

12 HYDROLOGY AND DRAINAGE (UPDATED JANUARY 2014)

12.1 Introduction

12.1.1 This chapter of the Environmental Statement assesses the likely impact of the proposed development upon local hydrology, with particular consideration given to flood risk and drainage during the construction and operational phases at existing sensitive receptor locations. Where potential impacts have been identified mitigation measures have been defined in order to minimise the significance of the effect which would result.

12.1.2 This chapter also describes the planning policy context relating to hydrology, drainage and flood risk. It should be read in conjunction with the Flood Risk Assessment report attached as Appendix 12.1.

12.1.3 The aims of this chapter are to:

- Identify all hydrological and drainage receptors within the study area that may be affected by the development;
- Establish the baseline hydrology and drainage characteristics for the study area including watercourse hydraulic characteristics, surface water run-off characteristics and flood risk;
- Identify the potential impacts of the construction and operation of the development;
- Identify the significance of identified impacts; and
- Propose appropriate mitigation measures where relevant.

Flood Risk Assessment

12.1.4 As the site is greater than 1 hectare, a flood risk assessment has been carried out and is referenced within this Chapter of the ES. The Flood Risk Assessment report:

- describes the existing situation with respect to flood risk and drainage;
- assesses future flood risk and drainage in accordance with the guidance set out in the NPPF, covering flood history, surface water flood risk, groundwater flood risk, surface water drainage, foul sewage disposal, climate change and residual risk and safety.

12.1.5 The FRA, which was updated in January 2014, covers flood risk elements affecting the development, therefore, flood risk to the development is not covered by this

Chapter. However, the potential impacts arising from the development which may affect the existing baseline environmental flood risk (i.e. the current level of flood risk on site and in the surrounding area) are covered.

12.2 Assessment Approach

12.2.1 The methodology applied in the assessment is a qualitative risk assessment methodology in which the probability of an impact occurring and the magnitude of the impact, if it were to occur, are considered. This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the risk presented by the development.

12.2.2 This chapter has been prepared by way of:

- Reference to relevant National and Local Planning Policy;
- Site walkover inspection;
- Reference to the Flood Risk Assessment report, updated in January 2014, appended in Appendix 12.1 of this Environmental Statement;
- Assessment of the potential impacts of the Development;
- Review of appropriate mitigation measures; and
- Assessment of the residual impacts and the significance of the resultant effects.

Methodology

12.2.3 The generic potential hydrological impacts associated with the development of commercial land uses include the reduction of surface water quality, alteration or disruption of existing watercourses, alteration of the saturation levels within superficial deposits, alteration in surface water runoff and drainage rates and increased risk of flooding.

12.2.4 **Receptor Sensitivity:** To assist in the assessment of individual impacts, specific guidelines on the definition of value and sensitivity for hydrology and drainage have been devised (Table 12.1). The hydrological sensitivity of a receptor is assessed by determining the impact that a change to that receptor will have on various environmental and economic issues.

12.2.5 The criteria for sensitivity are based on a hierarchy of factors relating to the aquatic environment, including international and national designations, waterbody status, site survey and the professional judgement of the assessment team. Not all of these criteria may actually be present within, adjacent to or downstream of the actual site.

These criteria are used to guide the analysis of the sensitivity of the baseline hydrological environment.

Table 122.1	
Hydrology sensitivity classification	
Sensitivity Category	Sensitivity Criteria
High	SSSI affected wetland / watercourse habitat of particular ecological importance Directly affects a commercial fishery Main River and/or Critical Ordinary Watercourse through or adjacent to site boundary
Medium	Wetland / watercourse habitat of some ecological importance Indirectly affects a commercial fishery Critical Ordinary Watercourse and/or Main River within 250m of site boundary
Low	Wetland / watercourse habitat of minor ecological importance Minimal effect to a commercial fishery Critical Ordinary Watercourse and/or Main River at >250m from site boundary
None	No aquatic habitats or watercourses present No commercial fisheries present No Main Rivers or Critical Ordinary Watercourses within 1km of the site boundary

12.2.6 Table 12.7 summarises the identified sensitive receptors and their sensitivity associated with this Development.

12.2.7 **Magnitude of Effect:** To assist in the assessment of individual impacts, specific guidelines on the definition of impact magnitude for hydrology and drainage have been devised (Table 12.2).

