15. Flood Risk and Drainage

Introduction

1. This chapter assesses the potential impacts of the proposed development on the water environment, and the likely significance of such impacts during its construction and operational phases.

2. The chapter addresses the following impacts:

- Surface water
  - Watercourses (rivers and canals)
  - Reservoirs, lakes and ponds
  - Wetlands
- Groundwater
- Flood risk management
- Land drainage
- Infrastructure
  - Water supply
  - Wastewater treatment and sewerage

3. The chapter describes the methods used to assess the likely significant effects; the baseline conditions that exist at the site and within the surrounding area; the mitigation measures required to prevent, reduce or offset any significant negative effects; and the likely residual effects after these measures have been adopted.

4. The chapter and appendices have been prepared in accordance with relevant key legislation, policy and guidance documents, including relevant requirements of the National Planning Policy Framework (NPPF) and supporting National Planning Practice Guidance (NPPG).

About the Author

5. This chapter of the Environmental Statement (ES) has been prepared by Weetwood Services Limited (“Weetwood”).

6. Weetwood is a water management and utilities consultancy serving the development industry across the UK. Weetwood has undertaken numerous Environmental Impact Assessments (EIA) in relation to the water environment for a range of developments.

7. This chapter of the ES has been written by Keely Bonser BSc (Hons), MSc, PhD. Keely is an Associate Director at Weetwood and has 7 years of experience working in the water environment. Keely has extensive experience of managing and co-ordinating both small and large projects and has produced numerous ES Chapters for a range of proposed developments and planning submissions including strategic development sites.

Legislation and Planning Policy Context

Legislative Framework

8. In preparing this section of the ES, a wide range of national legislation, and policy guidance documents relevant to the assessment have been considered. Relevant documents are listed in Table 15.1 and key documents are summarised in the subsequent text.

Table 15.1 Relevant Key Legislation, Policies and Guidance Documents

Context	Legislation, Policies and Guidance Documents
National	National Planning Policy Framework (updated 2019)
	National Planning Practice Guidance (2014, with subsequent updates, latest being 2019)
	Water Industry Act 1991
	Water Act 2003 (as amended)
	Flood and Water Management Act 2010
	Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
	National Flood and Coastal Erosion Risk Management Strategy for England, EA and DEFRA, 2011
	Control of Pollution (Oil Storage) (England) Regulations (2001)
	Surface Waters [Dangerous Substances (Classification)] Regulations 1998
	Groundwater Protection, 2017
	Control of Substances Hazardous to Health (COSHH) Regulations (2002)
	Environment Act 1995 (as amended)
	Surface Water (River Ecosystem) (Classification) Regulations 1994
	Land Drainage Act 1991 (as amended)
	Food and Environment Protection Act, 1985
	Making Space for Water – Taking Forward a New Government Strategy for Flood and Coastal Erosion Risk Management in England, DEFRA 2005
	Sustainable Drainage Systems: Non-statutory Technical Standards for SuDS, DEFRA 2015

	House of Commons Written Statement on Sustainable Drainage Systems (HCWS161), Department for Communities and Local Government, 2014
	The Building Regulations - Drainage and Waste Disposal, Approved Document H HM Government, Published in 2010, Amended 2015
	TAG Unit A3 Environmental Impact Appraisal, Department for Transport, January 2014
	Guidance on the Construction of SuDS (C768), CIRIA, 2017
	The SUDS Manual (C753), CIRIA, 2015
	Sustainable Drainage Systems – Hydraulic, structural and water quality advice (C609), CIRIA, 2004
	Control of Water Pollution from Construction Sites (C532), CIRIA, 2001
	Infiltration Drainage – Manual of Good Practice, CIRIA Report 156, 1996
	Control of Pollution from Highway Drainage Discharges, Report 142, CIRIA, 1994
	Code of Good Agricultural Practice for the Protection of Water (the “Water Code”) (DEFRA 1998 as amended 2002)
	Guidelines for the use of herbicides on weeds in or near watercourses and lakes, (DEFRA, 1995 PB2289)
	Sewerage Sector Guidance Appendix C - Design and Construction Guidance v2.0, March 2020
Local	Kirklees Council, Kirklees Local Plan Strategy and Policies, Adopted February 2019
	West Yorkshire Combined Authority, SuDS Guidance
Other Sources of Information	Humber River Basin Management Plan, Environment Agency, published 2016, last updated 2018
	Kirklees Council, Calderdale Metropolitan Borough Council and Wakefield Council, Calder Catchment Strategic Flood Risk Assessment, Volume I, April 2016
	Kirklees Council, Calder Catchment Strategic Flood Risk Assessment, Volume II, July 2016
	Kirklees Council, Preliminary Flood Risk Assessment, 2011
	Kirklees Surface Water Management Plan, 2011

