6 Surface Water Quality and Flood Risk

6.1. Introduction

This Chapter presents the assessment of the proposed West Gorton masterplan on the surface water environment and flood risk. It first sets out the legislative and planning policy context, the scope of the assessment, the methodology followed in the assessment of environmental effects and the environmental baseline. It then identifies potential effects for the construction and occupational phases, including mitigation measures where necessary and the residual effects that are likely to occur after the implementation of these mitigation measures.

6.1.1. Legislation and Planning Policy

The following lists relevant European and National Legislation with relevance to this assessment (Please refer to Appendix 6.1 for further details). The proposed scheme will have to comply with these pieces of legislation.

- European:
  - Water Framework Directive (WFD) (2000/60/EC);
  - Environmental Liability Directive (2004/35/EC);
  - Fish (Consolidated) Directive (2006/44EC, replacing 78/659/EC)[1];
  - Dangerous Substances Directive (2006/11/EC replacing 76/464/EC) [1]; and
  - Priority Substances Directive (2008/105/EC).
- National:
  - The Flood and Water Management Act 2010;
  - The Environmental Damage (Prevention and Remediation) Regulations 2009;
  - The Water Act 2003;
  - The Water Resources Act 1991;
  - The Land Drainage Act 1991 (as amended);
  - The Reservoirs Act 1975;
  - The Environmental (England and Wales) Permitting Regulations 2010;
  - The Water Environment (Water Framework Directive) Regulations 2003; and
  - The Control of Pollution (Oil Storage) (England) Regulations 2001.

National Planning Policy

The Government's Water Strategy for England, Future Water was published in February 2008. This strategy sets out the Government's long-term vision for water and the framework for water management in England. It aims to permit the supply of secured water supplies whilst ensuring an improved and protected water environment. Future Water brings together the issues of water demand, water supply, water quality in the natural environment, surface water drainage and river / coastal flooding into a single coherent long term strategy, in the context of the need to reduce greenhouse gas emissions. The strategy also considers the issue of charging for water. The water environment and water quality have great economic, biodiversity, amenity and recreational value, playing an important role in many aspects of modern day society, and thus the functions provided must be sustainably managed to ensure they remain available to future generations without compromising environmental quality.

The National Planning Policy Framework (NPPF) has recently been published (March 2012) and replaces existing national planning policy adopted since 2004 (e.g. PPS23). In particular, Section 11 Conserving and Enhancing the Natural Environment paragraph 109 states that development should be prevented from contributing or put at unacceptable risk from, or being adversely affected by unacceptable levels of water pollution. Section 10 Meeting the challenge of climate change, flooding and

[1] To be repealed by the WFD when fully implemented

coastal change paragraphs 94 and 99 emphasise the need to adopt proactive strategies to mitigate and adapt to climate change over the long term, taking into account flood risk and water supply and demand considerations.

NPPF seeks to ensure that climate change is taken into account over the longer term including factors such as flood risk, coastal change, water supply and changed to biodiversity and landscape. New development should therefore be planned to avoid increased vulnerability to the range of impacts arising from climate change. Where new development is brought forward in areas which are vulnerable to the range of impacts arising from climate change, care should be taken to ensure that flood risk can be managed through sustainable adaptation measures. In relation to flood risk, inappropriate development in areas at high risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere and taking into account the impacts of climate change.

Although the NPPF surperceedes previously adopted national planning policies, decision makers may continue to give consideration to relevant adopted policies according to their degree of consistency with the new NPPF for a 12 month period from its publication. Prior to the adoption of the NPPF, National planning policy for the prevention of water pollution was set out in Planning Policy Statement 23 (PPS23) Planning and Pollution Control (ODPM, 1994). PPS23 provided guidance on the location of, and appropriateness of certain "polluting" developments, so as to prevent pollution and ensure that the environment and human health are protected. In particular, PPS23 Annex 1 encouraged the use where appropriate of Sustainable Drainage Systems (SuDS) by developers. The Floods and Water Management Act 2010 intends to provide better, more comprehensive management of flood risk for people, homes and businesses. It also will tackle bad debt, improve the affordability of water bills, and help ensure continuity of water supplies. In particular, it encourages the uptake of SuDS by removing the automatic right to connect to sewers and providing for Lead Local Flood Authorities (unitary and county councils) to adopt SuDS for new developments and redevelopments. Unitary and county councils will be responsible for SuDS Approval Bodies (SABs) that will evaluate and approve SuDS in all new developments as well as adopt and maintain SuDS serving more than one property.

Local Planning Policy
Strategic policy 6 of the Manchester's LDF Core Strategy Development Plan Document (Publication Consultation February 2011 and submitted to the Secretary of State July 2011) is to *"protect and enhance both the natural and built environment of the City and ensure the sustainable use of natural resources, in order to mitigate and adapt to* ***climate change****, support biodiversity and wildlife, improve air,* ***water*** *and land quality, recreational opportunities and provide networks of high quality green infrastructure, ensuring that the City is inclusive and attractive to residents, workers, investors and visitors."*

Proposed policy EN 17 Water Quality states that:

'Development should avoid any adverse impact on water quality, including during the construction phase, and wherever possible should seek to enhance water quality, both chemical and ecological;

Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses;

Development close to a watercourse should also ensure that waste or litter cannot enter the watercourse from the site; and

Development should, where feasible and appropriate, seek to open up any culverted or hidden watercourse.'

The discharge of diffuse pollution from roads and urban areas has been identified by the EA as a key issue for the Northwest. The consultation Core Strategy explains that the principal way in which Local Authorities can influence water quality is by treating diffuse urban pollution through the implementation of appropriate SuDs for new development.

Local planning policy is currently set out in the MCC's Unitary Development Plan (UDP) (adopted in July 1995), although this is due to be replaced by policies within the LDF over the coming years. Until the LDF is adopted, the saved policies from the UDP are still applicable including policy E1.3 that states that '*The Council will promote measures to decrease the level of pollution in the City's watercourses including rivers and canals*'. Policy DC21.1 states that development *"will not normally be permitted where it would be at risk from flooding or would unacceptably increase the risk of flooding elsewhere."*

The Supplementary Planning Document (SPD) '*Guide to Development in Manchester – Supplementary Planning Guidance'* (April 2007), already adopted as part of the LDF, requires that SuDS be included in developments where possible and the amount of impermeable area minimised.

The Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) forms part of the LDF evidence base and contains detailed information and guidance on flood risk across the local area. As an allocated development site (reference M0010) the study area is considered in some detail in the SFRA.

Further details on relevant legislation and planning policy are presented in Appendix 6.1 Legislation and Planning Policy.

6.2. Methodology

This Section sets out the methodology that will be used to identify and assess the significance of effects on the surface water environment and flood risk.

6.2.1. Scope of Assessment

The scope of the assessment has been defined through a combination of experience of other similar schemes, consultation with key consultees (See Section 6.2.2 and Table 4.1 in Chapter 4) and professional judgement. The assessment includes a qualitative assessment of potential effects on surface water quality from construction works (e.g. silt-laden runoff, spillages) and consideration of the potential effects from highway/urban diffuse pollution from the site, and the increased demand on water resources during the occupational phase of the proposed development.

Opening of the culverted watercourses have been considered in order to provide enhancement of watercourses within the site in line with local planning policy. However, it is was concluded that the costs associated with opening stretches of the culverted watercourses are not only disproportionately expensive but technically unfeasible and probably unsafe at this particular location and thus this is not considered appropriate for this particular development.

The assessment of effects also includes a qualitative compatibility assessment with the objectives of the WFD, including general Programme of Measures and specific mitigation measures for watercourses under the North West River Basin Management Plan (RBMP).

This assessment has also covered an assessment of the flood risk (from all sources) associated with the development during construction and occupation. This has been assessed in accordance with the requirements of NPPF (which is in keeping with PPS25), which considers on-site flood risk, and flood risk elsewhere due to the development. This is based on a standalone FRA, including a high level drainage assessment, which has been presented in Appendix 6.2.

This assessment is iterative with the development of the masterplan and has sought to influence the design so that it is environmentally sympathetic.

6.2.2. Consultation

The Environment Agency (EA) and Manchester City Council (MCC) provided comments on the Scoping report with regards to the assessment of flood risk and effects on the surface water environment. These have been detailed in Table 4.1 in Chapter 4 and include reference to the need to consider the potential to remove some sections of Corn Brook and Black Brook culverts, which are located underneath the development site. Opening culverts would contribute to achieving the WFD objective of Good Ecological Potential (GEP) and to meeting the emerging Core Strategy policies.

During the assessment stage, the EA provided further information on the following:

- Confirmation of the status (i.e. Main River or Ordinary Watercourse) of Corn Brook and Black Brook, their route and where these discharge into.
- Location and details of active discharge consents and abstraction licences within the study area for the last 5 years.
- Identification of any European designated (i.e. Salmonid or Cyprinid river) or non-designated commercial fisheries within the study area.
- Information on fish species for each watercourse, particularly where there are Annex II/BAP/Protected species.

- Details of recorded pollution incidents within the study area to controlled waters during the last 5 years (location, pollution source, category and receiving waters).