12.2.8 The guideline criteria are based on professional experience which has been adopted in other assessments that have previously been agreed and accepted as best practice, in the absence of specific and documented guidance that relates to determining the magnitude of effect in relation to hydrology.

Impact magnitude	Guideline criteria
High	Total loss of, or alteration to the baseline resource such that post development characteristics or quality would be fundamentally and irreversibly changed (e.g. watercourse realignment). Very significant change to key hydrological/hydraulic characteristics of the receiving water body or drainage system
Medium	Loss of, or alteration to the baseline resource such that post development characteristics or quality would be partially changed (e.g. in-channel permanent bridge works). Major change to key hydrological/hydraulic characteristics of the receiving water body or drainage system
Low	Small changes to the baseline resource, which are detectable but the underlying characteristics or quality of the baseline situation would be similar to pre-development conditions (e.g. culverting of very small watercourses). Minor change to hydrological/hydraulic characteristics of the receiving water body or local drainage system
Negligible	A very slight change to the baseline conditions, which is barely distinguishable, and approximates to the 'no change' situation (e.g. short term compaction from plant movements). Insignificant changes to hydrological/hydraulic characteristics of local drainage system

12.2.9 The significance of effects is determined in relation to the sensitivity of the baseline resource and magnitude of potential impacts, using the matrix shown in Table 12.3.

Magnitude of effect	Receptor Sensitivity			
	High	Medium	Low	None
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible / none
Negligible	Minor	Minor	Negligible / none	Negligible / none

12.2.10 Fundamental changes are those that are permanent, detrimental and that will result in widespread change in the baseline environment. Within the matrix the effects that are defined as major and moderate are considered to be 'significant' in EIA Terms (Table 12.3).

12.2.11 Appropriate assessment criteria for potential drainage and hydrological impact have been determined by way of consultation and adherence to current industry good practice, which includes;

- Runoff from the development is not to exceed the Greenfield run-off rate; and
- The development must not increase flood risk elsewhere.

Planning Policy Framework

12.2.12 The Local Development Framework policy document guides the way in which City of Bradford Council MDC will view the flood risk and drainage aspects of development proposals. Replacement Unitary Development Plan for the Bradford District was Adopted in October 2005 and is in place until the Bradford Local Plan is completed. The policies relevant to flood risk, hydrology and drainage is summarised below:

Policy NR15B

12.2.13 In other areas of flood risk identified as indicative floodplain by The Environment Agency development will not be permitted where it would:

(1) Increase the risks of flooding further downstream

- by increasing flows; or
- by impeding the flow of floodwater; or
- through the discharge of additional surface water; or
- by undermining the integrity of existing flood defences

(2) Be at risk itself from flooding

(3) Impede access to watercourses for maintenance

(4) Fail to provide adequate measures for the protection of public safety unless adequate protection or mitigation measures are undertaken as part of the proposed development.

Policy NR16

12.2.14 Development proposals, which add to the risk of flooding or other environmental

damage, as a result of surface water run-off will not be permitted unless effective control measures are provided. Development proposals will be required to incorporate sustainable drainage systems, which control surface water run-off, as close to source as possible.

Policy NR17A

12.2.15 Development adjoining or near to watercourses and bodies will not be permitted if it would have an adverse effect on nature conservation, water quality, fisheries, landscape, public access, or water based or water side recreation.

