

Bredbury Park

Volume 2: Environmental Statement

Chapter G: Flood Risk and Drainage

December 2020



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G1.0 Introduction

- G1.1 This Environmental Statement has been prepared on behalf of Quorum Estates Ltd by Waterco Ltd in respect of the proposed extension to Bredbury Industrial Estate, Stockport. This Chapter describes the existing environment and the potential effect during the construction and operation phases of the proposed development in relation to Flood Risk and Drainage.
- G1.2 This Chapter is supported by the FRA (Ref: w10658-201211-FRA) and Drainage Strategy (Ref: w10658-201211-Drainage Strategy), both produced by Waterco Ltd in December 2020.

About the Author

- G1.3 Waterco Ltd are a consultancy specialising in water, drainage and flood protection.
- G1.4 Waterco Flood Risk Assessments (FRA) and drainage strategies have been utilised in planning applications for over many millions of pounds worth of developments. These developments have been across sectors including: residential, commercial, retail, leisure, infrastructure and agricultural and have ranged from a single niche development to mixed-use, large-scale regeneration projects. Waterco FRA and Drainage Strategy reports comply with UK development and flood risk planning policies and are produced following full consultation with the relevant statutory bodies.
- G1.5 Waterco FRA reports and Drainage Strategies comply with UK development and flood risk planning policies and are produced following full consultation with the relevant statutory bodies
- G1.6 Waterco's expertise also includes the compilation of Flood Risk and Drainage Environmental Statement Chapters.
- G1.7 Our technical staff are members and chartered members of relevant institutions. This Chapter has been prepared by Ms Ceire McGough BSc (Hons) (Waterco Ltd), checked by Mrs Johanne Williams LLB (Hons) PGDip MCIWEM and approved by Ms Victoria Griffin BSc (Hons) MSc MIEnvSc CEnv.

G2.0 **Policy Context**

Legislation

Water Framework Directive (WFD) 2000/60/EC

G2.1 Published in December 2000, the Directive aims to preserve, restore and improve the water environment. It is a legal requirement within England and Wales, originally transposed into law through the Water Environment (Water Framework Directive) (England and Wales) (2003) to record data within River Basin Management Plans. River Basin Planning is managed in six-year cycles.

G2.2 The environmental objectives of the WFD for surface waters include:

1. Prevent deterioration in the status of all bodies of surface water;
2. Protect, enhance and restore all bodies of surface water, with the aim of achieving good surface water status at the latest 15 years after the date of entry into force of the Directive (2015);
3. Protect and enhance all artificial and heavily modified bodies of surface water, with the aim of achieving good ecological potential and good surface water chemical status at the latest 15 years after the date of entry into force of the Directive (2015). There are five classes of rating which are; high, good, moderate, poor or bad. The ecological and chemical status of the waterbody is assessed, and the overall status is reflective of which of these is worst rated; and
4. Implementation of necessary measures, with the aim of progressively reducing pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substance

Directive on Environmental Quality Standards (EQSD) 2008/105/EC

G2.3 This Directive establishes the environmental quality standards (EQS) for priority substances and certain other pollutants in surface waters.

G2.4 With reference to the WFD, good chemical status is achieved when a water body complies with the EQS for all the priority substances and certain other pollutants listed in the EQSD.

Water Act 2014 and Water Resources Act 1991

G2.5 This Act governs the control of water abstraction, discharge to water bodies, water impoundment, conservation and drought provision.

Flood and Water Management Act 2010

G2.6 This Act provides details on the management of risks associated with flooding and coastal erosion.

Environmental Protection Act 1990

G2.7 This Act provides details for identifying and dealing with waste, emissions, contaminated land and water resources.

The Land Drainage Act 1991

- G2.8 This Act establishes the regulation of ordinary watercourses by Local Authorities and Internal Drainage Boards. It outlines that a watercourse should be maintained by its owner so that the flow of water is not impeded. The riparian owner must accept the natural flow from upstream but does not need to carry out works to cater for increased flows which may result from works carried out upstream.

Groundwater Directive 2006/118/EC

- G2.9 This Directive is on the protection of groundwater against pollution and deterioration from hazardous substances and non-hazardous pollutants.

The Groundwater (England and Wales) Regulations 2009

- G2.10 This Regulation transposes 2006/118/EC into law in England and Wales.

Environmental Permitting (England and Wales) Regulations 2016

- G2.11 This Regulation provides a consolidated system of environmental permitting including the discharge of water and groundwater activities.

The Environmental Damage (Prevention and Remediation) (England) Regulations 2015

- G2.12 This Regulation aims to prevent and remedy damage to a protected species, natural habitat, a site of special scientific interest, water or land.

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

- G2.13 This Regulation transposes 2000/60/EC into law in England and Wales and revokes the WFD (England and Wales) Regulations 2003.