	River Calder Catchment Flood Management Plan, Environment Agency, 2009
	Bradley Golf Course Flood Risk and Drainage Plan Report for Kirklees Council, RES Environmental Ltd, March 2018
	Websites for Government, DEFRA and British Geological Survey

National Legislation and Planning Policy

9. The aim of the Water Framework Directive (WFD) (Ref Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 - Establishing a framework for Community action in the field of water policy', available at: http://ec.europa.eu/environment/water/water-framework/index_en.html) is to establish good ecological and chemical status in all surface water and groundwater bodies. It also promotes the importance of sustainable water use.

10. During the implementation process, local planning authorities (LPA) must not act in a way to compromise the aims of the WFD, for which the Environment Agency (EA) is the 'competent authority'.

11. The WFD enables LPAs to enforce the control of diffuse pollution at source. Development proposals must not compromise the potential for delivering targets or actions set out in River Basin Management Plans (RBMP).

12. The Flood and Water Management Act 2010 (Ref Flood and Water Management Act, 2010. Available at: www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf) implements several key recommendations of Sir Michael Pitt's Review of the Summer 2007 floods.

13. The NPPF (Ref National Planning Policy Framework, Department of Community and Local Government, 2019, available at:) sets out the government's planning policies for England and how these are expected to be applied.

14. The NPPF guides LPAs and decision-takers both in drawing up plans and as a material consideration in determining applications. It includes policies to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk (paragraph 155 of the NPPF). In exceptional circumstances where new development is necessary in areas at risk of flooding, the policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall (paragraph 159-161 of the NPPF).

15. The NPPF advocates the use of the risk-based sequential test to steer new development to areas at lowest probability of flooding. It also matches the flood risk vulnerability of a development proposal to appropriate flood zones and provides details on how to include the potential effects of climate change on development.

16. The NPPF states that development should only be allowed in areas at risk of flooding if it incorporates Sustainable Drainage Systems (SuDS) (paragraph 163) and that major developments should incorporate sustainable drainage systems to appropriate operational

standards and with maintenance arrangements in place unless there is clear evidence that this would be inappropriate (paragraph 165).

1. The NPPF is accompanied by the NPPG (Ref https://www.gov.uk/guidance/national-planning-policy-framework

17. National Planning Practice Guidance, Department of Community and Local Government, 2019 available at:), which provides additional guidance to ensure the effective implementation of the policy set out in the NPPF.

National Regulations and Technical Guidance

The Building Regulations Approved Document H (Ref The Building Regulations - Drainage and Waste Disposal, Approved Document H, Published 2010, Amended 2015, CIRIA, Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf) stipulates that rainwater from roofs and paved areas is disposed of by, in order of priority: a soakaway or infiltration system; a nearby watercourse or a public sewer. The strategy for surface water drainage has taken account of this order of priority.

SuDS techniques as described in CIRIA C753 (Ref The SuDS Manual, Report 753, CIRIA, 2015) aim to deal with surface water as close to the source as possible and reproduce natural drainage patterns to prevent an increase in the volume and peak discharge from development sites. CIRIA C753 provides developers with best practice guidance on the planning, design, construction, operation and maintenance of SuDS.