As part of the standalone FRA, the EA and MCC were consulted regarding available flood risk information. All correspondences have been included within the FRA which has been included within Appendix 6.2. In summary, the following information was made available:

EA
- Detailed flood map (1: 10 000);
- Flood levels taken from the River Medlock and Corn Brook 2008/09 Flood Risk Mapping commission;
- Modelling Node Map;
- Confirmation that the site is located within a Conurbation Critical Drainage Area (CDA);
- Confirmation of allowable runoff rates (50% of existing/brownfield rates);
- Comments on historic flooding; and
- Description of the 'hidden watercourse' i.e. Corn Brook, Black Brook and associated tributaries.

MCC
- No information was provided by MCC Planning Department as no information was held; and
- Level 2 SFRA (mapping includes; Flood Zoning, Flood Depths, Flood Hazard, Groundwater Flooding, Canal Hazards Zone, Reservoir Screening Map, CDA and Surface Water Flooding).

At this stage United Utilities (UU) have not been consulted to provide any information on the risk of flooding from sewers or reported DG5 incidents. A Pre-Development Enquiry should be submitted to United Utilities at the detailed design stage to obtain this information. UU sewer record plans were provided within the available Desktop Studies as referenced in Section 6.3.2.

6.2.3. Method

The assessment of the potential effects of the proposed scheme on water quality and water resources has been carried out using a methodology base broadly on the Highways Agency Volume 11, Section 3, Part 10 of the Design Manual for Roads and Bridges (DMRB) (henceforth referred to as HD45/09). This sets out a robust methodology capable of being applied to developments projects generally to determine the significance of residual effects based on the importance of the water receptors and the magnitude of effects. Effects can be adverse, beneficial or have no effect.

6.2.4. Assessment of Significance

The assessment of significance follows the guidance set out in HD45/09. In assessing the significance of potential impacts of the proposed development, three key factors have been taken into consideration:

- The likelihood of that effect occurring;
- The sensitivity and / or importance of the receiving environment; and
- The potential magnitude of effect.

The likelihood of an effect occurring is based on a scale of certain, likely or unlikely. The sensitivity / importance of the receiving environment (i.e. its ability to absorb an impact without perceptible change) is defined in Table 6.1

Table 6.1 Criteria to assess the importance water receptors

Importance	Criteria	Selected Examples
Very High	Attribute has a high quality and rarity on a regional or national scale	Classified as High Ecological Status / Potential under WFD; European Designated Salmonid fishery (or salmonid & cyprinid fishery); Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI, Ramsar site); Critical social or economic uses (water supply, navigation or mineral extraction); and Flood plain or defence protecting more than 100 residential properties from flooding.
High	Attribute has a high quality and rarity on a local scale	Classified as Good Ecological Status / Potential under WFD; European Designated Cyprinid Fishery; Aquatic species protected under EU or UK wildlife legislation (e.g. Great Created Newt); Important social and/or economic uses such as water supply, navigation or mineral extraction; and Flood plain or defence protecting between 1 and 100 residential premises from flooding.
Medium	Attribute has a medium quality and rarity on local scale	Classified as Moderate Ecological status/potential under WFD; Limited social or economic uses; and Flood plain or defence protection 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality and rarity on a local scale	Classified as Poor Ecological status / potential under WFD; Minimal economic or social uses; and Flood plain with limited constraints and a low probability of flooding of residential properties.

Source: Reproduced and amended from HD45/09 (Highways Agency, 2009)

The magnitude of a potential effect is described in Table 6.2.

6.2.5. FRA Method

The FRA was based on information gathered from:

The standalone West Gorton Neighbourhood Regeneration FRA produced by AECOM, and has been included within Appendix 6.2, The FRA has been written in conjunction with NPPF and has been used as a basis to complete the assessment of potential flood risk and drainage impacts.

In completing the standalone FRA, the following key sources of information were utilised:

- Site walkover;
- The local Strategic Flood Risk Assessment;
- An Envirocheck Flood Screening Report;
- United Utilities asset plans;
- Information provided by the Environment Agency and Manchester City Council during consultation;
- A review of the existing FRA and Desktop Studies (as listed in Section 6.3.2); and
- Indicative Masterplan Drawing.

Table 6.2 Criteria to assess the magnitude of the predicted effect on surface water receptors

Magnitude	Description	Examples
Major Adverse	Results in loss of attribute and / or quality and integrity of the attribute.	Loss of Protected Area; Pollution of potable sources of water abstraction; Deterioration of a water body leading to a failure to meet Good Ecological Status (GES) and reduction in Class; and Increase in peak flood level (1% annual probability) >100 millimetre (mm).
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Loss in production of fishery; Discharge of a polluting substance to a watercourse but insufficient to change its water quality status (WFD class) in the long term; If not already at GES, prevents improvement to meet GES or other WFD target if applicable; and Increase in peak flood level (1% annual probability) >50 mm.
Minor Adverse	Results in some measurable change in attributes quality or vulnerability.	Noticeable effect on features, or key attributes of features, on the Protected Areas Register; Measurable changes in attribute but of limited size and / or proportion, which does not lead to a reduction in WFD status or failure to improve; and Increase in peak flood level (1% annual probability) >10mm.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	No effect on features, or key attributes of features, on the Protected Areas Register; Discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity; No effect on WFD classification or water body target; and Negligible change in peak flood level (1% annual probability)<+/-10 mm.
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	Where the proposal provides an opportunity to enhance the water environment but does not result in an improvement in class, status, output or other quality indicator; and Reduction in peak flood level (1% annual probability) >10 mm.

Source: Adapted from HD45/09 (Highways Agency, 2009)

The significance of effects is determined using the matrix presented in Table 6.3.

Table 6.3 Assessment of Significance Matrix

Importance of Attribute	Magnitude of Effect				
		Major	Moderate	Minor	Negligible
	Very High	Very large	Large / very large	Moderate / large	Neutral
	High	Large / very large	Moderate / large	Slight / moderate	Neutral
	Medium	Large	Moderate	Slight	Neutral
	Low	Slight / moderate	Slight	Neutral	Neutral

Source: Amended from HD 45/09 Volume 11, Section 3, Part 10 Road Drainage and the Water Environment)

The magnitude of impacts have been assessed initially without taking mitigation measures and good practice construction techniques into account. Impacts that remain once mitigation measures are taken into consideration are residual impacts. Temporary impacts are considered in the construction period whilst permanent impacts are discussed in the operational phase, albeit that the effect may first occur during construction. Impacts of moderate adverse or worse are considered to be significant.

Using the above assessment criteria, some issues may be identified as being neutral in terms of their environmental impact. However, it should be noted that whilst they may be considered to be neutral they may still result in a breach of legislation. Under the Water Resources Act 1991 (as amended) it is an offence to make polluting discharge into a controlled water. As such, controls shall be required to prevent the entry of substances to surface waters.

6.3. Baseline Conditions

This Section sets out the environmental baseline conditions.

6.3.1. Study Area

The proposed development site is located in East Manchester (see Figure 1.1). The topography of the area is generally flat gently sloping down towards the west of the site.

The study area considered for this assessment includes the development site and the surrounding area within 500 m of the site. (Please refer to Figure 6.1). Consideration might have been given to a wider study area when considered appropriate (e.g. polluting substances might propagate downstream to major watercourses where key surface watercourses discharge into).

6.3.2. Sources of information

A desk study was undertaken to identify key surface water features from Ordnance Survey (OS) mapping within 500 m of the development area and to establish a baseline to inform the identification of potential flood risks. The desk based review was carried out based on the information from the following available sources:

- EA website (http://www.environment-agency.gov.uk/);
- North West RBMP (EA, 2009);
- Scheme proposals (including Figure 2.1 Development Parameters, Figure 2.2 Phasing Principles, and Figure 2.3 Indicative Masterplan);
- OS mapping;
- Information provided by the EA and MCC during consultation (Included in FRA; in Appendix 6.2);
- UU Public Sewer Records;
- EA On-line Flood Maps, Risk of Flooding from Reservoirs Maps, Flood Warning Areas Maps;
- Site walkover undertaken as part of the FRA;
- Envirocheck Reports and Geology Maps (sourced from the previously produced FRAs and Desktop Studies listed below);
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA; and
- The following FRAs produced to support detailed planning applications for individual plots:
  - Bennet Street, Ardwick – FRA; White Young Green; March 2008;
  - Guiness Northern Counties – FRA- NAHP Housing – Plot 7.2 (Keepmoat) & Carisbrooke; West Gorton, Manchester; Atkinson Peck; July 2010;
  - Manchester City Councils - FRA- Affordable Housing – Plot 2 (formerly Plots 15-17), West Gorton, Manchester; Atkinson Peck; July 2010; and
  - Manchester City Councils - FRA- Affordable Housing – Plot 8 (formerly Plots 8B/32B), West Gorton, Manchester; Atkinson Peck; July 2010.
- The following Desktop Studies produced to support detailed planning applications for individual plots:
  - Atkinson Peck - Phase 1 Desktop Study: Plot-A, West Gorton, Manchester;
  - Atkinson Peck - Phase 1 Desktop Study: Plot-B, West Gorton, Manchester;
  - Atkinson Peck - Phase 1 Desktop Study: Plot-C, West Gorton, Manchester;
  - Atkinson Peck - Phase 1 Desktop Study: Plot-D-Hub E, West Gorton, Manchester;
  - Atkinson Peck - Phase 1 Desktop Study: Plot-F-G-H, West Gorton, Manchester;
  - Atkinson Peck - Phase 1 Desktop Study: Plot I, West Gorton, Manchester;
  - Atkinson Peck - Phase 1 Desktop Study: Plot J-K, West Gorton, Manchester; and

- Atkinson Peck - Phase 1 Desktop Study: Plot L, West Gorton, Manchester.