National Planning Policy

National Planning Policy Framework (NPPF) (Framework)

- G2.14 The Framework and the associated Practice Guide (NPPG) advise on how planning should take account of the risks associated with flooding and coastal changes in the plan-making and the application process.
- G2.15 In accordance with Paragraph 157 of the Framework, a sequential risk-based approach should be applied to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account the impact of climate change. This will be achieved by:
1. Applying the Sequential Test;
 2. If necessary, applying the Exception Test;
 3. Safeguarding land from development that is required for current and future flood management;
 4. Using opportunities offered by new development to reduce the causes and effects of flooding; and

5. Seeking opportunities to relocate development where climate change is expected to increase flood risk making the development unsustainable long-term.

G2.16 The aim of the Sequential Test is to steer new development into areas with the lowest probability of flooding.

G2.17 If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the proposed development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. For the Exception Test to be passed:

1. It must be demonstrated that the proposed development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
2. A site-specific flood risk assessment must demonstrate that the proposed development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

National Planning Practice Guidance (NPPG) (Practice Guide): Flood Risk and Coastal Change

G2.18 Table 2 of the Practice Guide [Reference I.D: 7-066-20140306] sets out the flood risk vulnerability classification for a range of developments and land uses. The proposed residential aspect of the proposed development is considered 'more vulnerable' in accordance with Table 2 of the Practice Guide. The proposed industrial development is classified as 'less vulnerable'.

G2.19 Table 3 of the Practice Guide [Reference I.D: 7-067-20140306] sets out the compatibility of each development and land use vulnerability classification within a specific flood zone, indicating whether development is 'appropriate' within a defined flood zone.

G2.20 The Practice Guide [Reference I.D: 7-079-201504415] states that; when considering major development, as defined in the Town and Country Planning Order 2015, sustainable drainage systems should be provided unless demonstrated to be inappropriate.

G2.21 The Practice Guide [Reference I.D: 7-080-20150323] states that, generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable;

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain or another drainage system; and
4. to a combined sewer.

Local Planning Policy

The Stockport Unitary Development Plan, May 2006

G2.22 The Stockport Unitary Development Plan, May 2006, contains the following policy which still applies from 1st April 2011 onwards (post core strategy adoption);

EP1.7 Development and flood risk

The Council will not permit development, including the raising of land, where it would:

- i Be at risk from flooding;

- ii Increase the risk of flooding elsewhere;
- iii Hinder future access to watercourses for maintenance purposes;
- iv Cause loss of the natural floodplain;
- v Result in extensive culverting;
- vi Affect the integrity of existing flood defences; or
- vii Significantly increase surface water run-off.

... All development which is likely to have an impact on drainage patterns should incorporate, as far as is practicable, sustainable drainage systems taking account of current Government advice.'

G2.23

The Stockport Metropolitan Borough Council Local Development Framework Core Strategy DPD (March 2011) contains the following policies in relation to drainage:

'Development Management Policy SD-6

Adapting to the Impacts of Climate Change

Development should be designed in such a way as to avoid, mitigate or reduce the impacts of climate change.

In particular, all development will be required to incorporate Sustainable Drainage Systems (SuDS) so as to manage the run-off of water from the site. Development on previously developed (brownfield) land must reduce the rate of unattenuated run-off by a minimum of 50% if it is within an identified Critical Drainage Area (CDA). Until CDAs have been identified in detail the same reduction (a minimum of 50%) will be required of developments on brownfield sites in all areas; once details CDAs have been identified, the minimum required reduction of run-off on brownfield sites outside of CDAs will be 30%. Development on greenfield (not previously developed) sites will be required, as a minimum, to ensure that the rate of run-off is not increased.

Where planning permission is required, areas of hard-standing or other surfaces, should be of permeable construction or drain to an alternative form of SuDS...

Development Management Policy SIE-3

Protecting, Safeguarding and enhancing the Environment

Where planning permission is required, areas of hard-standing or other surfaces, should be of a permeable construction or drain to an alternative form of SuDS'.

Guidance

**Construction Industry Research and Information Association (CIRIA) C753
'The SuDS Manual' 2015**

G2.24

This document provides guidance on the implementation of SuDS features, the advantages they offer and how benefits can be maximised.

G3.0 **Assessment Methodology & Significance Criteria**

Assessment Methodology

Flood Risk

G3.1 All potential sources of flooding have been reviewed as part of this assessment including fluvial (from rivers), tidal, surface water, sewer flooding, groundwater and artificial sources. The existing flood risk to the site has been assessed using a range of information sources including:

1. Environment Agency (EA) fluvial, tidal, surface water and reservoir flood mapping
2. Site specific topographical survey
3. Stockport Metropolitan Borough Council Strategic Flood Risk Assessment (SFRA)
4. Stockport Metropolitan Borough Council Preliminary Flood Risk Assessment (PFRA)

Environment Agency Definitions

G3.2 The EA 'Flood Map for Planning' highlights Main Rivers. Main Rivers are described by the EA as 'usually larger rivers and streams. Other rivers are called 'ordinary watercourses'. The Environment Agency carries out maintenance, improvement or construction work on Main Rivers to manage flood risk. Environment Agency powers to carry out flood defence work apply to main rivers only. Lead local Flood Authorities (LLFA's), district councils and internal drainage boards carry out flood risk management work on ordinary watercourses.