National Planning Policy Framework

12.2.16 The National Planning Policy Framework explains in Section 10 and in the associated Technical Guidance how flood risk should be taken into consideration during the planning and development process. The NPPF categorises flood risk by *flood zone* and defines the types of development *appropriate* to each flood zone according to *vulnerability*. The flood zones are defined as:

- Zone 1: Low Probability of flooding
- Zone 2: Medium Probability of flooding
- Zone 3a: High Probability of flooding
- Zone 3b: The Functional Floodplain - probability as Zone 3a

Environment Agency Flood Maps

12.2.17 The Environment Agency (EA) predicts the likelihood of flooding via a national series of indicative flood maps, available to the public by request and via the EA website, which show the NPPF Flood Zones described above.

City of Bradford Metropolitan District Council Preliminary Flood Risk Assessment

12.2.18 A Preliminary Flood Risk Assessment (PFRA) is a high level screening exercise to identify significant flood risk from Ordinary Watercourses, surface water run-off and groundwater. It does not directly consider flooding from main rivers, sewers or reservoirs. PFRAs have been produced by Lead Local Flood Authorities (LLFAs) to fulfil the requirements of the Flood Risk Regulations 2009. In this case, the LLFA is City of Bradford Metropolitan District Council and its PFRA was published in June 2011.

Scoping Responses

12.2.19 Environment Agency (9 July 2013):

- “It is expected that Greenfield surface water runoff rates must be adhered to. This applies for up to and including the 1 in 100 year (plus climate change) rainfall event. The reason for this is to reduce flood risk to the site and prevent an increase in flood risk elsewhere.”

12.2.20 Yorkshire Water (17 June 2013):

- “The application must be accompanied by details of where foul and surface water will be drained to. SUDs should be the preferred option for the disposal of surface water.
- Future site layout must take into account the presence of water and waste water infrastructure that is laid within the site boundary i.e. 2 * 1350mm diameter combined sewers, a 900mm diameter sewer, a 100mm diameter live water main along the site boundary. We would require appropriate stand-off distances between the infrastructure and any buildings/infrastructure. It may be possible to divert the pipes.”

12.2.21 City of Bradford MDC, Department of Regeneration (21 June 2013):

- “Separate drainage system required within site boundary.
- Public sewers cross the site in the area of the proposed buildings. The Sewerage Undertaker (Yorkshire Water) must therefore be consulted for any layout constraints and for a view of the impact of the development on the public sewerage system.
- No development shall take place until details of the proposed means of disposal of foul and surface water drainage, including details of any balancing works and off site works have been submitted to and approved by the local planning authority.
- The site must be investigated for its potential for the use of sustainable drainage techniques in disposing of surface water from the development. Only in the event of such techniques proving impracticable will disposal of surface water to an alternative outlet be considered.
- The developer must submit, to this council for comment a copy of a report detailing the results of the ground investigation, together with his design for the disposal of surface water from the development using sustainable drainage

techniques or, proof that such techniques are impracticable in this instance.

- Please note that drainage solutions for the development would be expected to adequately drain a 1 in 100 year event plus 20% for climate change and a further 20% to cater for increased urbanisation over the lifetime of the development.
- The development must be undertaken in such a manner so as not to change the overland surface water flow patterns to the detriment of adjacent landowners. Particular attention should be paid to ensuring ground levels are not changed at the site boundary. To this end a drawing indicating a plan of proposed and existing levels and cross sections is to be submitted to this council for comment.
- Any proposed liquid storage tanks for fuel oils or process chemicals, etc., shall be located within a bund having a capacity of not less than 110% of the combined volume of the tanks. The floor and walls of the bund shall be impervious to oil and water and shall also be resistant to any stored chemicals. All inlet/outlet/vent pipes and gauges shall be within the bunded area.
- Any oil or chemical drums used as storage containers shall be stored in a compound with an impervious base with the floor graded in such a manner that the contents of the largest drum are retained in the event of spillage.
- The developer is to submit his proposals for ensuring that the land drainage network is not subjected to pollution as a result of the processes to be used on this development.
- In accordance with PPS25, the application for the development site, being greater than one hectare, should be accompanied by a Flood Risk Assessment. This should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed.”