Consultation with relevant bodies was undertaken to obtain additional information (refer to Section 6.2.2) and a site walkover was undertaken on 27th July 2011 to confirm the location and current condition of Corn Brook before it is culverted underneath the development site.

6.3.3. Surface Water Baseline

There are no natural open surface water bodies on the site. Corn Brook enters a culvert at the A6010 east of the site and flows in a westerly direction beneath the proposed development (see Figure 6.1). A second culverted watercourse (Black Brook) flows into the north west of the study area, passing beneath the railway line on the northern boundary before joining into Corn Brook within the Quinn / Container plot before crossing the railway line on the eastern boundary (Please see Figure 6.1). According to the EA, Corn Brook is culverted until it discharges into the Manchester Ship Canal at Pomona Docks (approximately 5 km west of the proposed development). It is considered that Manchester Ship Canal is too far from the proposed development to be affected by any pollutants that may propagate downstream Corn Brook and/or Black Brook. Therefore, the Manchester Ship Canal will not be considered any further in this assessment.

No other surface water features have been identified within the study area.

Surface Water Quality

The WFD has replaced the existing methods of monitoring riverine water quality and has introduced a holistic approach with greater emphasis on ecological status as a broader indicator of river health. The ecological status of all watercourses within England and Wales has been presented within a series of RBMPs that have been prepared for each of the River Basin Districts (RBDs). The watercourses within the study area are within the North West RBD. Table 6.4 presents the available watercourse classification under the WFD for the Corn Brook, which is considered part of River Medlock classification (Lumb Brook to Irwell stretch). Although this classification has been used to determine the sensitivity of Corn Book, consultation with the EA, review of the *Strategic Flood Risk Assessment Manchester Salford and Trafford* (March 2011) and other available online sources, suggest that Corn Brook is not linked to River Medlock.

Table 6.4 Water Framework Directive Classifications

Watercourse	Hydro - morphological Status	Current Ecological Potential	Current Chemical Quality	Predicted 2015 ecological potential	Overall Risk	Protected areas
River Medlock (Lumb Brook to Irwell stretch) GB112069061152	Heavily modified (due to flood protection and urbanisation)	Poor Potential (due to invertebrates, phytobenthos and phosphate)	Assessment not required	Poor Potential (Good by 2027)	At risk	Fish (Consolidated) Directive Nitrates Directive

(Source: North West RBMP, amended 2011)

River Medlock is a Heavily Modified Waterbody (HMWB) due to flood protection and urbanisation. It is currently classified under the WFD as at Poor Ecological Potential due to invertebrates, phytobenthos and phosphates. It is unlikely that this watercourse will achieve its Good Potential before 2027 because it is considered that implementing the mitigation measures is disproportionately expensive and technically unfeasible.

During the site visit undertaken, a visual inspection of Corn Brook where it enters the culvert just outside the development boundary was undertaken. At this location the watercourse is approximately 2 m wide, canalised with vertical brick walk and an outfall of unknown origin discharging into it. At the time of the visit the flow was very slow. Coloured water was observed with high turbidity, surface scum and leaf material/debris present. A debris barrier exists to prevent large material from entering the culvert.

No other water quality information is available for Corn Brook and Black Brook.

Protected Areas and Fisheries
The River Medlock from the A62 (more than 6 km upstream the development site) tothe River Irwell (more than 4 km downstream the site) is a designated Cyprinid river under the Fish (Consolidated) Directive. The Fish (Consolidated) Directive sets out the imperative and guideline standards for freshwater water bodies. This watercourse is currently failing both its guideline and imperative standards.

The EA has no knowledge of fish in Black Brook and Corn Brook, and only minor species may be present (e.g. stickleback).

Water Resources (Abstractions, Discharge Consents and Pollution Incidents)

The EA have confirmed that there are no abstraction licences within the study area study area (i.e. 500 m of the site and / or 1 km downstream the site).

There are 5 discharge consents within the study area. These are sewage discharges to the sewage network. More information is presented in Table 6.3A in Appendix 6.3 and Figure 6.1.

The EA have also provided details of pollution incidents to the water environment as recorded on their National Incident Recording System (NIRS). During the past 5 years there have been 6 pollution incidents of at least Category 3 (minor). They have been caused by unauthorised disposal of oils and fuel, vehicles and vehicle parts, a road traffic accident, and non identified sources and pollutants. Further information is shown in Table 6.3B in Appendix 6.3 and Figure 6.1. No pollution incidents of either Category 1 (major) or 2 (significant) were recorded within the study area.

Future Baseline
The WFD will be implemented across three six year cycles up until 2027. The current classification of water bodies estimates that Corn Brook (being part of River Medlock's WFD classification) is unlikely to achieve Good Ecological Potential until 2027 due to ammonia, phosphates invertebrates and phytobenthos. The assessment has taken into account WFD programme of measures for these waterbodies to ensure that the scheme is compatible with the WFD (by not preventing WFD objectives being met and by not causing deterioration in water quality).

General improvements to the regulations of discharges, linked to the enforcement of the WFD, as well as continued action to control new developments so that they do not have an adverse effect on the surface water environment through national, regional and local planning policies, should lead to a general improvement in water quality of the surface water environment.

The existing sewer network within the site largely comprises a combined sewer network where not CSOs have been identified. Separate foul and surface water sewers will be incorporated as part of the proposed development. The replacement of combined sewers will provide opportunities for improvement of the water quality in line with the requirements of the WFD.

Importance of Water Features and Attributes
The importance of the relevant surface water features has been assessed applying the criteria presented in Table 6.1 to the baseline information presented throughout this Section. The level of importance for each water receptor and the justification for their classification is compiled in Table 6.5:

Table 6.5 Importance of Surface Water Features

Surface Water Feature	Reason	Importance
Corn Brook	Corn Brook (Ordinary Watercourse) has been classified under the WFD as being part of the River Medlock and hence is currently at Poor Ecological Potential. During the site visit, it has been found to have very low amenity or ecological value. Based on visual inspection and professional judgement the water quality of this watercourse before it is culverted underneath the site, appears to be very poor.	**Low**
Black Brook	There is no water quality data or environmental information for this Ordinary Watercourse. As it discharges into Corn Brook the same level of importance has been given to this watercourse.	**Low**

6.3.4. Flood Risk Baseline

Flooding from the Sea (Tidal)
The site is not located near the sea or any tidally influenced watercourse. The risk to the existing site from tidal flooding is therefore considered to be negligible, and the proposed development should not impact on tidal flood risk. Tidal flood risk has therefore not been considered further in this assessment.

Fluvial Flooding
There are no Main Rivers located within the boundary of the site or within the general vicinity of the site.

It is understood that Corn Brook and Black Brook (both Ordinary watercourses) flow beneath the Site within a culvert (See Figure 6.1). The EA online Flood Map (see FRA in Appendix 6.2) shows that there is a significant area of the site located within Flood Zones 2 and 3 (sourced from these Ordinary Watercourses), indicating a medium to high risk of fluvial flooding in these areas.

On the SFRA Flood Map (see FRA in Appendix 6.2), the extent of Flood Zone 3 is shown to be largely Flood Zone 3a. However, a small area of Flood Zone 3b (functional floodplain) exists within the Site towards the western boundary of the site. Based on the fact that the watercourses are culverted, it is not expected that the areas shown to be Flood Zone 3b to be actual functioning flood plain and as such this report will be based on the Environment Agency online Flood Map and the Detailed Flood Map acquired through consultation. As such, it is believed that the area of the Site shown to be in Flood Zone 3 is considered to be Flood Zone 3a and not Flood Zone 3b. This is based on the fact that the Site has previously been developed.

The SFRA flood depth mapping (see FRA in Appendix 6.2) shows that the flood depths within the site are considered to be between <0.5 to 1.5m in depth for the 1 in 100 year event, which presents a ‘flood hazard’ (see SFRA flood hazard mapping included within the FRA in Appendix 6.2) is considered to be between ‘Very Low Hazard’ to ‘Dangerous for Most’. The 1 in 1000 year event flood depth map shows an onsite flood water depth of >2m.

It should be noted that the EA online Flood Maps do not represent the projected effects of climate change, which is likely to increase the flood extents. Included within the SFRA are the flooding extent maps for the 1 in 100 and 1 in 1000 year event with climate change (i.e.an additional +20% in flow). As such the flooding extent and flood depths increase throughout the site and during the 1 in 1000 year event and the flood hazard within the site becomes largely ‘dangerous for most’ to ‘dangerous for all’.

Based on the above, the risk of fluvial flooding to the site from Main Rivers is considered to be low and has therefore not been considered further in this assessment. However, the risk of flooding to the site from Ordinary Watercourses (Corn Brook and Black Brook) is considered to be high.

Groundwater Flooding
The SFRA Groundwater Flood map (see FRA in Appendix 6.2) found that the site is located entirely outside the areas of groundwater flooding within the Manchester area.