G3.3 The EA 'Flood Map for Planning' outlines the areas at risk of flooding from fluvial and / or tidal sources. The Flood Zones are described in Table G3.1 below:

Table G3.1 Flood Zone Classification

Flood Zone	Description
Flood Zone 1	An area with a less than 0.1% (1 in 1000) chance of flooding from rivers or the sea in any given year.
Flood Zone 2	An area with between a 0.1% and 1% (1 in 100) chance of flooding from rivers, or with between a 0.1% and 0.5% (1 in 200) chance of flooding from the sea in any given year.
Flood Zone 3	An area with a 1% chance or greater of flooding from rivers, or with a 0.5% chance or greater of flooding from the sea in any given year.
Areas benefitting from flood defences	An area that benefits from flood defences in the event of a river flood with a 1% chance, or a flood from the sea with a 0.5% chance of flooding in any given year.

Surface Water Drainage

G3.4 An assessment of existing (greenfield) surface water runoff rates has been carried out using the Revitalised Flood Hydrograph Model (ReFH2) method, which is recognised as a suitable method for calculating greenfield runoff rates within The SuDS Manual.

- G3.5 An assessment of the proposed development surface water runoff rates and associated storm water attenuation volumes has been made using industry standard MicroDrainage software.

Foul Drainage

- G3.6 The effect of the proposed development on the public sewer network will be determined by the sewerage undertaker United Utilities, through an assessment of the existing capacity and proposed foul flows from the development.
- G3.7 Design guidance for the site's foul drainage system is in accordance with Sewers for Adoption 7th Edition (or applicable edition as accepted by United Utilities at the time of construction).

Significance Criteria

- G3.8 The assessment of potential effects as a result of the proposed development has considered both the construction and operation phases. The significance level attributed to each effect has been assessed based on the magnitude of change due to the development proposals and the sensitivity of the affected receptor / receiving environment to change.
- G3.9 The sensitivity of each receptor has been designated using professional judgement and by reference to the guidance criteria presented in Table G3.2.
- G3.10 The potential effects and magnitude of effects of each receptor have been identified using the criteria presented in Table G3.3 and informed by the baseline assessment.

Table G3.2 Sensitivity of receptor / receiving environment to change or effect

Importance	Description
High	A watercourse / feature with national hydrological importance to biodiversity and ecosystems; highly and more vulnerable property, residents / site users and land such as emergency services and residential properties. A Principal Aquifer. Flood Zone 3.
Medium	A watercourse / feature with regional hydrological importance to biodiversity and ecosystems, more vulnerable and less vulnerable property and land such as public, commercial and industrial buildings. A Secondary Aquifer. Flood Zone 2.
Low	A watercourse / feature with local / minimal hydrological importance to biodiversity and ecosystems, undeveloped land. Unproductive strata. Flood Zone 1.
Negligible	Sacrificial land, undevelopable land.

Table G3.3 Magnitude of Change / Effect

Importance	Description
Substantial Beneficial	The effect provides a significant positive gain; Long term / permanent improvements to the hydrology, significant change in the physical state of the water feature and / or large reduction in pollution levels resulting in substantial amelioration of the water quality. Significant enhancement to land and

	property occupiers. Major improvement from the baseline conditions. Reduction in flood risk offsite by 5mm or greater during all flood events.
Moderate Beneficial	The effect provides some gain to the environment; Short to medium term improvements to the hydrology, minor improvements in the physical state of the water feature and / or minor improvement of the water quality. Enhancement of land and property, resulting in moderate economic benefit. A gain of the economic value provided by the water feature. Less than 5mm reduction in flood risk offsite. Moderate improvement from the baseline conditions.
Minor Beneficial	The effect is of minor significance but has some environmental benefit; Small measurable improvements to the hydrology but no overall change in flood risk elsewhere. Minimal improvements in water quality which are unlikely to affect sensitive receptors. Minor change from the baseline conditions.
Neutral / Negligible	The effect is at a threshold of predictive quantification and is not of concern; Little to no change when compared with the baseline conditions.
Minor Adverse	The effect is undesirable, but of limited concern; Small measurable deterioration to the hydrology but no overall change in flood risk elsewhere. Minimal deterioration in water quality which are unlikely to affect sensitive receptors. Minor change from the baseline conditions.
Moderate Adverse	The effect gives rise to some concern, but it is likely to be tolerable (depending on its scale and/or duration); Short to medium term deterioration to the hydrology, minor deterioration in the physical state of the water feature and / or minor degradation of the water quality. Damage to land and property, resulting in moderate economic loss. A reduction of the economic value provided by the water feature. Less than 5mm increase in flood risk offsite. Moderate change from the baseline conditions.
Substantial Adverse	The effect gives rise to serious concern; it should be considered as unacceptable; Long term / permanent changes to the hydrology, significant change in the physical state of the water feature and / or serious pollution resulting in substantial degradation of the water quality. Significant damage to land and property occupiers. Major change from the baseline conditions. Increase in flood risk offsite by 5mm or greater during all flood events.

