood of groundwater flooding occurring, i.e. it is a hazard not risk-based dataset.

11.4.41 Based on the available data, it is considered by WSP that the risk of groundwater flooding to the Site is low. However, for completeness this effect has been considered in this Chapter.

Water Supply

11.4.42 The existing warehouse properties on-site are connected to the mains water supply provided by Yorkshire Water. Although the current water usage volume is unknown it is anticipated to be typical of retail / commercial land use.

11.4.43 In *Water Resources in England and Wales – Current State and Future Pressures* (Ref 11.23) the EA advises which areas of the UK they consider to be seriously water stressed by assessing where current and future household demand for water is a high proportion of the available freshwater resources. The Site is located in an area classified as 'Serious' water stress.

11.4.44 The Water Act, 2003 (Ref 11.6) requires water companies to produce '*Water Resources Management Plans*' which provide a realistic strategic plan for managing water resources and indicate how a water company intends to maintain the balance between supply and demand for water over the next 25 years. Much of the information provided in this section was obtained from the following document:

- Yorkshire Water, December 2009, *Water Resources Management Plan (WRMP)*. (Ref 11.24).

11.4.45 Yorkshire Water supply approximately 1.9 Million households and 131,000 businesses. Yorkshire Water state that the area will remain in surplus through to 2034/2035, these predictions are based on the economic climate and the integration of new pipelines. A pipeline is to be constructed to connect the East Ground Water Zone to the Grid Surface Water Zone in 2011. The site is located within the grid surface water zone.

11.4.46 The water supply for this region is principally sourced from reservoirs located in the Pennines. Yorkshire Water operated over 100 reservoirs with a total capacity of 160,432 MI. In addition, Yorkshire Water also has an

agreement to abstract 21,550 MI per year from the Derwent Valley Reservoirs in Derbyshire. Approximately 45% of water supply is from reservoirs, 25% from boreholes and 30% from Rivers (**Ref 11.25**).

11.4.47 The Catchment Abstraction Management Strategy (CAMS) document for The Don and Rother Catchment (**Ref 11.26**) for the area states that there are 350 current surface water and groundwater abstraction licenses in the catchment area, the greatest use of abstracted water is for industry (excluding public water supplies abstraction).

11.4.48 The CAMS document shows that the Site is located in an area where the water resource availability is 'Over Licensed'. This is defined as areas where the 'current actual abstraction is resulting in no water available at low flows. If existing licences were used to their full allocation they would have potential to cause unacceptable environmental impact at low flows. Water may be available at high flows with appropriate restrictions'.

Future Baseline

11.4.49 Should the Proposed Development not proceed, land uses remained as they are currently and current routine maintenance of water utilities services is continued; it is considered likely that the future baseline conditions in relation to drainage, flooding and potable water demand would remain relatively unchanged at the Site.

11.4.50 In the longer term, the risk of flooding at the Site may increase with the effects of climate change due to increased frequency of extreme rainfall events.

11.5 ASSESSMENT OF EFFECTS, MITIGATION AND RESIDUAL EFFECTS

Site Preparation, Earthworks and Construction Phase (including Demolition)

Increase in risk of physical contaminants (i.e. sedimentation) on the adjacent and on-site drainage channels, surface water sewers and ultimately the River Dearne from surface water run-off and dewatering activities.

11.5.1 Key potential surface water receptors include the adjacent River Dearne and adjacent/on-site surface water drains and culverts. Surface water at the Site currently drains to the two on-site drainage culverts to the north and south of the River Dearne. The surface water culverts ultimately discharge to the River Dearne.

11.5.2 The River Dearne is considered to be the principal surface water receptor. Current chemical water quality in the River Dearne is 'Good' and one non-potable surface water abstraction is located within 500m down gradient of the Site. Although the Dearne Valley Park Local Nature Reserve is located on the eastern boundary its designation is not thought to be dependent on river water quality. No internationally or nationally designated sites are present within 2km of the Site. Therefore, the sensitivity of the River Dearne is considered to be medium.

11.5.3 During the site preparation, earthworks and construction phase of the Proposed Development there will be a number of activities which could reduce surface water quality with respect to physical contaminants. These are likely to include and are not limited to the following:

- Demolition of existing buildings/structures (including internal/external stripping) and associated site clearance;
- Breaking out of existing ground slabs;
- Processing of aggregates from demolition rubble and arisings for reuse or removal from site (including crushing and screening);
- Materials handling, storage, stockpiling, spillage and disposal;
- Earthworks involving manipulation of ground levels and reengineering of existing made ground as necessary;

- Excavation and foundation construction within the Site and site preparation;
- Installation of temporary and permanent infrastructure and roads and haul routes;
- Construction of proposed buildings;
- Construction of drainage runs and utilities duct runs;
- Formation of public spaces, public realm and associated restoration and landscaping; and
- Movement and use of static and mobile plant/construction vehicles.