In comparison to the above, the British Geological Survey (BGS) mapping (see FRA in Appendix 6.2) shows that the site is located above a major aquifer. The BGS groundwater-flooding map (see FRA in Appendix 6.2) shows that a large proportion of the site has a negligible to high susceptibility to groundwater flooding based on these parameters. Based on the above, the risk of flooding to the site could be considered to be at high risk of groundwater flooding. However, the Site is almost entirely impermeable. It is therefore considered that the existing site would most likely be at low risk of groundwater flooding and that the proposed development should have no impact on the risk of flooding from groundwater. This is because groundwater flooding is when groundwater levels rise above ground levels, therefore development would not have a negative impact on groundwater flooding occurring, and that impermeable surfaces would prevent groundwater flooding from occurring. The risk of flooding from groundwater has therefore not been considered further in this assessment.

Flooding from Overland Flow (Pluvial Flooding)
The Risk Management Solutions (RMS) flood maps within the Envirocheck Reports (see FRA in Appendix 6.2) show that a large proportion of the site will be susceptible to pluvial flooding during 75, 100 and 1000 year return period events. A small area to the east of the site is shown to remain unaffected during any of the above events. The susceptibility to surface water flooding maps within the SFRA (see FRA in Appendix 6.2) for the existing and future scenarios also suggest significant susceptibility to surface water flooding along a number of the roads in the vicinity of the Site. Most notably there is significant susceptibility to flooding along Pottery Lane (A6010) on the east of the area, both to the south of Wenlock Way and to the north around the Ambrose Street / Gorton Road junction. A further location of significant susceptibility to surface water flooding is the west of the Site, to the east of the railway line. This is understood to be around the location of the Corn Brook, which is culverted beneath the area.

Based on the above, the risk of pluvial flooding to the site is considered to be high.

Land Drainage Flooding
As the site and surrounding area is largely urbanised, the likelihood of land drainage being present is considered low. No records of land drains or flooding from any land drains within the Site or in its vicinity have been identified as part of the investigation. The risk of flooding to the site from land drainage is therefore considered to be low and acceptable, and the proposed development should have no adverse impact on land drainage flood risk. The risk of flooding from land drainage has therefore not been considered further in this assessment.

Flooding from Artificial Sources
Based on the online EA online Risk of Flooding from Reservoir Map (see FRA in Appendix 6.2), in the event of a breach, it can be seen that there is a significant risk to the site from reservoir flooding if this were to occur. With reference to the EA maps and the SFRA maps it can be seen that there are five UU's reservoirs approximately 5 km east of the Site to which this risk is attributed.

Such reservoirs are controlled under the Reservoir Act 1975, and as such are subject to periodic inspection and maintenance by appropriately qualified and approved personnel. Therefore, although the consequences of a reservoir failure may have a significant impact, the likelihood of such an event is considered extremely low. Furthermore, the reservoir is located 5 km east from the development, by which time any flood water energy and depth would likely to have dissipated in terms of energy and depth before it reached those plots affected.

A review of the SFRA Canal Hazard Zone Map (see FRA in Appendix 6.2) shows that the entire site is located outside the canal breach zones and no further assessment is needed.

No further artificial waterbodies have been identified in the vicinity of the site. From the above it is concluded that the risk of flooding from artificial sources is low and acceptable, and the proposed development should have no adverse impact on flood risk from artificial waterbodies. The risk of flooding from artificial sources has therefore not been considered further in this assessment.

Flooding from Sewers (Public and Private)
UU public sewer records for the area (see FRA in Appendix 6.2) show there to be a network of combined public sewers located within and around the site. At this stage UU's have not been consulted to provide any information on the risk of flooding from

sewers or reported DG5 incidents. A Pre-Development Enquiry should be submitted to UU at the detailed design stage to obtain this information.
UU are responsible for maintaining their assets, so the probability of a public sewer failing is considered low. The consequence of a public and private sewer failing, and flooding occurring as a result, is also considered low. This low consequence of flooding is based on the shallow depth of flooding that would be experienced as any flood water would spread out over the site and surrounding area. It is anticipated that all new foul and surface water sewerage should be designed in accordance with Building Regulations Part H and Sewers for Adoption (6th Edition) where sewers are to be adopted by UU.

Based on the above, the risk of flooding to the proposed development from both private and public sewer is therefore considered to be low and acceptable.

Future Baseline - Climate Change
In keeping with the now superseded PPS25, NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are summarised in Table 6.6 below.

Table 6.6 Climate Change Allowances (Extract from NPPF, Table 5)

Parameter / Horizon	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

In accordance with EA policy and the expected lifetime of the proposed development (100 years), the drainage system for the development must be designed to account for +30% increase in rainfall intensity, over its lifetime. The development must also be designed to account for a +20% increase in peak river flow (i.e. within Corn Brook and Black Brook).

6.4. Identification of Effects

This section presents the assessment of the potential effects of the proposed development (both during construction and occupation) on the surface water environment as required by NPPF (which supersedes PPS23 and PPS25) and to satisfy regional and local planning policies. Groundwater effects have been considered in Chapter 5 Ground Conditions.

6.4.1. Construction Phase

Construction activities will include the demolition of some existing buildings, earthworks to create development platforms and to raise floor levels in the area of the existing container terminal to comply with flood protection requirements for proposed development in that area. Residential properties (houses and flats) will be constructed together with landscaped areas, public open space and local services.

Surface Water
During construction the following effects on the surface water environment could occur if appropriate good practice and mitigation measures are not put in place:

- Water pollution from silt-laden runoff if allowed to drain into watercourses untreated;
- Chemical / fuel spillages and leaks from plant and machinery, and from chemicals and other pollutants substances (e.g. cement, paints, etc.) used / stored on site; and
- Inappropriate disposal of foul water from construction site.

Although there are no open natural water bodies on the site, there remains the possibility that contaminated runoff and chemicals / fuels could pollute Corn Brook and Black Brook by draining into surface water drains that then connect with these brooks.

Silt-laden runoff is generated when fine sediments normally occurring during construction activities are washed out by water used on site or heavy rainfall. This effect is more severe when vegetation has been removed and ground has been compacted. If allowed to drain into the culverted watercourses without appropriate treatment, silt-laden runoff can cause pollution. According to the topography of the area (gently sloping to the western site boundary), only the northern plots of the scheme will naturally drain towards Corn Brook or Black Brook. In addition, to account for the flood risk, it will be necessary to raise the ground level in this location by approximately 1 to 1.5 m and the earthworks that will be required are likely to increase the risk from silt-laden runoff in this location. High levels of suspended solids in watercourses can have a number of direct effects on animals (e.g. blocking fish gills) but also can adversely affect animals, insects and plants by removing essential oxygen from water and preventing sunlight reaching them (although this may not of particular significance in culverted watercourses). However, although it is an offence under the water Resources Act 1991 (as amended) to pollute controlled waters, it should be acknowledged that within the culvert these brooks will only have a very limited biodiversity and relatively poor water quality. It is anticipated that the unmitigated magnitude of effect on Corn Brook and Black Brook is **Moderate Adverse**.

During construction, fuel, hydraulic fluids, solvents, paints, concrete and detergents and other potentially polluting substances will be stored and/or used on site. Leaks and spillages of these substances could pollute the culverted watercourses within the site, if these are not managed accordingly. To allow such substances to enter a watercourse would be in breach of the Water Resources Act 1991. It is predicted that an effect of **Moderate Adverse** magnitude will occur on the Corn Brook and Black Brook if mitigation measures are not implemented.

Foul water drainage from the construction site will be connected to the nearest public sewer. If this is not possible, portable toilets, etc. will be used. These will be regularly emptied by an appropriate contractor and disposed off at a suitable facility off-site. Construction site foul water will not be discharged into a watercourse under any circumstances. Therefore, the magnitude of this potential impact is considered to be **Negligible** for all watercourses within the study area.

Flood Risk

During construction the following effects could occur if appropriate good practice and mitigation measures are not put in place:

- Flooding on site due to restriction of flow by mud / debris entering the surface water drainage system;
- Risk of flooding due to temporary increases in impermeable area; and
- Flooding due to damage of water mains or sewers.

These impacts on the different sources of flooding are discussed in detail below.

Fluvial Flooding

There is the potential for the construction of the proposed development to impact on flooding from the culverted Ordinary Watercourses (Corn Brook and Black Brook). For example, the construction process and excavation activities could break through into the culvert or potentially collapse the culverts. Furthermore, the construction phase could impact upon the floodplains of these watercourses and reduce their floodwater storage capacity.

During the construction phase there is the potential for mud and debris arising from the construction works to enter the culverted watercourses, causing blockages and restricting the flow. This could result in on-site and off-site flooding, especially after heavy or prolonged rainfall. This is considered to present a potential risk of flooding to the study area as the site is located in the Conurbation Core CDA, meaning that any problems with the culverted watercourses could impact upon the surface water drainage systems, and in turn result in a flood risk to people or property.

Based on the above, the impact of the construction phase on fluvial flooding sourced from Ordinary Watercourses is considered to be **Moderate Adverse**.

Flooding from Overland Flow (Pluvial Flooding)

The construction of the proposed development could potentially change pluvial flow routing within the study area, which could potentially increase the risk of pluvial flooding on the site. Although the existing Site is almost entirely impermeable and would not be increased during construction, the phased development of the Site may impact upon the existing drainage of the impermeable

surface areas within the Site (as it would be assumed the combined system will be replaced by a separate foul and surface water system), causing localised flooding. Based on the urban / brownfield nature of the existing Site, the impact on pluvial flooding is considered to be **Moderate Adverse** during construction.