G3.11 To assist in the assessment process, the effects assessment matrix provides a mechanism for assessing significance (see Table G3.4). An initial indication of effect significance (adverse or beneficial) is gained by combining magnitude and importance/sensitivity in accordance with the effects assessment matrix provided. It should be noted that although the effect assessment matrix provides a good framework for the consistent assessment of effects across all environmental parameters, there is still an important role for professional judgement and further objective assessment to play in moderating an effects significance (where applicable). Given that the criteria represent levels on a continuum, professional judgement and awareness of the relative balance between magnitude and importance / sensitivity is required.

Table G3.4 Matrix for the Calculation of Significance

Magnitude of Effect	Importance (Value) and/or Sensitivity of Feature		
	High	Medium	Low
Substantial	Major	Major	Moderate
Moderate	Major	Moderate	Minor
Minor	Moderate	Minor	Neutral/Negligible

- G3.12 Where adverse effects are identified, potential mitigating measures must be examined and recommended in order to reduce potential effects, as far as possible, to environmentally acceptable levels. Residual effects must then be stated.

Consultation

- G3.13 A generic pre-planning request was submitted to the LLFA in April 2018. The LLFA state ‘You would have to design to greenfield run-off and take every effort to apply all sustainable options prior to assuming any conventional drainage and direct discharge. Infiltration will need to be proven.’
- G3.14 A pre-planning opinion request was submitted to the EA in April 2018. The EA have stated that ‘We have no record of flooding affecting this site. However, this does not mean flooding has not occurred in the past or that it will not flood in future. We recommend that you also contact United Utilities and Stockport Metropolitan District Authority who may hold additional information (the former especially in relation to sewer flooding)’.
- G3.15 A developer enquiry request was submitted to United Utilities (UU) in April 2018. Their response was received in May 2018. UU states that; ‘Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself. Surface water can drain to the nearby 1050mm surface water sewer at a maximum pass forward flow of 160 l/s’.

Assumptions and Limitations

- G3.16 This chapter is based on the site location and proposed design provided to Waterco Ltd in November 2020 (refs; B9269-AEW-XX-XX-DR-A-0513_P3_ – Proposed Masterplan 90,000 SQM).
- G3.17 All third-party published information and data is assumed to be correct, up to date and based on verified and accurate records, for example, EA flood mapping and British Geological Survey (BGS) geological mapping.
- G3.18 It is assumed that adequate storage will be provided onsite to accommodate the required surface water attenuation volumes to achieve the proposed restricted discharge rates. It is assumed that all required permits and formal agreements will be sought with relevant consultees.
- G3.19 It is assumed that the site is not contaminated. No monitoring or investigation has been undertaken by Waterco Ltd.
- G3.20 A site walkover has not been undertaken by Waterco Ltd as part of this chapter or associated reports.
- G3.21 Land beyond approximately 200m of the site boundary has not been considered to have an effect in this chapter.

G4.0 **Baseline Conditions**

Existing Conditions

Topographical Setting

- G4.1 A topographical survey has been undertaken by Survey Systems in April 2017. The topographical survey shows that the site slopes from approximately 95.7metres Above Ordnance Datum (m AOD) in the south-west to 68.7m AOD in the north.
- G4.2 Topographic levels to m AOD have also been derived from a 1m resolution EA composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model. A review of LiDAR data shows that the site and surrounding area slopes from south-west to north-east.

Geological Setting

- G4.3 Reference to the British Geological Survey online mapping (1:50,000 scale) indicates that the majority of the site is underlain by superficial deposits of Devensian Till, generally comprising Diamicton. An isolated area of Devensian Glaciofluvial Deposits is identified in the northern extent of the site, generally comprising sand and gravel. The superficial deposits are identified as being underlain by the Pennine Middle Coal Measures Formation comprising mudstone, siltstone and sandstone. An outcrop of Bardsley Rock crosses the site from north to south which comprises sandstone.
- G4.4 According to the EA's online Groundwater Vulnerability Mapping, the superficial Devensian Till is classified as A Secondary (undifferentiated) aquifer. This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. The superficial Devensian Glaciofluvial Deposits and the underlying Pennine Middle Coal Measures Formation bedrock are classified as a Secondary A aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers.
- G4.5 The Environment Agency's online 'Groundwater Source Protection Zones' map indicates that the site is not located within a Groundwater Source Protection Zone.
- G4.6 The Cranfield University 'Soilscapes' map indicates that the site is underlain by 'slowly permeable seasonally wet... loamy and clayey soils'.

Local Drainage Setting

- G4.7 Public sewer records have been obtained from United Utilities. The sewer records show that there is a 1,050mm public surface water sewer that crosses the southern extent of the site from south-west to north-east, discharging to the River Tame. A 750mm public surface water sewer flows north from the southern extent of the site, joining the 1,050mm public surface water sewer in the south-western extent of the site. Furthermore, immediately adjacent to the site entrance in the south-western extent of the site, there is a 225mm public foul sewer that flows north-west within the road, to a pumping station.
- G4.8 Multiple manholes are located onsite, however, not all manhole invert levels have been provided. Manhole 5701 in the south-western extent of the site, on the 1050mm public surface water sewer, has a cover level of 89.36m AOD and an invert level of 83.48m AOD. The manhole

immediately upstream of the discharge point to the River Tame (9901) in the north-eastern extent of the site has a cover level of 80.9m AOD however the invert level has not been provided.