11.5.4 The demolition and construction activities may lead to the increased disturbance and mobilisation of physical contaminants (i.e. dust, sediments, and mud). In particular during periods of heavy rainfall, vehicle movements resulting in damage to soil structure may generate increased sedimentation within surface run-off. In addition, during periods of dry, windy weather wind blown dusts generated by the demolition of buildings and excavation of soils have the potential to directly reduce the quality of surface water features.

11.5.5 Dewatering of excavations may be required (for example during the construction of foundations), dependent on groundwater elevations. There is the potential for the dewatered groundwater to contain sediments.

11.5.6 These activities may result in sediments directly (e.g. wind-blown) or indirectly (e.g. via surface water runoff) entering surface water features, impacting on the physical quality of the surface water receptors on-site and in the surrounding area.

11.5.7 This has the potential to also subsequently impact the chemical and biological quality of surface water receptors. The biological quality could be impacted indirectly through sediment smothering feeding and breeding grounds and physically altering the habitat. The potential impacts on surface water quality from an increase in chemical contaminants are assessed in **Chapter 10 – Ground Conditions, Hydrogeology and Contamination**.

11.5.8 The sensitivity of surface water receptors in the vicinity (in particular the River Dearne) to physical contaminants is medium and the magnitude of change, prior to mitigation, is medium. Hence, there is likely to be a direct, temporary, medium-term effect on surface water receptors of **moderate negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.9 Prior to the commencement of the site preparation, earthworks and construction phases, site run-off will be controlled to mitigate both flood risk and sediment loading. At this time the proposed drainage strategy for the construction stage of the Proposed Development has not been finalised. It is understood that this will be addressed during the detailed design stage.

11.5.10 It is assumed that site run-off will be collected and directed through the drainage system and attenuated on-site prior to discharge ensuring the protection of water quality in receiving waterbodies from an increased sediment load. The surface water runoff will be restricted in line with EA and BMBC guidelines.

11.5.11 A variety of good environmental site practices will be implemented to avoid or minimise effects at the source. Such measures will include, but are not limited to, the following:

- Working areas shall be clearly defined to ensure the disturbance of soils is minimised, where possible;
- Haul routes and accesses shall be clearly defined to minimise the risk of accidents; and

- Implementation of a phased temporary drainage network in line with construction phasing to prevent sediment laden surface run-off from leaving the Site or entering surface water such as drainage channels or the River Dearne. Measures may include:
 - The cleaning of vehicle wheels prior to leaving site;
 - Controlled and covered waste storage areas;
 - Dust suppression (i.e. damping down);
 - Provision of environmental awareness training for site workers;
 - Adopting the EA Pollution Prevention Guidelines (outlined below); and
 - Installation of systems such as silt traps including adequate maintenance and monitoring of these to ensure effectiveness, particularly after adverse weather conditions.

11.5.12 The position and extent of working areas shall reflect the sensitivity of surrounding areas and works being carried out. The contractor shall appraise the suitability of such working areas in this respect as part of working method statements.

11.5.13 Should dewatering be required, abstraction and discharge licences will be sought from the EA under the terms of the Water Resources Act 1991. Attenuation of dewatered groundwater will be undertaken to allow sediments to settle out of suspension before discharge to surface water features or drainage features.

11.5.14 The type and configuration of the drainage systems during construction would be subject to the proposed phasing and areas of development. However consideration will be given to utilising the areas for permanent drainage and SUDS strategy features for run-off control during construction (**Appendix 11.3**).

11.5.15 Where necessary, all site works will be undertaken in accordance with the EA's Pollution Prevention Guidelines, in particular:

- PPG1 '*General Guide to the Prevention of Water Pollution*';
- PPG5 '*Works in, near or Liable to Affect Watercourses*'; and
- PPG6 '*Working at Construction and Demolition Sites*'.

11.5.16 Earthworks and construction activities will also be undertaken in accordance with CIRIA guidance '*C532 – Control of Pollution from Construction Sites*' (**Ref 11.27**). All site works and ground works will be undertaken in accordance with the Considerate Contractors Scheme to help ensure a well-managed operation which minimises environmental risks.