Flooding from Sewers (Public and Private Sewers)
The construction process could potentially lead to a risk of on-site and off-site flooding if impermeable areas are temporarily increased without mitigation measures in place. Temporary hard standing or compacted soil could result in rapid surface water runoff to local drainage system or increase overland flow. The removal of existing drainage, or rendering it temporarily inoperable during construction could also lead to an increase in runoff, especially during heavy or prolonged rainfall.

There are a number of water mains, public sewers and private sewers within the study area. These may be encountered during excavation for construction or may require diversion as part of the proposals. If the construction process does not adequately take into account the location of existing water mains and sewers, there could be a risk of flooding from water mains and sewers from unintentional damage during construction.

During the construction phase there is the potential for mud and debris arising from the construction works to enter the surface water drainage system, causing blockages and restricting the flow. This could result in localised on-site flooding, especially after heavy or prolonged rainfall. This is considered to present a potential moderate adverse impact of flooding to the study area as the site is located in the Conurbation Core CDA, meaning that any problems with the surface water drainage systems could result in a flood risk to people or property. The impact of this would be **Moderate Adverse**.

Flooding from Foul Drainage
Foul water services will need to be provided during the construction of proposed development.

The preferred option is to connect foul water services to the nearest public sewer. Based on the proximity of the existing public sewers to the site, it is likely that onsite facilities (i.e. toilets and washrooms) will be able to discharge to the public sewer. If these services are not maintained appropriately there is the potential for foul water flooding to occur. Based on the urban / brownfield nature of the existing Site, and the temporary nature of the risk, the potential impact on foul water flooding is considered to be **Negligibl**e in the short term.

6.4.2. Occupation Phase
Surface Water
During occupation the following effects could occur on the surface water environment if appropriate mitigation is not implemented:

- Increased highway and diffuse urban pollution if allowed to enter watercourses untreated;
- Spillages (including CSO);
- Increased demand of potable water supplies; and
- Increased demand of waste water treatment.

Across the development site, surface water runoff from impermeable areas such as roofs of buildings, hard standing and road surfaces may transport small quantities of chemical pollutants (e.g. oils and heavy metals from vehicles using the site, detergents, herbicides, etc.), organic matter, animal faeces (containing nutrients and pathogenic bacteria), inert particles (dust/silt) and litter into the surface water drainage system. In addition, there is potential for increased runoff entering combined sewers which could affect the number of spills to watercourses via Combined Sewer Overflows (CSOs).

A significant increase in traffic flows can potentially increase the loading of highway runoff discharges with dissolved and sediment bound pollutants, which can be detrimental to water quality and have secondary adverse impacts on aquatic fauna and flora. In addition, an increase in traffic flows can also increase the risk that a traffic accidents leads to a serious pollution incident which could cause significant temporary acute adverse impacts on a receiving water body.

By 2022, it is predicted that traffic flows along all surrounding road network will increase by up to 6.3% (i.e. increase from 3,420 AADT do-minimum scenario to 3,634 AADT do-something scenario along Bennett Street). However, this is not believed to be a

significant increase as increases in traffic flows are not considered to be significant if below 20%, which is a threshold referenced for screening new development by HD45/09 (P6/2). Therefore no significant increases are predicted for the opening year and hence traffic flows are unlikely to give rise to significant increase in pollutant concentration in runoff. However, as a number of roads will accommodate relatively high volumes of traffic ranging from 30,624 along Alan Turin Way to 11,020 along Gorton Lane consideration has been given to the possibility of affecting water quality (generally water quality impacts from roads are not significant until at least 10,000 24h 2 way AADT). It is predicted that Hyde Road, between Bennett Street and Devonshire Road North and west of junction with Devonshire Street North, will accommodate the highest proportion of HGVs (6.2% and 6.6%).

It is not known whether runoff from the road network drains to any of the watercourses within the study area, but if it does the pollutant loading is not expected to be increased by the proposals.

The use of SUDS has been considered and incorporated into the indicative masterplan (refer Figure 2.3) design where practicable to attenuate flow, to protect and enhance water quality as well as to provide amenity value. The scheme proposals include locations within the site where there is space available for swales, ponds and bioretention features and pervious pavements.

Therefore, it is predicted that the unmitigated effect of highway and diffuse urban pollutionwill be of **Minor Adverse** magnitude for Corn Brook/Black Brook. The incorporation of SuDS elements within the development site has been taken into consideration in the assessment of unmitigated effects.

Likewise, if surface water runoff from the site is attenuated or separate foul and surface water sewers are provided, the number of spills could be reduced. Where buildings are to be demolished and new houses are proposed, there is potential for installation of separate surface and foul water drainage system that will replace the existing combined sewer network. Therefore, this asset improvement across the development site can potentially limit the number of spills into watercourses and thus minimising the adverse effect on the surface water environment. Therefore, it is predicted that a **Negligible** effect will occur as a result of spillages from road traffic accidents and CSOs.

The proposed scheme could potentially increase the demand for water resources at a local level, including potable and foul water, as a net increase of 126 residential properties is proposed. The proposed development is committed to achieve a minimum of a three star sustainability rating under the Code of Sustainable Homes standard (which requires a maximum water consumption of 105 litres per person per day), in line with Manchester City Council's Guide to Development. However, taking into account the fact that new homes will incorporate water saving measures to achieve the required standards, the increase in demand (if any) is not likely to be significant at a local scale and an effect of **Negligible** magnitude is expected. This aim to minimise water consumption is in line with the Water Resource Management Plan (UU, 2009) covering the Integrated Resource Zone where the proposed development site is located. The water resources and demand strategy set out in the plan states that water supply reliability will be maintained by ensuring sustainable water abstraction by demand reduction and supply enhancement. UU will confirm at detail design stage that adequate water resources are available for the proposed development.

Flood Risk

During occupation the following effects could occur if appropriate mitigation is not implemented:

- Potential flood risk from local culverted watercourses; and
- Potential risk of increasing flood risk elsewhere due to changes in drainage regime and increased impermeable areas.

These impacts on the different sources of flooding are discussed in detail below:

Fluvial Flooding

There is the potential for the occupation of the proposed development to affect the identified Ordinary Watercourses (Corn Brook and Black Brook) and subsequently flood risk. For example, the proposed development could impact upon the floodplain of the watercourses (i.e. loss of floodplain in comparison to previous development) or inundate the watercourse / culvert capacity with surface water runoff from the new development.

Without mitigation, the impacts of the occupation phase on fluvial flooding from Ordinary Watercourses could potentially be **Moderate Adverse.**

Flooding from Overland Flow (Pluvial Flooding)
The proposed development could potentially change pluvial flow routing in the study area, which could potentially increase the risk of pluvial flooding occurring if an appropriate drainage strategy is not implemented. Assuming an appropriate drainage strategy is not implemented, the effect would be **Moderate Adverse.**

Flooding from Sewers (Public and Private Sewers)
The proposed development will create both foul and surface water flows from the site, which will be discharged to the public sewer network rather than to private sewer. This could potentially increase the risk of flooding from public sewers, if an appropriate drainage strategy is not implemented for the proposed development. Assuming an appropriate drainage strategy is not implemented, the effect would be **Moderate Adverse.**

6.5. Mitigation

This Section summarises the proposed mitigation measures to be implemented during construction and occupation.

6.5.1. Construction Phase

Procedures and mitigation measures to be adopted during the construction phase of reserved matters applications will be documented in a Construction Environmental Management Plan (CEMP). Construction work will require a number of separate consents and licences from the EA, which are in part required to prevent adverse effects on the water environment. These include:

- The discharge of trade effluent (including treated site runoff) into a controlled water will require a Water Activity Permit under the Water Resources Act 1991 and the Environmental Permitting Regulations 2010; and
- Land Drainage Consent from the EA under Section 23 of the Land Drainage Act 1991 until the powers are transferred to the Flood Defence Consents under the Flood and Water Management Act 2010 for any works to divert culverted watercourses from the Lead Local Flood Authority (LLFA)

Following consultation with the EA, it was recommended that an easement was provided around the Ordinary Watercourses, that is in keeping with Main Rivers consent, i.e. an 8 m easement.
It is an offence under Section 85 of the Water Resources Act 1991 to cause or knowingly permit pollution of controlled waters. Controlled waters include all watercourses (drainage ditches, streams, and rivers), canals, lakes, estuaries and groundwater. The Water Resources Act (as amended by the Environmental Permitting Regulations (England and Wales), 2010) also makes provision for the consenting (by the EA) of discharges of potentially polluting substances and the licensing of water abstractions (amended by the Water Act 2003).

Applications for appropriate permits as described above will be made following detailed design. All consents and licences will be in place prior to commencement of any works. The works will be carried out in accordance with any conditions imposed by these consents and licences.