Consultations

12.2.22 The following sources of information have been consulted in order to investigate the hydrology, flood risk and drainage aspects of the site area:

- Flood Risk Assessment Report, Land off Marley Road, Keighley by Wardell Armstrong, August 2013, updated January 2014;
- Correspondence with the Environment Agency dated 13th August 2013;
- Correspondence with Yorkshire Water Services dated 19th August 2013.

Limitations of study

12.2.23 The exact location and sources of all water supplies and sewerage connections / septic tanks / outfalls that may be interrupted by the Development have not been determined by this study. Such details will need to be confirmed on the ground by the appointed construction contractor as and when required to ensure continuity of water supply and sewer services at nearby properties.

12.3 Baseline Conditions

12.3.1 This section presents an overview of the environmental baseline in the site area with respect to hydrology, flood risk and drainage.

Desk study

12.3.2 The approach included a review of the following:

- existing published hydrological information for the site area (EA, SFRA, PFRA etc)
- preliminary consultations with statutory bodies including EA, Yorkshire Water Services;
- assessment of baseline hydrological conditions within the site area and wider catchments.

Field study

12.3.3 The site inspection included a survey and verification of the following:

- watercourses, surface water features and land drainage network;
- ground conditions and nearest watercourses to building locations and access tracks.

Catchment Description and Surface Water Features

12.3.4 The nearest surface watercourses are an unnamed stream located 120m to the south east of the site and the River Aire at 220m to the north. The stream is assumed to join the River Aire to the north across the Aire Valley Road.

12.3.5 Average annual rainfall for Keighley is 1024mm as recorded by the Met Office between 1981 - 2010.

12.3.6 The site was inspected with respect to hydrology by Wardell Armstrong on the 16 August 2013. The site is generally level but is hummocky with reworked soil cover in the west and dense vegetative soil surface cover in the east. The site visit did not identify any official land drainage network on site area but a drainage ditch was

observed along the boundary with the Aire Valley Road and an area of standing water had formed by natural water flows along the central northern boundary.

Fluvial Flooding

12.3.7 The EA Flood Map shows that the site is within Flood Zone 1 and has a Low Probability of flooding.

Drainage

12.3.8 There are there are 750mm, 900mm, 1200mm, 1350mm and 1400mm diameter and 990x660mm size and 915 x 610mm size public foul/combined water sewers recorded crossing/crossing close to the site.

Greenfield Run-off Rate

12.3.9 The Greenfield run-off rate has been estimated using Micro Drainage software for a 1 in 100 year storm with an allowance of 20% for climate change. The indicative rate has been calculated in the Flood Risk Assessment as 25 litres per second.

Surface Water Abstractions / Discharges Consents

12.3.10 The nearest surface water abstraction licence at 718m west and is operated by Leach & Thompson Limited for Industrial/Commercial/Public Services: General Cooling (Existing Licences Only) (High Loss). There are two discharge consents within 250m of the site at 87m and 99m W (sewage discharge).

12.4 Key Impacts and Likely Significant Effects

Summary Description of the Development

12.4.1 Drawing 009 shows the site development layout. The Development would incorporate the following key elements:

- An energy from waste plant, constructed and operated;
- Hard-standing areas would need to be constructed adjacent to buildings to be used for access roadways and car parking;
- Modifications to the site entrance off Aire Valley Road and other minor road works within the boundary of the site.

12.4.2 This assessment addresses the potential impact, without mitigation, of the Development at three stages of the life cycle: construction, operation and decommissioning, and also considers the residual impacts. Operational effects associated with the Development relate to maintenance operations. Mitigation

measures have been identified and the impact reassessed post mitigation, resulting in the identification and assessment of residual effects.

Sensitive receptors

12.4.3 Sensitive hydrological and hydrogeological receptors within the vicinity of the Site are described in Table 12.4 and categorised in accordance with Table 12.1.