Hydrological Setting

- G4.9 The EA 'Flood Map for Planning' shows that the site is located within Flood Zone 1 - an area outside of the extreme flood extent, considered to have a less than 0.1% annual probability of flooding from rivers or the sea.
- G4.10 The nearest watercourse is the River Tame which is located approximately 20m north-east of the site. There are no other watercourses within the immediate vicinity of the site.
- G4.11 The site is situated at a minimum of 68.7m AOD and is significantly above sea level. Therefore, the risk from tidal flooding is very low.
- G4.12 The EA 'Flood Risk from Surface Water' map indicates that the majority of the site is at very low risk of surface water flooding, meaning it has a less than 0.1% annual probability of flooding. There are isolated areas of high risk of surface water flooding within the site, with a greater than 3.3% annual probability of flooding. The isolated areas at high risk of surface water flooding are associated with surface water ponding in isolated topographical low points. The low points will likely be removed as part of the proposed development. Surface water flow routes with a low risk of flooding are identified in the eastern extent of the site. The flow routes originate on site and derive from topographical depressions. The flow routes would not be realised when the development is in place and served by a sustainable drainage system.
- G4.13 The PFRA 'Local Historic Flood Map' shows that there are no records of sewer flooding at or in the immediate vicinity of the site. Furthermore, the PFRA 'United Utilities S.I.R.S and W.I.R.S' Map shows that there are no sewer incidents recorded by United Utilities at or in the immediate vicinity of the site.
- G4.14 The PFRA 'Areas Susceptible to Groundwater Flooding' map shows that the northern extent of the site is located within a 1km² grid with between a 50% and 75% susceptibility of groundwater flooding and the southern extent of the site is within a 1km² grid with between a 25% and 50% susceptibility of groundwater flooding. However, the SFRA states that 'there are no documented records of groundwater flooding within Stockport MBC district'. Furthermore, it is unlikely that any basement levels will be proposed as part of the development.
- G4.15 The development will result in the majority of the site being covered by hardstanding, limiting the vertical migration of groundwater to the surface. No basement levels are proposed as part of the development. It can therefore be concluded that the risk of groundwater flooding is low.
- G4.16 The Peak Forest Canal is located approximately 440m east of the site. The canal is not raised above surrounding ground and therefore there is no risk of a canal breach. Furthermore, the site is separated from the canal by a low point of approximately 80m AOD. Therefore, in the unlikely event of an overtopping event, flooding of the canal would not reach the site and there is no associated flood risk. The EA 'Flood Risk from Reservoirs' map shows that the site is not at risk of flooding from reservoirs. It can therefore be concluded that the risk of flooding from artificial sources is very low.

Future Baseline

- G4.17 The site is elevated by a minimum of 15m above the River Tame. Therefore, climate change and the resulting increase of flood levels within the River Tame are highly unlikely to have an effect on the site. The effects of climate change on the flood zone classification is therefore not considered to be pertinent.

G4.18 Local and national planning policies require drainage systems to accommodate climate change. Therefore, it is reasonable to assume that the drainage systems of all future neighbouring developments have been designed accordingly. Therefore, climate change and the increase in surface water drainage flows are highly unlikely to have an increased effect on the site.

G5.0 Potential Effects

During Construction

G5.1 During the construction phase, there is the potential for the construction of the proposed development to result in the following effects on the water environment:

1. Chemical and fuel spillages from construction plant and material;
2. Construction activity including the construction and use of haul roads;
3. Siltation of watercourses through increased erosion of temporary stockpiles; and
4. Excavated ground and exposed ground.

G5.2 During the construction phase, prior to mitigation measures being implemented, there are potential significant effects anticipated from chemical and fuel spillages and from the siltation of watercourses. The assessment of this is considered below.

Chemical / Fuel Spillages

G5.3 The use of oils, solvents and fuels on construction sites provide a risk of leakages and spillages, leading to pollution incidents. This could affect the water quality in the receiving waterbodies if pollution is mobilised. Where fuels and chemicals reach a waterbody, there is a potential for effects on water quality, which can affect local flora and fauna.

G5.4 The sensitivity of the River Tame adjacent to the site to chemical / fuel spillages is considered to be medium. The underlying aquifers are considered to have a medium sensitivity due to its designation as Secondary A and undifferentiated Aquifers.

G5.5 Accidental leakages and spillages of contaminants which have the potential to migrate towards the River Tame or the underlying Secondary A and undifferentiated Aquifers could have an adverse moderate magnitude of effect due to the potential of causing medium-term, reversible, significant changes to the water quality.