11.5.17 Best practice recommendations for the prevention of contamination will be outlined in more detail in a Construction Environment Management Plan (CEMP) or equivalent, which will be developed and agreed with the appropriate regulators, prior to site preparation, earthworks or construction commencing.

Residual Effects

11.5.18 The sensitivity of surface water receptors in the vicinity to physical contaminants is medium and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on surface water receptors following the implementation of mitigation measures.

Increase in risk of surface water and drainage flooding on construction workers and construction activities

11.5.19 Surface water and drainage flooding, especially after extreme rainfall events, has the potential to harm construction workers on-site if it is received in large volumes, particularly if they are working in excavations which have the potential to fill with water. Small parts of the Site may be inundated with up to 0.5m of water according to the SFRA during a 100 year rainstorm.

11.5.20 Any overland flow that did flow into or out of the Site would currently follow the line of least resistance and follow natural topography which is likely to change during site preparation, earthworks and construction works.

11.5.21 During the overall site preparation, earthworks and construction phase, the extent of hardstanding surface cover is likely to decrease and the proportion of bare soil will increase during the earthworks stage. This is therefore likely to result in an increased rate of rainfall infiltration and a decreased volume of surface water run-off.

11.5.22 As there is no hardstanding present within the northern part of the Site currently, the permeability/rate of infiltration in the soils in this area will vary and runoff will potentially increase during the site preparation, earthworks and construction phase.

11.5.23 The risk of flooding from the on-site culverts is considered to be negligible, and any flows resulting from surcharging of other sections of the drainage or sewer system during extreme rainfall events are likely to be short term, relatively shallow in depth and should pass through the Site following the natural topography.

11.5.24 The sensitivity of construction workers and construction activities to surface water and drainage flooding at the Site is high and the magnitude of change should this occur, prior to mitigation, is medium. Therefore, there is likely to be a direct, temporary, medium-term effect on construction workers and construction activities of **moderate to major negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.25 Prior to the commencement of each construction phase, site surface run-off will be controlled to mitigate flood risks as discussed in the sediment loading section above. At this time, the proposed drainage strategy for the site preparation, earthworks and construction stage of the Proposed Development has not been developed in detail. It is understood that this will be addressed during the detailed design stage.

11.5.26 Consideration of the design of site levels during construction should also mitigate against the risk of surface water and drainage flooding.

Residual Effects

11.5.27 Providing that the construction phase drainage strategy is adequately prepared, the sensitivity of construction workers and construction activities to surface water and drainage flooding at the Site is high and the magnitude of change should this occur, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on construction workers and construction activities following the implementation of mitigation measures.

Increase in risk of fluvial flooding on construction workers

11.5.28 The Site lies within Flood Zones 1 (low risk), 2 (medium risk) and 3 (high risk). The SFRA indicates that parts of the Site could be inundated up to 1 m depth. The EA have confirmed that they do not have any historical flood records for the Site. However, areas upstream and downstream of the Site were affected during a flood event which occurred in June 2007.

11.5.29 Should fluvial flooding occur, the consequences to construction workers would be similar to those identified in the surface water flooding section above, with particular regard to excavations potentially filling with water.

11.5.30 The sensitivity of construction workers to fluvial flooding at the Site is high and the magnitude of change should this occur, prior to mitigation, is medium. Therefore, there is likely to be a direct, temporary, medium-term effect on construction workers of **moderate to major negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.31 Demolition and construction workers on-site will be made aware of risks during the site preparation, earthworks and construction phases and contingency and evacuation plans for any risk will be prepared and the information provided to all workers on-site. Early warning systems will also be put in place to enable evacuation of areas at risk.

Residual Effects

11.5.32 The sensitivity of construction workers to fluvial flooding at the Site is high and the magnitude of change should this occur, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect to construction workers following the implementation of mitigation measures.

Increase in risk of groundwater flooding on construction workers and construction activities (e.g. foundation construction).

11.5.33 The previous reports for the northern area of the Site confirm that groundwater flow direction is toward the River Dearne and is expected to be in continuity with the River. Groundwater levels at the Site are potentially shallow and perched in nature within the Alluvial deposits as described within the ground investigation data summarised in **Appendix 10.1**.

11.5.34 Ground excavations are proposed, in particular for foundation construction and service corridors. Therefore groundwater has the potential to ingress ground excavations at the Site creating health and safety risks to construction workers if they are required to work within the excavations.