Table 12.4 Sensitive hydrological and hydrogeological receptors		
Receptor	Sensitivity	Justification
Surface Water		
River Aire	Medium	A Main River within 250m of the site boundary.
Unknown stream	Medium	Water course within 250m of the site boundary.

Potential Effects of Development

12.4.4 The potential hydrological impacts typically associated with the development of the waste to energy plant include the following and are summarised in Tables 12.5:

- change in surface water runoff and drainage regimes through soil stripping and installation of new drains (i.e. the response of watercourses to rainfall can be speeded up by the removal of soil resources and installation of new drains);
- alteration or disruption of existing watercourses including increased erosion, sediment deposition, and suspended solids in watercourses as a result of construction and decommissioning works;
- pollution downstream as a result of accidental spillages (including the introduction of calcareous waters) or inappropriate storage or refuelling practices during construction, operation and decommissioning which may filter into surface and groundwater reserves.

12.4.5 The potential impacts of the construction phase of the Development pre- and post-mitigation are discussed in the following paragraphs. Table 12.5 presents the results of the impact assessment pre- and post- mitigation, following the mitigation and best practice proposals set out in Section 12.7.

Construction Phase

12.4.6 A range of construction activities are proposed that could lead to impacts on the hydrology and drainage of the local environment and surface water watercourses.

These works include:

- the creation of bare earth surfaces through stripping of topsoil and vegetation and stockpiling;
- making changes to site topography and the levelling;
- the creation of impermeable and semi-permeable surfaces.

12.4.7 The types of impacts identified for construction works are as follows:

- Elevated surface water run-off and increased risk of flooding off-site; and
- Accidental spills and lead and/or elevated sediment delivery and deposition in watercourses.

12.4.8 Without appropriate mitigation in place, there is the potential for an increase in surface water runoff from the site which could cause flooding off-site.

12.4.9 The potential impact on surface water quality is related to the numerous activities during construction including creation of access roads and parking, earthworks associated with the erection of the buildings as well as the potential for accidental spills and leaks. The development activities may encourage soil erosion and increase the sediment loads of nearby watercourses or could pollute surface water.

12.4.10 These are considered to be a **moderate impact** if unmitigated. Potential impacts associated with fluvial/groundwater flooding and foul sewerage are considered negligible or absent.

Operational Phase

12.4.11 The potential impacts upon the local hydrology of the area during the operational phase are associated with the maintenance of buildings, parking areas and relevant infrastructure, including culverts, ditches and drains.

12.4.12 The main impacts would arise from potential pollution incidents and contaminated runoff from the site entering the drainage infrastructure, impacts associated with increased run-off from impermeable areas and buildings and additional loading on the foul sewerage system.

12.4.13 These are considered to be a **moderate impact** if unmitigated. Potential impacts associated with fluvial and groundwater flooding are considered negligible or absent.

Table 12.5
Summary of impacts, pre and post mitigation – Construction Phase

Potential Impacts	Nature of Impact	Receptor Sensitivity	Magnitude of effect	Significance of unmitigated effect	Mitigation Measures	Significance of residual effect
Change in surface water runoff regime and land drainage	Soil stripping and compaction and removal of vegetation which reduces attenuation potential and increases surface water runoff	Medium	Medium	Moderate	Upslope drainage design, road culverts, on site attenuation, controlled discharge, Brownfield discharge rate with betterment.	Minor
	Works affecting existing land drains or remains of historical culverts	Medium	Medium	Moderate		Minor
Surface Water Pollution	Increased erosion, sediment deposition and suspended solids in watercourses	Medium	Medium	Moderate	Pollution Incident Response Plan, appropriate storage. Strict preventative measures. No direct discharges to surface water or groundwater. Limited storage of soils. Operational measures. Maintenance of access tracks	Minor
	Change in water quality due to spillage of oils, fuels and cement	Medium	Medium	Moderate		Minor
Fluvial Flooding	Unlikely to be affected	-	-	-	-	-
Groundwater Flooding	Unlikely to be affected	-	-	-	-	-
Foul Sewerage	Unlikely to be affected	-	-	-	-	-