G5.6 In accordance with the assessment matrix included in Table G3.4, the overall significance of chemical and fuel spillages on the water quality of the River Tame and / or the underlying aquifers, if unmitigated, are considered to be **Moderate Adverse**.

Haul Roads

G5.7 The runoff from haul roads can contain large amounts of suspended solids as well as hydrocarbons. This could lead to siltation of receiving watercourses and therefore an increase in flood risk. The effect of the siltation on the watercourse would be moderate due to the short to medium term, reversible effect. This could also have a low adverse effect on water quality.

G5.8 In accordance with the assessment matrix included in Table G3.4, the overall significance of siltation of watercourses from haul roads on the water quality within the River Tame and / or the underlying aquifers, if unmitigated, are considered to be **Minor Adverse**.

Stockpiles

G5.9 Rainfall could lead to erosion of material should a stockpile be uncovered. This could lead to siltation of receiving watercourses and therefore an increase in flood risk.

- G5.10 Recently disturbed and vegetation free ground allows for relatively low velocity runoff to erode the surface. Rainfall could also lead to erosion of material should a stockpile be uncovered. This leads to increased runoff and sedimentation of receiving waters, thereby increasing flood risk.
- G5.11 The River Tame is considered to have a low sensitivity to stockpiles.
- G5.12 Runoff which has a high concentration of suspended solids and silt has the potential to migrate towards the River Tame and could have a moderate magnitude of effect due to the short term, reversible effect, with the potential to increase flood risk elsewhere.
- G5.13 In accordance with the assessment matrix included in Table G3.4, the overall significance of siltation of the River Tame, if unmitigated, is considered to be **Minor Adverse**.

Excavated Ground and Exposed Ground

- G5.14 Recently disturbed and vegetation free ground allows for relatively low velocity runoff to erode the surface. This leads to increased runoff and sedimentation of receiving waters, thereby increasing flood risk. The magnitude of the effect is considered to be moderate due to the short term, reversible effect.
- G5.15 The River Tame is considered to have a low sensitivity to excavated and exposed ground.
- G5.16 In accordance with the assessment matrix included in Table G3.4, the overall significance of excavated ground and exposed ground on the water quality within the River Tame and / or the underlying aquifers, if unmitigated, are considered to be **Minor Adverse**.

During Operation

- G5.17 During the operational phase, there is the potential for the operation of the proposed development to result in the following effects on the water environment:
- 1 Increasing the amount of surface water runoff entering the receiving watercourse through introduction of impermeable areas;
 - 2 Increasing the amount of foul water runoff as a result of the introduction of industrial development facilities; and
 - 3 Chemical and fuel spillages.

Increased Surface Water Runoff

- G5.18 The increase in hardstanding area will result in an increase in a significant increase in surface water runoff rates and volumes which can will ultimately pass to the receiving watercourse and therefore could result in a substantial effect through the increase in flood risk elsewhere. The offsite impact would be for the lifetime of the development and would be exacerbated by climate change resulting in a potential long term and ongoing effects. The River Tame and land downstream are considered to have a medium sensitivity to increased surface water runoff.
- G5.19 In accordance with the assessment matrix included in Table G3.4, the overall significance of the increase in runoff rates and volume on flood risk and drainage, if unmitigated, is considered to be **Major Adverse**.

Increased Foul Water Runoff

- G5.20 The proposed development will result in an increase in foul water discharge. The River Tame and land both upstream and downstream of the site along the sewer network are considered to have a medium sensitivity to foul water exposure. However, site users and or residents of surrounding development have a high sensitivity to exposure to foul water. The magnitude of

the effect of exceedance of the sewer network is considered to be substantial and would result in a significant human health risk for the lifetime of the development resulting in potential long term and ongoing effects.

- G5.21 In accordance with the assessment matrix included in Table G3.4, the overall significance of the increase in foul water runoff rates on the United Utilities public sewer network, if unmitigated, is considered to be **Major Adverse**.

Chemical / Fuel Spillages

- G5.22 The specific end use of the individual plots which comprise the development is not yet known. However, given the industrial nature of the wider development there is the potential for the use of oils, solvents and fuels onsite and / or for haulage purposes resulting in a risk of leakages and spillages, leading to pollution incidents. This could affect the water quality in the receiving waterbodies if pollution is mobilised. Where fuels and chemicals reach a waterbody, there is a potential for adverse effects on water quality, which can affect local flora and fauna.
- G5.23 The sensitivity of the River Tame adjacent to the site is considered to be medium. The underlying aquifers are considered to have a medium sensitivity due to its designation as Secondary A and undifferentiated Aquifers.
- G5.24 Accidental leakages and spillages of contaminants which have the potential to migrate towards the River Tame adjacent to the site or the underlying Secondary A and undifferentiated Aquifers could have a major magnitude of change due to the potential of causing long-term, reversible, significant changes to the water quality.
- G5.25 In accordance with the assessment matrix included in Table G3.4, the overall significance of chemical and fuel spillages on the water quality within the River Tame and / or the underlying aquifers, if unmitigated, are considered to be **Major Adverse**.