11.5.35 The sensitivity of construction workers to groundwater flooding at the Site is high and the magnitude of change should this occur, prior to mitigation, is medium. Therefore, there is likely to be a direct, temporary, medium-term effect on construction workers of **moderate to major negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.36 A supplementary intrusive ground investigation will be undertaken prior to commencement of the site preparation, earthworks and construction phase during which boreholes will be installed for the purpose of establishing groundwater levels and groundwater flow direction.

11.5.37 Groundwater levels will be monitored during all excavations. Construction workers will not be permitted or expected to enter excavations at risk of groundwater flooding.

11.5.38 Dewatering measures will be employed if necessary. Should dewatering be required, abstraction and discharge licences will be sought from the EA under the terms of the Water Resources Act 1991.

Residual Effects

11.5.39 The sensitivity of construction workers to groundwater flooding at the Site is high and the magnitude of change should this occur, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect to construction workers following the implementation of mitigation measures.

Operational Phase

Increase in risk of physical contaminants (i.e. sedimentation) on the adjacent and on-site drains and ultimately the River Dearne from surface water run-off and site activities.

11.5.40 As discussed in the site preparation, earthworks and construction phase section above, the key potential surface water receptors in the vicinity of the Site include the River Dearne and adjacent/on-site surface water drains and culverts. Adjacent and on-site surface water drains and culverts ultimately discharge to the River Dearne.

11.5.41 Current chemical water quality in the River Dearne is 'Good' and one non-potable surface water abstraction is located within 500m down gradient of the Site. No internationally or nationally designated sites are present within 2km of the Site. Therefore, the sensitivity of the River Dearne is considered to be medium.

11.5.42 During the operational phase the potential for sediment entrainment in surface water run-off is anticipated to decrease from that anticipated in the site preparation, earthworks and construction phase. As it will be a controlled amenity / retail area, there is anticipated to be a low volume of physical contaminants (sediment) which could potentially be entrained in surface water run-off over hardstanding and landscaping areas and discharged to surface water receptors, reducing the physical, chemical and biological quality.

11.5.43 The sensitivity of surface water receptors in the vicinity to physical contaminants is medium and the magnitude of change, prior to mitigation, is low. Therefore, there is likely to be a direct, permanent, long-term effect on surface water receptors of **minor negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.44 Although the proposed drainage strategy has not yet been finalised, surface water will be collected on-site within a new drainage system. The majority of the surface water will be collected in an attenuation tank and all surface water will ultimately discharge to the existing culvert. It is anticipated that proposed pollution control measures will include trapped road and car park gullies and oil interceptors which will attenuate physical contaminants to an acceptable concentration before discharging to the culvert. These facilities will be subject to routine maintenance.

11.5.45 To mimic the existing catchment, a SUDS management train will be incorporated in series to incrementally reduce pollution (including sedimentation), flow rates and volumes.

11.5.46 Vegetation cover in areas of soft landscaping will serve to hold topsoil material in position and reduce the sediment loading in surface water draining into the River Dearne. The exact nature of the coverage of vegetation will be further defined during the detailed design stage. For further information, please refer to **Chapter 12 – Ecology and Nature Conservation**.

Residual Effects

11.5.47 The sensitivity of surface water receptors in the vicinity to physical contaminants is medium and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect to surface water receptors following the implementation of mitigation measures.

Increase in foul drainage (and associated potential increase in flood risk) and associated demand on sewage network.

11.5.48 A drainage strategy report has been prepared by WSP which includes information regarding the foul drainage strategy for the Proposed Development.

11.5.49 Currently, foul drainage facilities in the vicinity of the Site include a 225 mm combined sewer flowing from west to east along Twibell Street; a 300 mm combined sewer flowing north along the eastern boundary of the Site and connecting into the 750 mm combined sewer running west to east; a combined sewer overflow adjacent to the A61 road bridge and a combined sewer overflow to the west of the gas holder.

11.5.50 The current foul dry weather flows have been estimated at 0.8l/s and it is assumed that the foul drainage drains by gravity. The current foul drainage system is presented on **Appendix 11.3**.

11.5.51 Yorkshire Water has confirmed that sewer diversionary works would have to be undertaken. The proposed development would include separate foul and surface water drainage systems. Yorkshire Water has confirmed that the foul drainage should discharge to the public combined sewers crossing / within the Site. Due to the topography of the Site it is envisaged that foul flows from site would drain by gravity.

11.5.52 As Yorkshire Water have suggested that once the diversion works have been completed the sewer network has the capacity for the increase in foul drainage, there is not anticipated to be an increase in risk of foul drainage flooding.