The Technical Standards for SuDS, published by DEFRA (Ref Sustainable Drainage Systems: Non-Statutory Technical Standards for Sustainable Drainage Systems, Department for Environment, Food and Rural Affairs, 2015, Available at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards) provides non-statutory guidance on runoff control (rates and volumes) for new drainage systems discharging to any drain, sewer or surface water body.

Design and Construction Guidance (Ref Sewerage Sector Guidance Appendix C - Design and Construction Guidance v2.0, March) provides guidance on the design, construction and maintenance of drains and sewers outside buildings which are to be adopted by a relevant sewerage undertaker.

Local Planning Policy

18. Kirklees Local Plan references flood risk in Policy LP5: Masterplanning Sites Part M and in Policy LP24: Design Part D vii.

19. Policy LP27: Flood Risk is summarised as follows:

- *Proposals for development which require a Sequential Test will need to demonstrate that development has been directed to areas at the lowest probability of flooding, following a sequential risk based approach*
- *Proposals within flood zone 3ai will be assessed in accordance with national policies relating to flood zone 3a but with all of the following additional restrictions: No new highly vulnerable or more vulnerable uses will be permitted; Less vulnerable uses may only be permitted where the sequential test has been passed and where extensions*

are linked operationally to an existing business or where redevelopment of a site provides buildings with the same or a smaller footprint

- *All proposals will be expected to include flood mitigation measures which should be identified and considered through a site specific flood risk assessment*
- *Development will not be permitted within the functional floodplain*

20. Policy LP28: Drainage is summarised as follows:
    - *SuDS will be used to assist in achieving the following:*
        - *Greenfield runoff rates should not be exceeded*
        - *Brownfield sites should have a minimum 30% reduction in runoff where previous positive surface water connections from the site can be proven. New connections will be subject to at least greenfield restrictions*
        - *No negative impact on local water quality*
        - *Consider whether proposed open spaces and green infrastructure within sites can contribute to sustainable drainage of the site*
    - *Local conditions may require a lower runoff rate to be agreed to reflect volume control, local surface water risks, watercourse capacity and flood risk further downstream*
    - *There will be a general presumption against pumping surface water. Also demonstrate that the surface water management solution is designed for the lifetime of the development including maintenance arrangements*
    - *Accommodate flow paths by ensuring paths are designed to avoid buildings and curtilages*
    - *Development will only be permitted if water supply and waste water infrastructure is available or can be co-ordinated to meet the demand from the new development.*

Other Sources of Information

21. The EA Humber RBMP (Ref River Basin Management Plan - Humber River Basin District, 2015. Available at:) focuses on achieving protection, improvement and sustainable use of water and is a requirement of the WFD. The plan identifies the management of future development as one of the key aspects that can influence achievement of the WFD requirements.
22. The Calder Catchment Strategic Flood Risk Assessment (SFRA) Volume I for Kirklees Council, Calderdale Metropolitan Borough Council and Wakefield Council (Ref 10) was produced to provide an evidence base to inform Council's Local Plans and Sustainability Appraisal (SA) with respect to local flood risk issues and the location of future development within each authority. The SFRA Volume II (Ref Kirklees Council (July 2016) Calder Catchment SFRA Volume II (Kirklees Council), available at:) has been prepared to build on the work that was included in the SFRA Volume I specifically for Kirklees.
23. The overarching aim of the SFRA is to provide a framework for the management of flood risk by ensuring that all new development is located in areas of lowest flood risk and where this is not possible that there is appropriate justification and that there is sufficient mitigation to prevent an unacceptable increase in flood risk to people and property.

Methodology

24. Surface and sub-surface receptors (refer to Table 15.2) potentially susceptible to environmental effects from flooding and drainage issues associated with the proposed development have been identified as discussed below. The identification of receptors has been informed by an assessment of baseline conditions.