G6.0 **Mitigation and Monitoring**

During Construction

Chemical / Fuel Spillages

G6.1 Conventional good practice measures can be taken to prevent oil and hydrocarbons becoming pollutants, such as:

1. Maintenance of machinery and plant;
2. Drip trays;
3. Regular checking of machinery and plant for oil leaks;
4. Correct storage facilities;
5. Check for signs of wear and tear on tanks;
6. Care with specific procedures when refuelling;
7. Designated areas for refuelling;
8. Emergency spill kit located near refuelling area;
9. Regular emptying of bunds; and
10. Tanks located in secure areas to stop vandalism.

Haul Roads

G6.2 Temporary haul roads will be designed so that the length is kept to a minimum, but still serves its purpose. The gradient will be shallow to prevent increasing runoff velocity and, if possible, bunds and / or discrete ditches constructed to intercept runoff. Haul roads will be sprayed regularly to keep down dust. If any section of a haul road is hard surfaced, then it will be swept on a regular basis to prevent accumulation of dust and mud. Gullies will be covered when not in use.

G6.3 Plant and wheel washing will take place in designated locations. Dirty water will be contained within sealed storage tank(s) and will not be allowed to discharge into a watercourse or infiltrate to groundwater. Some proprietary vehicle washing systems offer a recycling facility, which filter and settle solids, with effluent being pumped back into the system. The solid waste materials from this process need to be treated as contaminated waste due to the high hydrocarbon content.

Stockpiles

G6.4 Stockpiles will be located away from watercourses or site drainage system to prevent leaching of contaminants. Protective coverings will help prevent runoff stripping a stockpile. Concrete should also be stored correctly to prevent release into watercourses and / or drains.

Excavated Ground and Exposed Ground

G6.5 To limit the volume of runoff reaching the exposed ground, runoff diversion or interception devices can be placed upstream. To help prevent pollution from entering a watercourse, silt fences, hay bales or stilling ponds can be placed downstream.

- G6.6 The pollution, sediment and erosion control mitigation measures as detailed above will ensure that the effects on receptors during the construction phase are negligible.

During Operation

Increased Surface Water Runoff

- G6.7 In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge rates and volumes from the site will be controlled.
- G6.8 Existing greenfield runoff rates have been estimated using the ReFH2 method. The existing 1 in 1 year event greenfield rate for the 30.9ha development site is 170.1 l/s.
- G6.9 In order to ensure no increase in surface water runoff as a result of the development, the runoff rate will be controlled, and sustainable drainage systems used to accommodate the 1 in 100 year plus 40% CC storm event in line with local and national policy.
- G6.10 Full planning permission is sought for Units 1 and 2 and as such, the layout for these units is fixed. Outline planning permission is sought for the remainder of the site, with layouts of the units subject to change. Surface water runoff will be discharged to the River Tame via an existing outfall on the public surface water sewer which crosses the site at a rate of 170.1 l/s, this rate will be split pro-rata between the development Units. It is proposed to replace the existing 1050mm public surface water sewer which crosses the site with a with new surface water culvert. Surface water runoff up to the 1 in 100 year plus 40% climate change allowance event will be attenuated on site. In order to achieve a 1 in 1 year greenfield runoff rate, Unit 1 has an estimated storage volume of 3,420m³ and Unit 2 has an estimated storage volume of 1,542m³. For the remainder of the site, a total attenuation volume of 7,358m³ will be required to achieve the greenfield discharge rate. Attenuation should be calculated on a plot by plot basis with discharge rates and attenuation volumes prorated.
- G6.11 The proposed surface water drainage scheme will ensure no increase in runoff over the lifetime of the proposed development.
- G6.12 Given the size of the development, the drainage arrangements may need to be phased. This should be confirmed at the detailed design stage. It may therefore be preferred to calculate the discharge rates and attenuation per plot.
- G6.13 Storm events in excess of the 1 in 100 year plus 40% CC event should be permitted to produce temporary shallow depth flooding within the yards, parking areas, access roads and landscaped areas. Where appropriate (given the proposed site development), finished floor levels will be set at a minimum of 150mm above surrounding ground levels ensuring exceedance flooding will not affect the buildings.
- G6.14 The mitigation offered by the surface water drainage system is reliant upon it functioning correctly. The surface water drainage system will need to be managed and maintained to ensure it functions correctly and provides the necessary mitigation.
- G6.15 Maintenance for SUDS features which could include detention basins, ponds, swales, permeable pavement or an attenuation tank, will be undertaken in accordance with the operation and maintenance requirements as detailed in the CIRIA C753 publication The SuDS Manual (2015).

Increased Foul Water Runoff

- G6.16 Correspondence from UU states that; 'Foul will be allowed to drain to the public combined sewer network at an unrestricted rate'. The foul water drainage system will be designed

accordingly. This will ensure that the effects on receptors during the construction phase are negligible.

Chemical /Fuel Spillages

G6.17 The final use(s) of the proposed industrial units is to be confirmed. However, any future users of the proposed unit will be required to conform with building regulations and specific legislative requirements for the intended end use.