11.5.53 Therefore, the sensitivity of the foul drainage and sewerage network to increases in foul drainage from the Site is low and the magnitude of change, prior to mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on the foul drainage and sewerage network (and therefore future populations and third parties through flood risk).

Mitigation

11.5.54 The detailed foul drainage system for the Site has not been finalised to date and it is understood that this will be addressed during the detailed design stage in collaboration with Yorkshire Water, and will be designed and constructed in accordance with current regulations.

11.5.55 It is anticipated that this will include measures for minimising foul drainage in combination with measures for minimising water use as discussed in a later section.

Residual Effects

11.5.56 The sensitivity of the foul drainage and sewerage network to increases in foul drainage from the Site is low and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on the foul drainage and sewerage network (and therefore future populations and third parties through flood risk).

Increase in, or change in patterns of, surface water drainage and associated flood risk

11.5.1 Details on the proposed surface water drainage strategy are provided within the **FRA** and are utilised in this assessment. Considering all of the available information at this stage, the risk of flooding from surface water and foul drainage is currently considered to be low to medium.

11.5.2 The drainage strategy for the northern part of the Site has already incorporated drainage design within the development of the road scheme that is currently under construction. Therefore, the discussions below relate to the southern part of the Site.

11.5.3 The existing runoff for the southern portion of the Site is approximately 420l/s. Drainage strategies for new developments must also allow for an increase in rainfall intensities of 30% in line with PPS25. The EA aspires to reduce the rate of surface water discharge from new developments for any given storm event and specifies that the drainage system should be designed to control runoff for up to the 1 in 100 year rainfall event.

11.5.4 The EA has stated that there should be no increase in surface water runoff from the new development. As the existing site drains to a watercourse, surface water runoff should be attenuated to provide a 30% reduction in the final surface water discharge from the Site when compared to the existing site outflow prior to redevelopment.

11.5.5 The southern part of the Site is currently predominantly covered with hardstanding. Therefore, the typical volumes of surface run-off are likely to be similar following the Proposed Development.

11.5.6 The sensitivity of future populations and third parties to surface water flooding at the Site is high and the magnitude of change should this occur, prior to mitigation, is low to medium. Therefore, there is likely to be a direct, permanent long-term effect on future populations and third parties of **moderate negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.7 The detailed surface water drainage system for the Site has not been finalised to date and it is understood that this will be addressed during the detailed design stage in collaboration with Barnsley Council and the EA.

11.5.8 The extent of these areas and the interaction of the proposed and existing drainage systems and the existing watercourses will be modelled in detail at the detailed design stage.

11.5.9 Surface water run-off from the Proposed Development will continue to discharge into the River Dearne with a 30% reduction in line with Barnsley Council and EA requirements.

11.5.10 The attenuation storage will be provided to ensure no surface flooding for up to the 1 in 30 year return period design storm and no flooding of properties for up to the 1 in 100 year plus climate change return period design storm. Flows will be retained on site for up to the 1 in 100 plus climate change return period design storm.

11.5.11 A detailed ground investigation will be undertaken as part of the detailed design works to assess infiltration rate and where considered appropriate the EA's SUDS hierarchy shall be used to ensure that the most sustainable SUDS solutions are utilised where possible. Surface water runoff from the Proposed Development will be controlled using SUDS in order not to exacerbate any existing flood risk to Site users and third parties upstream or downstream of the Site.

11.5.12 The hierarchical approach to the SUDS system includes the following:

- Prevention – use of local soakaways where layout and ground conditions permit;
- Source Control – control of run-off near its source through the use of soakaways (subject to ground conditions), permeable pavements for exposed car parking areas;
- Site Control – management of water local to the plot development through the use of swales, filter strips and trenches and where site conditions and layout allow attenuation basins; and,
- Regional Control – the use of attenuation basins prior to restricted discharge to a local watercourse.

11.5.13 The exact configuration and nature of the SUDS and drainage systems would be determined at the detailed design stage.

11.5.14 A robust maintenance regime will be implemented to ensure future performance of all SUDS and drainage components throughout the lifetime of the development.

11.5.15 Any water discharged into drainage channels/culverts or the ground through SUDS will be uncontaminated surface water to avoid deterioration of water quality in the groundwater and surface water bodies (River Dearne). Hence oil interceptors and trapped gullies would be included within the drainage design for car parking areas to allow for sedimentation to settle out of suspension.

11.5.16 Finished site levels, where possible, will be engineered to provide positive drainage and prevent ponding. Gradients of external areas will be designed to ensure that flood waters are directed away from buildings, such that any overland flow resulting from extreme events will follow the line of least resistance and flow to the existing roads. The accumulation of standing water will therefore not occur and thus not pose a risk.