Appropriate measures to prevent pollution of the water environment will be required during construction work and should be referred by the CEMP. Good practice guidance is set out by the following documents:

- CIRIA Report 697 (2007) The SuDS Manual;
- CIRIA Report 650 (2005) Environmental Good Practice on site;
- CIRIA Report 532 (2001) Control of Water Pollution from Construction Sites;
- EA (2004) Getting Your Site Right: Industrial and Commercial Pollution Prevention; and
- EA Pollution Prevention Guidelines (PPGs), the most relevant being:
  - PPG 1 – General Guide to the Prevention of Pollution (no date);
  - PPG 2 – Above Ground Oil Storage Tanks (August 2011);
  - PPG 3 – Use and Design of Oil Separators in Surface Water Drainage Systems (April 2006);
  - PPG 5 – Works or Maintenance in, or Near Watercourses (October 2007);

- PPG 6 – Working at Construction and Demolition Sites (no date);
- PPG 7 – Refuelling Facilities (August 2004);
- PPG 8 – Safe Storage and Disposal of Used Oils (February 2004);
- PPG 13 – Vehicle Washing and Cleaning (July 2007);
- PPG 18 – Managing Fire Water and Major Spillages (no date);
- PPG 21 – Pollution Incidence Response Planning (February 2004); and
- PPG 22 – Dealing with Spills (no date).

The site is not considered to be a high risk for the generation of silt laden runoff due to the nature of the ground conditions, the urban nature of the site, and the lack of nearby sensitive watercourses. However, in keeping with good practice it is recommended that measures are incorporated into the CEMPs for any construction to minimise the creation of silty laden runoff, prevent its movement across the surface if the site and potentially into drains leading to culverted watercourses, and to provide treatment as required prior to consented discharge to a watercourse or sewer. The following typical measures are suggested, although this list is not exhaustive and site specific proposals should be development. In addition to the above, a Silt Management Plan will be produced which will include:

- Works that are likely to generate silt-laden runoff (e.g. earthworks and excavations) will be undertaken preferentially during the drier months of the year;
- Site compounds and stockpiles will be located away from surface water drains;
- The drainage system will be developed to prevent silt-laden runoff from entering surface water drains without treatment (e.g. earth bunds, silt fences, straw bales, or proprietary treatment) under any circumstances;
- Earth stockpiles will be seeded as soon as possible, covered with geotextile mats or surrounding by a bund;
- Mud will be controlled at entry and exits to the site using wheel washes and/or road sweepers;
- Tools and plant to be washed out and cleaned in designated areas within the site compound where runoff can be isolated for treatment before discharge to watercourse/ground or sewer under appropriate consent;
- Debris and other material will be prevented from entering watercourses;
- Construction SUDS to be used during construction if necessary; and
- Discharges to watercourses will only be carried out if a consent from the EA is in place.

In order to minimise the risk of spillages resulting in a serious pollution incident, a Storage and Spillage Emergency Response Plan should be in place:

- Fuel and other potentially polluting chemicals will be stored in a secure impermeable and bunded storage area (minimum capacity 110%);
- Refuelling of plant will take place in a designated area at the site compound only;
- Maintenance of vehicles will take place at designated areas in the site compound;
- Fixed plant will be self bunded;
- Mobile plant will be in good working order, kept clean and fitted with drip trays where appropriate;
- Spillage kits and oil absorbent material will be carried by mobile plant;
- The site will be secured to prevent vandalism that could lead to a pollution incident;
- Designated concrete wash out areas will be constructed in accordance with good practice guidance and will be clearly identified and used;
- Construction workers will be trained to respond to spillages;
- An Emergency Response Plan will be prepared; and
- Construction waste / debris will to be prevented from entering any water body.

Based on the construction phase impacts outlined within Section 6.4.2, mitigation options relating to each source of flooding is discussed below.

Fluvial Flooding
The construction process should take the location of culverted Ordinary Watercourses into account, and it should be ensured that the construction process does not adversely impact these culvert structures.

The impact of the construction process on the Ordinary Watercourses and associated floodplains should be mitigated as far as practically possible. While it may not be possible to prohibit construction work within the vicinity of the culverted watercourses or their associated floodplains (should this occur it would be temporary and short term) it is possible to monitor and limit construction work carried out within the associated floodplains. Furthermore, construction equipment and materials should not be stored within close proximity to the Ordinary Watercourses on the site should a flooding event occur.

Flooding from Overland Flow (Pluvial Flooding)
It is recommended that the impact of construction on pluvial flow routing is considered further during construction. If pluvial flow is assessed to be having a significantly adverse affect then installing a temporary appropriate drainage system may be necessary. It is noted that the temporary drainage system will be needed to manage surface water runoff from a quantity and quality perspective.

Installing a temporary appropriate drainage system should mitigate any adverse impacts, and could possibly be provided in the form of a simple ditch drainage system discharging or pumping to the Ordinary Watercourses (Corn Brook and Black Brook) within the site.

Flooding from Sewers (Public and Private Sewers)
The construction process should take the location of existing public and private sewers into account, and it should be ensured that the construction process does not adversely impact on these assets. This should ensure that there is no risk of flooding from sewers during the construction phase.

While it may not be possible to prohibit construction work within the vicinity of the existing drainage system (should this occur it would be temporary and short term) it is possible to monitor and limit construction work carried out.

It is noted that the existing drainage system would be replaced by a separate foul and surface water system. However, development will be phased, and during construction there is the risk that the existing sewers may surcharge and flood the Site. Therefore, during construction phase, equipment and materials etc should not be stored within close proximity to the existing drainage network within the site.

Flooding from Foul Drainage
The foul water services provided during construction should be maintained to ensure appropriate disposal. This should ensure that there is no foul discharge to watercourse and that there is no risk of foul water flooding during construction.

6.5.2. Occupation Phase
The proposed Masterplan proposals have taken into account statutory requirements and good practice to ensure its compatibility with local, regional and national policy. Planning policy relevant to the development site requires that pollution of watercourses is avoided and that enhancement of watercourses is promoted. The assessment undertaken has been an iterative process with the development of the proposed masterplan and has sought to influence the design so that it is environmentally sympathetic. This has included the consideration of water quality and flood risk issues through the design layout of the north-westerly plot where an easement of 8 m has been provided for the culverted watercourses flowing underneath the site at this location.

During the occupation of the site highway and urban diffuse pollution could have adverse impacts on receiving watercourses. The use of SUDS has been considered and incorporated into the indicative masterplan (Please see Figure 2.3) design where practicable to attenuate flow, to protect and enhance water quality as well as to provide amenity value. The scheme proposals include space within the site to accommodate SUDS, which might include different techniques such as swales within areas of open space, ponds and bioretention features (i.e. underdrained and enhanced vegetation and filtration) in combination with pervious pavements along some landscaped streets which can provide attenuation and treatment. Specific SUDS techniques will be determined at reserved matters applications. Providing SUDS features are well maintained no further mitigation should be required. It should be noted that the provision of SUDS will be redefined at detail design stage.

The occupation of the site will also lead to a local increase in the demand for water supply and foul water treatment. The proposed development will achieve a minimum of a three star sustainability rating under the Code of Sustainable Homes standard, in line with Manchester City Council's Guide to Development. The three star sustainability ranking requires a maximum water consumption of 105 litres per person per day. To offset the increased demand for water supply and achieve that standard, the scheme will investigate options for water conservation measures to minimise water demand and wastewater treatment.

The enhancement of the culverted watercourses, which would help to achieve the GEP of Corn Brook (currently classified at Poor Potential) and to be compliant with the emerging Core Strategy policies in relation to opening culverts, has been considered. However, it is has been considered that the costs associated with opening stretches of the culverted watercourses are not only disproportionately expensive but technically unfeasible at particular location and thus this is not considered appropriate for this particular development.

All surface water discharges from the development will require attenuation in accordance with the requirements of the SFRA for the Conurbation Core CDA, and this attenuation will include consideration of the projected increase in rainfall due to climate change.

Recommended mitigation for fluvial flood risk across the site will depend upon the determined level of food risk in each area of the site from difference sources, following further assessment. Mitigation measures during the occupational phase are discussed below in relation to each source of flood risk.

Fluvial Flooding
Based on the indicative masterplan (Please refer to Figure 2.3) an 8 m buffer zone can ben provided around the vicinity of the culverted Ordinary Watercourses. In addition to these buffer zones, routine inspection and maintenance of these watercourses / culverts should be undertaken. This will ensure the watercourses are regularly cleared of debris to prevent blockages and will improve channel capacity and conveyance of flow.

The proposed development will include a mix of retained homes, as well as new homes and community buildings. For those areas of the site designated as being retained homes, then it would be unfeasible to change the existing finished floor levels. However, if the retention of the existing building requires renovation works, then flood resistance and resilience techniques should be utilised (for those homes at risk of fluvial flooding) as described below.

Following discussions with the EA (see Section 3.1 of the FRA; included within Appendix ** of this report), it was recommended that the finished floor levels of the new homes and community buildings, which are at risk of fluvial flooding, should be located +100 mm above the 1 in 100yr+ Climate Change modelled flood levels.

It is recommended that the proposed new homes at risk of fluvial flooding are designed such that the ground floor use should be designated as garage and utility room space. Habitable area should then be located on the first and second floor (subject to building designs). It is recommended that the ground floor space of those homes at risk of fluvial flooding should incorporate flood resilience and resistance measures into the design, as described below.