Table 12.5
Summary of impacts, pre and post mitigation – Operational Phase

Potential Impacts	Nature of Impact	Receptor Sensitivity	Magnitude of effect	Significance of unmitigated effect	Mitigation Measures	Significance of residual effect
Change in surface water runoff regime	Rapid transfer of rainwater to water courses via drains	Medium	Medium	Moderate	Upslope drainage design, road culverts, on site attenuation, controlled discharge, maintain greenfield discharge rate	Minor
Foul Sewerage	Additional load on the public sewerage and sewage treatment system	Medium	Medium	Moderate	On site attenuation, controlled discharge to sewer	Minor
Surface Water Pollution	Change in water quality due to spillage of oils and fuels	Medium	Medium	Moderate	Pollution Incident Response Plan, appropriate storage. Strict preventative measures. No direct discharges to surface water or groundwater. Limited storage of soils. Operational measures. Maintenance of access tracks	Minor
Fluvial Flooding	Unlikely to be affected	-	-	-	-	-
Groundwater Flooding	Unlikely to be affected	-	-	-	-	-

12.5 Mitigation Measures

Construction Phase

12.5.1 The impact assessment is based on the assumption that best practice measures would be used to minimise potential adverse impacts such as areas for water flow and quality attenuation of discharges before release and application of Sustainable Drainage System (SuDS) principles.

Construction - Surface Water Flooding

12.5.2 As there is minimal vegetative soil cover in the western part of the site, there will be minimal changes to the surface water run-off during construction works. However, in the eastern part of the site following the topsoil strip during earthworks there will be less retention of rainwater by soil and vegetation and consequently more run-off which is likely to contain silt washed off the exposed soil. Temporary site drainage will be installed during the construction period to direct this run-off to suitable discharge points where the attenuation pond will be constructed. Silt which settles out will be cleaned out regularly. The sensitivity of the surface runoff regime of the Site as a receptor is classified as medium given the soil's low attenuation properties; removal of this soil would have a magnitude of effect of medium and a **moderate adverse** impact if unmitigated

Construction – Land Drainage and Sewers

12.5.3 There is the potential for construction works to sever existing land drains and combined sewers. Appropriate stand-off distances between the combined sewers and any buildings/infrastructure will be adopted as part of the site construction. Known land drains will be incorporated into the permanent works where possible. Should unknown land drains be impacted during construction, they will be diverted temporarily into the site drainage system before being incorporated into the permanent works.

Construction – Pollution

12.5.4 Any accidental release of pollution during construction (e.g. sediment, fuel / oil) which may enter water course via surface water runoff or drainage ditches, would be classed as having a medium magnitude of effect, resulting in a **moderate** impact if unmitigated. Similarly, if unmitigated there could be a release of calcareous water during the construction of the site (i.e. accidental release of cementitious materials etc), resulting in a **moderate** impact if unmitigated.

12.5.5 The contractor should be required to adopt the following housekeeping measures:

- ensure all fuel, oils and other polluting substances are securely stored in suitable containers / bunded containers / impermeable areas;
- static machinery will be placed over a drip tray;
- Regular inspection and maintenance of plant for leaks; and
- plant refuelling will, where possible, be undertaken in a designated refuelling area.

12.5.6 A detailed pollution incident response plan will be prepared, identifying the resources available for control of accidental releases of pollution. These resources will be made readily available to contractors during construction.

Construction – Fluvial Flooding

12.5.7 Most of the construction works will be remote from the River Aire and therefore unlikely to affect it. No construction plant or materials will be stored near to watercourses.