Residual Effects

11.5.17 It is considered that due to consideration of the surface water drainage risk in the design of the Proposed Development and the mitigation measures described above that the Proposed Development will result in a reduction in surface water flood risk at the Site.

11.5.18 Therefore, the sensitivity of future populations and third parties to surface water flooding at the Site is high and the magnitude of change should this occur, following mitigation, is low. Therefore, there is likely to be a direct, permanent long-term effect on future populations and third parties of **minor positive** effect on future populations and third parties following the implementation of mitigation measures.

Increase in risk of fluvial flooding on future populations and third parties

11.5.19 The River Dearne flows through the centre of the Site in an easterly direction.

11.5.20 The proposed development site is located in Flood Zones 1 (<0.1% probability of flooding), 2 (between 0.1% and 1%) and 3 (between 0.1% and 0.5 %) on the EA Flood Zone Map and within the Strategic Flood Risk Assessment (2010). The Flood Zone Map also indicates a flood storage area within the Site boundary.

11.5.21 The SFRA indicates that parts of the Site could be inundated up to 1 m depth. The EA have confirmed that they do not have any historical flood records for the Site. However, areas upstream and downstream of the Site were affected during a flood event which occurred in June 2007.

11.5.22 Based on the available information, it is considered that fluvial flood risk is low to medium for the majority of the Site but is high in areas immediately adjacent to the River Dearne. The proposed masterplan layout will take account of the existing watercourses crossing the Site, including an 8 m easement from the top of the bank of the River Dearne and a 6 m easement from the culverted watercourses crossing the Site, which must be protected during the proposed works. Therefore the magnitude is considered to be medium.

11.5.23 The culvert to the north of the Site is not affected by the proposed development and BMBC has agreed that the culvert to the south can be diverted as required.

11.5.24 CSP 4 Flood Risk (**Ref 11.11**) states that the extent and impact of flooding will be reduced by not permitting new development where it would be at an unacceptable risk of flooding or would give rise to flooding elsewhere.

11.5.25 The sensitivity of future populations and third parties to fluvial flooding at the Site is high and the magnitude of change should this occur, prior to mitigation, is medium. Therefore, there is likely to be a direct, permanent long-term effect on future populations and third parties of **moderate to major negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.26 Detailed hydraulic modelling will be undertaken at the detailed design stage to prove that the flood storage area is not reduced as a result of the proposed development. Preliminary calculations indicate that compensatory flood storage is not required.

11.5.27 The levels in the vicinity of the PFS will be raised above the 1 in 100 year plus climate change flood level to allow its development. Compensatory flood storage will be provided as necessary. The EA has recommended that the finished floor level of the proposed units should be set 600 mm above the 1 in 100 year plus climate change flood level.

11.5.28 The main food superstore will be developed on 'stilts', providing flood mitigation. In addition, it is recommended that flood resilience measures be incorporated into the design of the buildings. Further information is contained in 'Improving the Flood Performance of New Buildings – Flood Resilient Construction', Department of Communities and Local Government, May 2007.

11.5.29 The site is not located within an EA flood warning area, however a detailed flood plan / evacuation plan will be developed as part of the detailed design.

11.5.30 Access to the main retail store (for both customers and service vehicles) is proposed via a new road bridge over the River Dearne from a spur to the Wickes roundabout on the new Quality Bus Corridor. This will be designed above the 1 in 100 year plus climate change flood level. In addition, a separate pedestrian access will be available directly from the A61.

Residual Effects

11.5.31 It is considered that due to consideration of the fluvial flood risk in the design of the Proposed Development and the mitigation measures described above that the Proposed Development will result in a reduction in fluvial flood risk at the Site.

11.5.32 Therefore, the sensitivity of future populations and third parties to fluvial flooding at the Site is high and the magnitude of change should this occur, following mitigation, is low. Therefore, there is likely to be a direct, permanent long-term effect on future populations and third parties of **minor positive** significance on future populations and third parties following the implementation of mitigation measures.

Increase in risk of groundwater flooding

11.5.33 The intrusive ground investigations indicate that groundwater levels at the Site are shallow. However, there is no history of groundwater flooding at the Site and there are no proposed basement structures.

11.5.34 Therefore, the sensitivity of future populations and third parties to groundwater flooding at the Site is high and the magnitude of change should this occur, prior to mitigation, is low. Therefore, there is likely to be a direct, permanent, long-term effect on future populations and third parties of **minor to moderate negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.35 Supplementary ground investigation will be undertaken at the Site during which boreholes will be installed for the purpose of establishing groundwater levels and groundwater flow direction. Further assessment will be undertaken if required at the detailed design phase.