- **Flood Resistance:** flood resilient means that flood water may enter the building, but the impact of flooding is reduced. Typical flood resilient construction techniques include:
  - Hard finishes;
  - Tiling;
  - Breathable plaster finishes and water resistant materials; and
  - Landscaping of the Site should be designed to route flows away from residential and community buildings, towards less vulnerable areas including car parks, and public open spaces etc. Landscaping should also allow flood which enters the building to drain away freely.

  Flood resilient construction techniques should be implemented in accordance with 'Improving the Flood Performance of New Buildings: Flood Resilient Construction (Defra 2007)'. Using flood resilient construction techniques should ensure no structural damage occurs and that flooded buildings are reusable as soon as possible after a flood event.

- **Flood Resistance:** flood resistance is a means of preventing flood water from entering the building or damaging its fabric. Typical flood resistant techniques include:
  - Reinforced concrete designs to water retaining codes, tanking, waterproofing;
  - Flood defences at access points into buildings; and
  - Fitting non-return valves to all drains and water inlets.

In addition to the above, it is recommended that those properties at risk of fluvial flooding are registers with the EA's Floodline Warnings Direct Service by calling Floodline on 0845 9881188. It is further noted that the EA Flood Warnings website provides a three day flood warning forecast which is in force by region and is updated every 15 minutes. Furthermore, it is recommended that that a Flood Plan is developed for this development. Full details on how this can be achieved is outlined within the FRA along with commentary on safe access / egress and place of refuge

Flooding from Overland Flow (Pluvial Flooding)
The Drainage Assessment within the FRA (Please see Appendix 6.3 in Volume 3) demonstrated that surface water from the proposed development can be attenuated to the EA's requirement of 50% reduction of existing brownfield rates, before being discharged into the onsite Ordinary Watercourses.

The Drainage Assessment within the FRA (Please see Appendix 6.3 in Volume 3) also demonstrates that all surface water flows up to the 100 year plus climate change event can be contained on site, thus providing no increased surface water flood risk to the proposed development or neighbouring sites.

Regular inspection and maintenance should be undertaken to ensure that the drainage infrastructure remains in a suitable condition.

Flooding from Sewers
The Drainage Assessment within the FRA demonstrates that foul water from the proposed development can be discharged to the public sewer network safely, without increasing flood risk.

The details of the foul and surface water drainage strategy is summarised below:

- Foul water should discharge to the local public combined sewer network. Exact discharge points for foul water flow will need to be agreed with UU at the detailed design stage and should be designed in accordance with Building Regulations Part H and Sewers for Adoption.
- In line with the EA requirements, surface water flow produced from the proposed development should be reduced to 50% of the existing (brownfield) runoff rate.
- Surface water should be stored within the onsite drainage system for the 1 in 30 year storm event. In excess of the 1 in 30 year event, up to the 1 in 100 year (plus climate change) event, above ground storage areas should be provided on site and will be subject to water being stored in controlled areas, such as landscaped features and car parks, ensuring buildings do not flood.
- The surface water drainage system for the site should discharge into the culverted Ordinary Watercourse (Corn Brook and Black Brook) located within the boundary of the site.

Regular inspection and maintenance should be undertaken to ensure that the drainage infrastructure remains in a suitable condition.

6.6. Residual Effects

This section presents the effects of the proposed development after taking into account mitigation measures.

6.6.1. Construction Phase

Table 6.7 Construction Residual Effects

Description of Potential Effect	Classification of Potential Effect	Importance of Receptor	Magnitude of Effect (without mitigation)	Significance of Effect (without mitigation)	Proposed and Recommended Mitigation Measures	Residual Effect Magnitude (with mitigation)	Residual Effect Significance (with mitigation)
Surface Water Quality and Water Resources							
Water pollution from silt-laden runoff if allowed to drain into watercourses untreated	Direct Likely Temporary Short Term	Corn Brook (Low Importance) Black Brook (Low Importance)	Moderate Adverse	Slight Adverse	Measures to control the generation of silt-laden runoff, such as construction SUDS techniques (e.g. silt fences, earth bunds, etc.) will be put in place on site in order to prevent silt entering watercourses in accordance with good site practice as detailed in the guidance documents listed in Section 6.5.1. Any discharge of site runoff to a controlled watercourse will also require a temporary discharge consent from the EA. Therefore, assuming good practice construction techniques are implemented and appropriate consents obtained, the effects of silt-laden runoff can be mitigated and a neutral impact is predicted on all receiving watercourses.	Minor Adverse	**Neutral**
Chemical / fuel spillages and leaks from plant and machinery, and from chemicals and other pollutants used/stored on site.	Direct Unlikely Temporary Short Term	Corn Brook (Low Importance) Black Brook (Low Importance)	Moderate Adverse	Slight Adverse	The storage of potentially hazardous substances will be in accordance with the Control of Substances Hazardous to Health Regulations 2002, and the Control of Pollution (Oil Storage) (England) Regulations 2001. Construction works will take place following good practice as set out in the various documents listed in Section 6.5.1. This will include bunded fuel storage areas (minimum 110% storage capacity), designated refuelling areas isolated from surface runoff drainage, easily accessible spill kits and oil absorbent materials, and training for construction workers. As a result, it is unlikely that the storage of these substances will lead to pollution of receiving surface waterbodies.	Minor Adverse	**Neutral**
Inappropriate disposal of foul water from the construction site	Direct Unlikely Temporary Short Term	All watercourses	Negligible	Neutral	Where possible, construction site and compound foul water should be temporarily connected to the nearest public sewer. If this is not possible portable toilets etc. will be used and regularly emptied by an appropriate contractor and disposed off at a suitable facility off site.	Negligible	**Neutral**

Description of Potential Effect	Classification of Potential Effect	Importance of Receptor	Magnitude of Effect (without mitigation)	Significance of Effect (without mitigation)	Proposed and Recommended Mitigation Measures	Residual Effect Magnitude (with mitigation)	Residual Effect Significance (with mitigation)
Flood Risk							
Fluvial Flooding	Direct Unlikely Temporary Short Term	Corn Brook Black Brook	Moderate Adverse	Slight Adverse	The construction process should take the location of culverted Ordinary Watercourses into account, and it should be ensured that the construction process does not adversely impact these culvert structures. Construction work carried out within the associated floodplains should be limited and monitored Construction equipment and materials etc should not be stored within close proximity to the Ordinary Watercourses.	Negligible	**Neutral**
Pluvial Flooding	Direct Unlikely Temporary Short Term	Corn Brook Black Brook Public Sewer Private Sewer	Moderate Adverse	Slight Adverse	A temporary drainage system should be installed on site and discharge to the Ordinary Watercourses (Corn Brook and Black Brook) located within the Site.	Negligible	**Neutral**
Flooding from Sewer	Direct Unlikely Temporary Short Term	Public Sewer Private Sewer	Moderate Adverse	Slight Adverse	The construction process should take the location of existing public and private sewers into account, and it should be ensured that the construction process does not adversely impact on these assets. Construction work carried out within the proximity of the existing drainage system should be limited and monitored. Construction equipment and materials etc should not be stored within close proximity to the existing drainage system.	Negligible	**Neutral**
Flooding from Foul Drainage	Direct Unlikely Temporary Short Term	Corn Brook Black Brook	Negligible	Slight Adverse	The foul water services provided during construction should be maintained to ensure appropriate disposal. This should ensure that there is no foul discharge to surface water sewers or to watercourse and that there is no risk of foul water flooding during construction.	Negligible	**Neutral**

6.6.2. Occupation Phase

Table 6.8 Occupational Residual Effects

Description of Potential Effect	Classification of Potential Effect	Importance of Receptor	Magnitude of Effect (without mitigation)	Significance of Effect (without mitigation)	Proposed and Recommended Mitigation Measures	Residual Effect Magnitude (with mitigation)	Residual Effect Significance (with mitigation)
Surface Water Quality and Water Resources							
Highway and diffuse urban pollution if allowed to enter watercourses untreated	Direct Likely Long Term	Corn Brook (Low Importance) Black Brook (Low Importance)	Minor Adverse	Neutral	As part of the proposed scheme surface runoff from the proposed development will be treated/attenuated using SUDS techniques at suitable locations prior to discharge into any watercourse. Swales, ponds and bio-retention areas/permeable paving have been incorporated into the masterplan design.	Minor Adverse	**Neutral**
Spillages	Direct Unlikely Long Term	Corn Brook (Low Importance) Black Brook (Low Importance)	Negligible	Neutral	If surface water runoff discharges into a separate surface water drainage system rather than into the existing combined sewer network the frequency of spills into watercourses may be reduced.	Negligible	**Neutral**
Increased demand of potable water	Direct Likely Long Term	Local water resources	Negligible	Neutral	The masterplan is committed to meet a minimum standard of achieving a three star sustainability rating under the Code for Sustainable Homes standard. This will include water saving measures and water recycling systems. Therefore, no additional mitigation measures are required and a neutral effect is predicted.	Negligible	**Neutral**
Increased demand of waste water treatment	Direct Likely Long Term	Local water resources	Negligible	Neutral	Foul flows from the site are not expected to increase significantly at a local level. Therefore, it is not envisaged that foul flows from the proposed development will adversely affect the water environment. It is assumed that the sewer network will have sufficient capacity to accommodate foul waters from the proposed scheme. Therefore, no additional mitigation measures are required and a neutral effect is predicted.	Negligible	**Neutral**
Flood Risk							
Fluvial Flooding	Direct Unlikely Temporary Short Term	Corn Brook Black Brook	Moderate Adverse	Slight Adverse	An 8m easement or buffer zone has been provided along both sides of the culverted Ordinary Watercourses in order to allow access for inspection and maintenance of these culverts. This will ensure the watercourses are regularly cleared of debris to prevent blockages and will improve channel capacity and conveyance of flow.	Negligible	**Neutral**