Construction – Groundwater Flooding

12.5.8 Construction works are not considered likely to impact groundwater. Any uncontaminated groundwater encountered in excavations will be controlled by pumping out to the temporary site drainage system and this water will be dealt with in the same manner as surface run-off. However, any contaminated groundwater will be pumped out and passed through a water treatment system prior to discharge to temporary site drainage system.

Construction – Foul Sewerage

12.5.9 The construction works will involve making a connection to the existing combined sewers. Normal construction good practice will be employed to ensure that there is no adverse impact on the sewer. As with all works affecting public sewers, these works will be carried out under the supervision of the Water Authority, in this case Yorkshire Water Services.

Operational Phase

12.5.10 Potential impacts upon the local hydrology of the area during the operational phase are associated with the maintenance of storage tanks and relevant infrastructure, including culverts, ditches and drains.

12.5.11 Potential impacts include:

12.5.12 Pollution incidents and contaminated runoff impacts entering surface watercourses resulting in a **moderate** impact if unmitigated;

12.5.13 Surface water impacts associated with blocked culverts, drains and ditches from the site entering the sewers resulting in a **moderate** impact if unmitigated; and

12.5.14 Additional loading of the foul sewer network resulting in a **moderate** impact if unmitigated.

Operation – Surface Water Flooding

12.5.15 The proposed creation of about 2.87ha of impermeable area on this 3.5ha Brownfield site will result in a reduction in surface water run-off compared to current, due to betterment following development. Modelling of the surface water run-off from the impermeable areas using Micro Drainage software for a 1 in 100 year storm with an allowance of 20% for climate change indicates that a storage volume of about 1700 m³ will be needed to limit the discharge to the Greenfield run-off rate of 25 litres per second.

12.5.16 It is proposed to provide this storage volume in a SuDS-based underground tank in the western part of the site. The tank will occupy an area of about 1100 m² and have a depth of around 1.54m which will store the required 1700 m³ of stormwater.

12.5.17 All bare earth surfaces created during the construction phase that are not to be converted to impermeable / semi-permeable surfaces would be reseeded to reduce erosion and sediment entering the drainage and sewerage system.

Operation – Pollution

12.5.18 Site operator should be required to adopt the following housekeeping measures:

- ensure all fuel, oils and other polluting substances are securely stored in suitable containers / bunded containers / impermeable areas; and
- Regular inspection and maintenance of plant for infrastructure such as underground storage tanks and oil water separator in car park areas.
- A detailed pollution incident response plan will be prepared, identifying the resources available for control of accidental releases of pollution.
- By restricting drainage run-off rates through SuDS techniques, the erosion of bare soils would be reduced leading to a reduction in potential sediment generation and discharge off-site.

Operation – Foul Sewerage

12.5.19 A foul sewer connection will be made to either of the 1400/1350/900mm diameter public combined water sewers crossing the site.

Operation – Fluvial flooding

12.5.20 All the proposed development is located in Flood Zone 1 where the probability of flooding is low. Consequently, there is no significant risk of flooding from fluvial sources.

Operation – Groundwater Flooding

12.5.21 There is not considered to be any likely operational impact on groundwater.

Monitoring programme

12.5.22 No monitoring is required with regard to flood risk and drainage.

Robustness of Analysis

12.5.23 The assessment is based on data provided by the Environment Agency, City of Bradford MDC and Yorkshire Water Services. Numerical analysis has been carried out using the industry standard Micro Drainage software.

12.6 Summary and Conclusions

12.6.1 The only significant potential impact of this proposed development on the existing environment will be that of surface water run-off and its effect of increasing flood risk downstream. However, as described above and in the associated FRA, this impact will be fully mitigated by the provision of SuDS-based attenuation storage and flow control.

12.6.2 Other potential impacts concerning fluvial and groundwater flooding, land drainage, pollution and foul sewerage will be mitigated by good design to the point where their residual impacts are acceptable or negligible.

12.6.3 Overall, therefore, the proposed development will not adversely impact the hydrological or drainage environment.