Residual Effects

11.5.36 The sensitivity of future populations and third parties to groundwater flooding at the Site is high and the magnitude of change should this occur, following mitigation, is negligible. Therefore, there is likely to be a **negligible** effect on future populations and third parties following the implementation of mitigation measures.

Increase in demand on potable water supply.

11.5.37 It should be noted that this assessment considers impacts in relation to the availability of potable water supply only.

11.5.38 Although the current potable water usage volume is unknown. It is anticipated that as the proposed land use will be a similar retail / commercial nature that the water usage will not increase significantly.

11.5.39 The EA assess where current and future household demand for water is a high proportion of the available freshwater resource. The Site is located in an area classified as 'Serious' water stress. (**Ref 11.23**).

11.5.40 The CAMS document (**Ref: 11.25**) shows that the Site is located in an area where the water resource availability is 'Over Licensed'.

11.5.41 Over the next 25 years the rise in population, new housing, shrinking household sizes and business growth are likely to increase water demand. However, agricultural and industrial demand is considered likely to decrease which coupled with climate. Yorkshire Water predicts that the area will remain in surplus through to 2034/35 due to the economic climate and the integration of two areas by a new pipeline to be constructed to connect the East Ground Water Zone to the Grid Surface Water Zone in 2011 (**Ref 11.24**). After this date the situation will be reassessed and a new WRMP will be undertaken to ensure that potable water demand is met in the supply area.

11.5.42 Although Yorkshire Water has not directly confirmed that they can manage the extra water demand that the Proposed Development will generate, they predict that there will be a surplus of water in the area through to 2035. Therefore, the sensitivity of water resources in the vicinity is medium and the magnitude of change, prior to mitigation, is low. Hence, there is likely to be a direct, permanent, long-term effect on water resources of **minor negative** significance prior to the implementation of mitigation measures.

Mitigation

11.5.43 Although site specific water saving measures have not been determined in detail yet, they are likely to include the following:

- Water saving fittings such as dual flush toilets and aerated taps and shower heads in the residential and public toilets;
- Rain water harvesting for the public toilets;
- Green roofs; and
- Leak detection and proximity auto water shut off will be installed in the retail units to comply with BREEAM requirements.

Residual Effects

11.5.44 The sensitivity of water resources in the vicinity is medium and the magnitude of change, following mitigation, is negligible. Therefore, there is likely to be a direct, permanent, long-term effect on water resources of **negligible** significance following the implementation of mitigation measures.

Monitoring and Follow Up

11.5.45 A CEMP for the control and management of potential risks at the Site will be developed for each phase and implemented by individual contractors for the preparatory and construction stages of the development. Each CEMP will incorporate the mitigation measures recommended above to reduce the significance and, where possible, eliminate the identified effects.

11.5.46 The CEMP will be a live document setting out the construction management system to be adopted on-site. Detailed risk assessments will be produced for all operations from which a safe system of work shall be developed. Contractors will be required to monitor this process and develop assessments and working methods appropriate to changes in work activities.

11.5.47 The temporary construction phase surface water drainage and the finer details of the operational phase surface water and foul drainage systems are to be designed during the detailed design stage encompassing measures discussed in the sections above, particularly including measures for minimising volumes and preventing contamination of sensitive waterbodies. Silt traps utilised in the drainage system in the construction phase should be routinely monitored to ensure effectiveness.

11.5.48 Groundwater elevations and flow direction and the potential for specific SUDS techniques will be determined during the proposed intrusive investigations.

Limitations and Assumptions

11.5.49 Outline designs for the surface water drainage strategy during the construction and operational phases have been utilised in the above assessments. This Chapter supports an outline application with no confirmed detailed surface water drainage design that seeks to establish the principle of the scheme. Assumptions have been made in the assessment sections above on drainage and potable water design and capacity. Following the detailed design phases, should the design details vary in a manner that compromises the assessments, further assessment will be provided.