Description of Potential Effect	Classification of Potential Effect	Importance of Receptor	Magnitude of Effect (without mitigation)	Significance of Effect (without mitigation)	Proposed and Recommended Mitigation Measures	Residual Effect Magnitude (with mitigation)	Residual Effect Significance (with mitigation)
					Flood resilience and resistance techniques should be incorporated into the refurbishment of those retained homes which are at risk of fluvial flooding. The finished floor levels of proposed new homes and community buildings should be located +100mm above the 1 in 100yr+CC modelled flood levels. It is recommended that the proposed new homes which are at risk of fluvial flooding are designed such that the ground floor use should be designated as garage and utility room space. Habitable area should then be located on the first and second floor (subject to building designs). It is recommended that the ground floor space of new homes and community buildings which are at risk of fluvial flooding should incorporate flood resilience and resistance measures into their design. It is recommended that those properties at risk of fluvial flooding are registers with the Environment Agency's Floodline Warnings Direct Service by calling Floodline on 0845 9881188. It is recommended that that a Flood Plan is developed for this development which considers safe access / egress and place of refuge		
Pluvial Flooding	Direct Unlikely Temporary Short Term	Corn Brook Black Brook Public Sewer Private Sewer	Moderate Adverse	Slight Adverse	It is recommended that the finished floor levels of proposed new homes and community buildings should be located +150mm above external ground levels.	Negligible	**Neutral**
Flooding from Sewer	Direct Unlikely Temporary Short Term	Public Sewer Private Sewer	Moderate Adverse	Slight Adverse	It is recommended that the finished floor levels of proposed new homes and community buildings should be located +150mm above external ground levels.	Negligible	**Neutral**

6.6.3. Cumulative Effects

The Cumulative Effect Assessment considers the proposed development in the context of other consented developments within the surrounding area.

Water Quality

Although a number of planning applications have been granted in the vicinity of the proposed scheme (Please refer to Chapter 2), only those envisaged to have a potential effect on surface water bodies are considered for the cumulative assessment. However, assuming all construction work is carried out in accordance with good practice mitigation measures and appropriate consents are put in place, as described in Section 6.5.1, cumulative effects during construction on the surface water environment can be controlled and are predicted to be neutral.

It is reasonable to expect that, based on the relatively small scale of the proposed development and the measures set out in the Water Resources Management Plan (UU, 2009), adequate resources will exist to provide with potable water and collect and treat foul water flows. It is therefore predicted that no significant cumulative effects will occur

Therefore no cumulative effects on the surface water environment are predicted.

Flood Risk

Cumulative effects are considered where the presence of other projects of a similar type and scale within the study area may

Water Framework Directive Compatibility Appraisal

Under the WFD water bodies in the UK are classified against a series of parameters that describe the biological, chemical and hydromorphological characteristics of particular water body types with reference to predicted pristine conditions. The WFD encourages the long term improvement of water bodies and measures it by monitoring the status of the ecology. It is therefore concerned primarily with non-temporary effects, and thus potential effects that might be caused during construction, which are temporary and short term, are not relevant when determining compliance.

As discussed in the previous sections, highway and diffuse urban pollution represents only a low risk to surface water quality. The risk of spills to surface water bodies will be minimised by the incorporation of separate foul and surface water sewers, replacing the existing combined sewer network which is currently in place across the site. In addition, SUDS techniques that will be incorporated into the scheme will provide protection from the adverse effects of pollution on the surface water environment. Therefore, it is concluded that the release of diffuse urban pollutants to watercourses throughout the site is unlikely to lead to deterioration or prevent improvement in local designated watercourses at the water body level.

Corn Brook (as part of the WFD classification for River Medlock) is a HMWB due to flood protection and urbanisation. It is currently classified as at Poor Ecological Potential due to invertebrates, phytobenthos, ammonia and phosphates. It is unlikely that this watercourse will achieve its Good Potential before 2027 because it is considered that implementing the mitigation measures is disproportionately expensive and technically unfeasible to improve these parameters. The proposed development is not likely to affect these and thus will not have any effect on the achievement of the WFD objectives.

Water consumption on site is not predicted to be significant at a water body level as the net increase in houses is only minor at a local level. In addition, water consumption will be minimised by water efficient design and appliances within buildings, rainwater recycling. The FRA outlines that it is feasible to discharge foul and surface water to the existing drainage network. UU will need to confirm at design stage that there is sufficient capacity in both the sewer network to accommodate foul flows from the site and treat them within existing consents, and to provide potable water supply to the site. As a result, no additional pressures from water abstraction are expected as a result of the proposed development.

Overall, it is predicted that the proposed development will be compliant with the requirements of the WFD.

6.6.4. Assumptions and Limitations

In preparation of this Chapter, the following assumptions and limitations have been made:

Assumptions:

- The Indicative Masterplan is based on the assumed locations of the Ordinary Watercourses (Corn Brook and Balck Brook) which flow through the Site.
- This Chapter is based on the finding of the standalone FRA. The FRA is based on hydraulic modelling provided by the EA, which was taken from the River Medlock and Corn Brook 2008/09 Flood Risk Mapping commission. The modelling data provided is one interpretation of predicted flood levels which may be experienced across this Site. At this stage it is unknown what information, data sources or assumptions were used to produce the Environment Agency model.
- The FRA is therefore based on hydraulic modelling data which is assumed to be correct.

Limitations:
- Topographic surveys were undertaken as part of the previous FRA and Desktop Studies for individual plots across the Site. A full topographic survey is not available for the whole of the Site. At this stage the FRA is limited in terms of making recommended finished floor levels across the whole Site based on hydraulic modelling data provided by the EA.

6.7. Summary and Conclusion

This chapter of the ES provides an assessment of the water quality/water resources, flood risk and drainage effects relating to the proposed development. In relation to flood risk and drainage effects, the chapter has been based on the standalone FRA, which has been included within Appendix 6.2. This FRA will be submitted as a standalone report as part of the planning application process.

Water Quality and Resources

This chapter has presented a summary of the potential effects that the proposed development may pose to the surface water environment (in relation to water quality and water resources) during construction and occupation.

It has been identified that there is the potential for short term temporary adverse effects during construction. However, providing appropriate measures as described in this chapter are implemented, all potential construction effects can be fully mitigated and neutral effects are predicted.

As part of the masterplan design, surface runoff from the proposed development will be treated/attenuated using SUDS techniques, including swales, ponds and bio-retention areas/permeable paving, at suitable locations prior to discharge into any watercourse. In addition, if surface water runoff discharges into a separate surface water drainage system rather than into the existing combined sewer network the frequency of spills into watercourses may be reduced. Therefore, no residual significant effects are envisaged in relation to highway and urban diffuse pollution to the surrounding surface water environment.

Finally, it is concluded that the increase in demand for potable and foul flows and treatment (if any) will not significantly affect the water resources at a local level. The commitments to meet a minimum of achieving a three star sustainability rating under the Code for Sustainable Homes standard have been deemed sufficient to mitigate any potential adverse effects.

Therefore, it is concluded that the proposed development is compliant with current relevant legislation and planning policy, as outlined in this chapter. No significant cumulative effects have been identified.

Flood Risk

The chapter initially outlined the baseline flood risk and drainage conditions, and then assessed the potential impacts of the Proposed Development on flood risk and drainage during both the construction and occupational phases. Based on the assessment of potential impacts, the chapter outlined necessary mitigation measures to reduce the residual effects.

Baseline

Based on the assessment of baseline flood risk, flooding from tidal, groundwater, land drainage and artificial sources of flooding were not considered as part of the impact assessment.
The baseline risk of flooding from the sources listed above was assessed to be between negligible to low, and the proposed development was assessed not to impact on any of these sources of flooding.

Based on the assessment of baseline flood risk, the flooding Ordinary Watercourse (Corn Brook and Black Brook) were considered further as part of the impact assessment.

The baseline risk of flooding from the sources listed above was assessed to be low. However, the proposed development has the potential to impact upon the risk of flooding from these sources during construction and occupation.

Construction Phase
The construction phase of the proposed development has the potential to adversely impact upon flooding from fluvial, pluvial, sewer and foul drainage. Without mitigation, the impacts are predicted to range between moderate adverse to negligible.

By implementing the recommended mitigation measures, the residual impacts on the risk of flooding from these sources are reduced to negligible and no impact during construction.

Occupational Phase
The occupation phase of the proposed development has the potential to adversely impact upon flooding from fluvial, pluvial and sewer. Without mitigation, the impacts are predicted to be moderate adverse.

By implementing the recommended mitigation measures, the residual impacts on the risk of flooding from these sources are reduced to negligible and no impact during occupation.

Overall Impact
The overall impact of the proposed development on flood risk and drainage is considered to be negligible during construction and occupation, taking into account the mitigation measures that should be implemented.

Cumulative Impact
It has been determined that there should be no cumulative impact on flood risk and drainage.

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