25. The presence, location and quality of surface water and groundwater bodies at and within the vicinity of the site and the risk of flooding from known sources have been assessed utilising Ordnance Survey (OS), Government, EA and British Geological Survey (BGS) (Ref British Geological Society website, available at: http://www.bgs.ac.uk/data/mapViewers/home.html) data and mapping and the other sources of information listed in Table 15.1 including the SFRA Volumes I and II for Kirklees and Humber RBMP.

26. Geological information for Parcel R and Parcel A within the site has further been informed by a Geo-Environmental Appraisal report (Ref 13) and a Phase 1 Geo-Environmental Appraisal report (Ref 14) respectively.

27. The assessment of flood risk has also been informed by topographic data derived from EA LiDAR.

28. In accordance with national and local planning policy and guidance (as set out in Table 15.1), and based upon professional experience and judgement, a package of measures to mitigate flood risk has been developed to ensure that the proposed development will be safe from flood risk for its lifetime, taking climate change and the vulnerability of its users into account.

29. A strategy for the management of surface water runoff has also been developed in accordance with planning policy and technical standards and the requirements of the WFD. The strategy has been informed by an assessment of the existing drainage regime at the site utilising EA LiDAR data and BGS borehole records and geology mapping to define the topography of the site and the underlying ground conditions. This information has in turn been utilised to inform the proposed means of disposal of surface water runoff from the proposed development.

30. The EIA has been informed by a site-specific Flood Risk Assessment (FRA) (Ref 15; Appendix 15.1) prepared in accordance with the NPPF.

31. Flood Risk and Drainage Assessment (FRDA) reports have been prepared for Parcel R and Parcel A within the site (Ref 16 and Ref 17); for completeness, both parcels of land are included within the FRA for the site as a whole (Ref 15).

32. The requirements for sewerage and wastewater treatment have been informed through consultation with Yorkshire Water (YW) for Parcel A in October 2018 and Parcel R in February 2019.

33. Consultation responses to the EIA Scoping Opinion have been provided by the EA and Kirklees Council (as lead local flood authority) which have been used to inform this chapter.

Assumptions and Limitations

34. The scope of the assessment has been based upon a review of available desktop information within the study area to identify the baseline conditions and development receptors. This has been supported by detailed assessments where necessary/required as detailed within this chapter.

35. An assessment of the potential effects of the development has been undertaken based on utilising the best data, methods and scientific knowledge available at the time.

36. A pre-planning enquiry response is only valid for a maximum period of 12 months, and therefore, responses from YW would require validating through re-consultation.

Significance Criteria

37. Informed by the baseline assessment, surface and sub-surface hydrology receptors of potential environmental effects have been identified (Table 15.5). The 'importance' of each receptor has been designated using professional judgement and by reference to the guidance criteria presented in Table 15.2.

38. The potential effects and magnitude of effects on each receptor have been identified using the criteria presented in Table 15.3 (informed by the baseline assessment), professional experience and stakeholder consultation.

39. In order to assess the potential significance of the effect of the proposed development on the identified receptors, the characteristics of each identified effect at the demolition and construction and operational stages have been considered in accordance with the following factors:

    - Direction (positive, negative or neutral effect)
    - Magnitude (the amount or level of effect)
    - Extent (area in hectares, linear metres)
    - Duration (in time)
    - Cumulative effects (from a number of different sources)

40. Identified effects may be significant at the level of importance defined for the receptor, or at a lesser geographical scale. For example, limited effects on a watercourse of County value might be assessed as being significant at a District level. Thus, the significance of effects has been determined from the importance of the receptor, the magnitude of the change and, where appropriate, the likelihood of the effect occurring using the effect significance matrix presented in Table 15.4. For the purposes of this assessment, a significant effect is a moderate magnitude or above and is highlighted in bold in Table 15.4

41. Mitigation measures have been developed for identified effects using technical guidance, best practices and professional experience. Where the significance of an effect (or effects) is assessed to be “Negligible”, no mitigation measures are considered to be necessary.