G6.18 Examples of potential mitigation will include but not be limited to the following:

- 1 Appropriate storage of fuels and chemicals;
- 2 Correct storage and disposal of waste liquids and materials;
- 3 Maintenance of machinery and plant in accordance with manufacturers recommendations;
- 4 Designated areas for refuelling and appropriate procedures and training for refuelling;
- 5 Emergency response procedures; and
- 6 Appropriate security to minimise the risk /impact of vandalism /mis-adventure.

G7.0 **Residual Effects**

During Construction

G7.1 Residual effects during construction have been categorised as those having a more than 'minor or negligible' effect or significance after the application of mitigation measures. The mitigation measures will ensure that the effect of the development on all receptors is 'minor' or 'negligible'. No residual risks are identified.

During Operation

G7.2 Residual effects during operation have been categorised as those having a more than 'minor or negligible' effect or significance after the application of mitigation measures. The mitigation measures will ensure that the effect of the development on all receptors is 'low' or 'negligible'. No residual risks are identified.

G8.0 Summary & Conclusions

- G8.1** The site is situated at a minimum of 68.7metres Above Ordnance Datum. The site is located within Flood Zone 1 on the EA 'Flood Map for Planning' meaning it has a less than 1 in 1000 annual probability of flooding. The site is considered to be at low risk of flooding from all sources. The River Tame is located approximately 20m north-east of the site. The site is underlain by Secondary (undifferentiated) and Secondary A aquifers. The Groundwater Source Protection Zones' map indicates that the site is not located within a Groundwater Source Protection Zone.
- G8.2** The United Utilities sewer records show that there is a 1,050mm public surface water sewer that crosses the southern extent of the site from south-west to north-east, discharging to the River Tame. A 750mm public surface water sewer flows north from the southern extent of the site, joining the 1,050mm public surface water sewer in the south-western extent of the site. Furthermore, immediately adjacent to the site entrance in the south-western extent of the site, there is a 225mm public foul sewer that flows north-west within the road, to a pumping station.
- G8.3** The site is elevated by a minimum of 15m above the River Tame. Therefore, climate change and the resulting increase of flood levels within the River Tame are highly unlikely to have an effect on the site. The effects of climate change on the flood zone classification is therefore not considered to be pertinent.
- G8.4** A summary of the effects of the identified effects and proposed mitigation are detailed in Table G8.1 below.

Table G8.1 Summary of Effects

Receptor	Effects	Mitigation	Residual Effects
During Construction			
Receptors to chemical / fuel spillages include the River Tame and underlying aquifers	Moderate adverse	Prevent oil and hydrocarbons becoming pollutants. Conventional good practice measures can be taken to prevent oil and hydrocarbons becoming pollutants.	Negligible
Receptors to siltation from haul roads include the receiving watercourses	Minor adverse	Appropriate design, minimal length, shallow gradients; plant and wheel washing; intercept runoff and keep gullies clear; reduce dust	Negligible
Receptors to siltation from stockpiles include the receiving watercourses	Minor adverse	Locate away from watercourses; use protective coverings; store concrete correctly	Negligible
Receptors to excavated ground and exposed ground include the receiving watercourses	Minor adverse	Install diversion / interception devices or silt fences, hay bales or stilling ponds.	Negligible
During Operation			

Receptor	Effects	Mitigation	Residual Effects
Receptors to an increase in surface Water Runoff include the River Tame and land downstream of the site	Major adverse	Discharge at greenfield runoff rate; accommodate runoff in SuDS features; up to the 1 in 100 year plus 40% CC event; drainage system installation and operation may need to be phased; drainage system should be maintained appropriately	Negligible
Receptors to an increase in foul water runoff include the River Tame and land and users upstream and downstream of the site	Major adverse	Foul fowls will be allowed to drain to the public combined sewer network at an unrestricted rate	Negligible
Receptors to chemical / fuel spillages include the River Tame and underlying aquifers	Major adverse	Prevent oil and hydrocarbons becoming pollutants. Conventional good practice measures can be taken to prevent oil and hydrocarbons becoming pollutants.	Negligible

G9.0 **Abbreviations & Definitions**

- 1 WFD – Water Framework Directive
- 2 EQSD - Environmental Quality Standards Directive
- 3 EQS - Environmental Quality Standards
- 4 NPPF – National Planning Policy Framework
- 5 NPPG – National Planning Practice Guidance
- 6 DPD – Development Plan Document
- 7 SuDS – Sustainable Drainage Systems
- 8 CC – Climate Change
- 9 CDA - Critical Drainage Area
- 10 SFRA – Strategic Flood Risk Assessment
- 11 PFRA – Preliminary Flood Risk Assessment
- 12 EA – Environment Agency
- 13 LiDAR - Light Detecting and Ranging
- 14 QMED – flood with a 1 in 2 year return period
- 15 CIRIA - Construction Industry Research and Information
- 16 m AOD – metres Above Ordnance Datum
- 17 LLFA – Lead Local Flood Authority
- 18 UU – United Utilities

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