Table 11.1: Summary of Effects Table for Drainage, Flooding and Water Resources

Description of Likely Significant Effects	Significance of Effects					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		
Site Preparation, Earthworks and Construction Phase (including Demolition)													
Increase in risk of physical contaminants (i.e. sedimentation) on the adjacent and on-site drainage channels, surface water sewers and ultimately the River Dearne from surface water run-off and dewatering activities.	Moderate	Negative	T	D	MT	■ Design of temporary drainage system ■ Good environmental site practices. ■ Contractors to prepare Construction Environment Management Plans (CEMPs). ■ Adoption of Relevant EA PPGs. BMBC guidance.	Negligible	N/A	N/A	N/A	N/A	PPS 23 – Planning and Pollution Control CSP 3 - SUDS	Water Act (2003) Water Environment (Water Framework Directive) Regulations (2003) Environment Act (1995) Land Drainage Act (1991)
Increase in risk of surface water and drainage flooding on construction workers and construction activities.	Moderate to Major	Negative	T	D	MT	■ Collection, attenuation and subsequent discharge of surface water through a temporary drainage system ■ Consideration of site levels	Negligible	N/A	N/A	N/A	N/A	PPS 25 – Development and Flood Risk CPS 4 – Flood Risk	Water Act (2003) Water Environment (WFD) Regulations (2003) Environment Act (1995) Land Drainage Act (1991)

Description of Likely Significant Effects	Significance of Effects					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		
Increase in risk of fluvial flooding on construction workers.	Moderate to Major	Negative	T	D	MT	- Contingency and evacuation plans - Awareness of risk for site workers - Early warning system	Negligible	N/A	N/A	N/A	N/A	PPS 25 CPS 4	Water Act (2003) Water Environment (WFD) Regulations (2003) Environment Act (1995)
Increase in risk of groundwater flooding on construction workers and construction activities (e.g. foundation construction).	Moderate to Major	Negative	T	D	MT	- Intrusive investigation to determine groundwater elevations - Monitor groundwater elevations during excavations - Employ dewatering systems if necessary	Negligible	N/A	N/A	N/A	N/A	PPS 25 CPS 4 – Flood Risk	Water Act (2003) Water Environment (WFD) Regulations (2003) Environment Act (1995)
Operational Phase													
Increase in risk of physical contaminants (i.e. sedimentation) on the adjacent and on-site drains and ultimately the River Dearne	Minor	Negative	P	D	LT	Collection, attenuation and subsequent discharge of surface water through the	Negligible	N/A	N/A	N/A	N/A	PPS 23 CPS 3	Water Act (2003) Water Environment (WFD) Regulations (2003)

Description of Likely Significant Effects	Significance of Effects					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT)		
from surface water run-off and site activities.						drainage system ■ Vegetation cover to reduce sediment loading							Environment Act (1995) Land Drainage Act (1991)
Increase in foul drainage (and associated potential increase in flood risk) and associated demand on sewage network.	Negligible	N/A	N/A	N/A	N/A	■ The proposed foul drainage strategy to be agreed with YW and designed in accordance with regulations. ■ Implementation of water efficiency measures to reduce foul drainage	Negligible	N/A	N/A	N/A	N/A	PPS 1 – Delivering Sustainable Development CPS 4	Water Act (2003)
Increase in, or change in patterns of, surface water drainage and associated flood risk.	Minor to Moderate	Negative	P	D	LT	■ Collection, attenuation and subsequent discharge of surface water through the drainage system ■ Development designs to prevent accumulation of standing water	Minor	Positive	P	D	LT	PPS 25 CPS 4	Water Act (2003) Water Environment (WFD) Regulations (2003) Environment Act (1995) Land Drainage Act 1991
Increase in risk of fluvial flooding on	Moderate	Negative	P	D	LT	■ Completion of hydraulic	Minor	Positive	P	D	LT	PPS 25	Water Act (2003)

Description of Likely Significant Effects	Significance of Effects					Summary of Mitigation / Enhancement Measures	Significance of Residual Effects					Relevant Policy	Relevant Legislation
	(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT		(Major, Moderate, Minor, Negligible)	Positive / Negative	(P/T)	(D/I)	ST/MT/LT		
future populations and third parties.						modelling. ■ Design of the food store development on stilts. ■ Standoffs apply. ■ Levels of the PFS will be raised.						CPS 4	Water Environment (WFD) Regulations (2003) Environment Act (1995)
Increase in risk of groundwater flooding.	Minor to Moderate	Negative	P	D	LT	■ Intrusive investigation to determine groundwater elevations	Negligible	N/A	N/A	N/A	N/A	PPS 25 CPS 4	Water Act (2003) Water Environment (WFD) Regulations (2003) Environment Act (1995)
Increase in demand on potable water supply.	Minor	Negative	P	D	LT	■ Anticipated resource saving methods in development	Negligible	N/A	N/A	N/A	N/A	PPS1	Water Act (2003)

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term

N/A = Not Applicable

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