42. The magnitude of effects following the application of the identified mitigation measures (i.e. the residual effect) has been assessed with reference to the extent, magnitude and duration of the effect and performance against environmental quality standards, again with reference to the criteria presented in Table 15.2. The significance of the residual (i.e. post mitigation) effects has been assessed as described above.

Table 15.2: Estimating Receptor Importance

Importance	Criteria	Measures
Very high *National*	Receptor has a high quality and rarity on an international or national scale	Surface Water: Designated Salmonid / Cyprinid fishery High WFD Ecological status Good WFD Chemical status Protected under UK habitat legislation (e.g. Site of Special Scientific Interest, EA Water Protection Zone, Ramsar site)
		Groundwater: Principal aquifer providing a regionally important resource or supporting site protected under UK habitat legislation Source Protection Zone 1 Good WFD status
		Flood Risk Management: Highly vulnerable land uses such as essential transport and utility infrastructure.
High *County to Regional*	Receptor has a high quality on a county or regional scale	Surface Water: Major Cyprinid fishery Good WFD Ecological status Good WFD Chemical status Species protected under UK habitat legislation
		Groundwater: Principal aquifer providing a locally important resource or supporting river ecosystem Source Protection Zone 2 Good WFD status
		Flood Risk Management: Highly vulnerable land uses such as emergency services and basement dwellings

Importance	Criteria	Measures
Medium *Local to District*	Receptor has a medium quality on a local or district scale	Surface Water: Moderate WFD Ecological status Good WFD Chemical status
		Groundwater: Secondary aquifer with limited connection to surface water Good/Poor WFD status Source Protection Zone 3
		Flood Risk Management: More vulnerable land uses such as hospitals, residential units, educational facilities and waste management sites
Low *Site*	Receptor has a low quality and rarity on a local scale	Surface Water: Poor/Bad WFD Ecological status Poor WFD Chemical status
		Groundwater: Unproductive strata Poor WFD status
		Flood Risk: Less vulnerable land uses such as water-compatible developments, retail, commercial and general industrial units, agricultural/forestry sites and water/sewage treatment plants

Table 15.3: Criteria for Estimating the Magnitude of Change on a Receptor

Magnitude	Criteria	Descriptor
Substantial beneficial	Major improvement in receptor quality	Surface Water: Improvement in WFD class Removal of existing polluting discharge to or removal of likelihood of polluting discharge occurring

Magnitude	Criteria	Descriptor
		Groundwater: Improvement in WFD class Removal of existing polluting discharge to aquifer or removal of likelihood of polluting discharge occurring Increase in aquifer recharge
		Flood Risk Management: Substantial reduction in flood risk. This may be a reduction in flood depth, flood flow velocities or extent of flooding
Moderate beneficial	Moderate improvement of receptor quality	Surface Water: Improvement in WFD class
		Groundwater: Improvement in WFD class Major reduction in risk of pollution of groundwater by spillage
		Flood Risk Management: Moderate reduction in flood risk. This may be a reduction in flood depth, flood flow velocities or extent of flooding
Minor beneficial	Some minor beneficial change to receptor or a reduced risk of negative effect occurring	Surface Water: Improvement in WFD class
		Groundwater: Significant reduction in risk of pollution of groundwater by spillage
		Flood Risk Management: Minor reduction in flood risk. This may be a reduction in flood depth, flood flow velocities or extent of flooding
Negligible	Effect on receptor but of	Surface Water: Negligible or no risk of pollution from a spillage

Magnitude	Criteria	Descriptor
	insufficient magnitude to affect the use or integrity	Groundwater: No measurable effect on aquifer Negligible risk of pollution from spillages
		Flood Risk Management: Negligible change in flood risk
Minor adverse	Measurable change in receptor quality or vulnerability	Surface Water: Minor risk of pollution from a spillage
		Groundwater: Low risk of contamination of groundwater from polluted runoff Minor effects on groundwater supported wetlands
		Flood Risk Management: Minor increase in flood risk. This may be an increase in flood depth, flood flow velocities or extent of flooding
Moderate adverse	Change to integrity of receptor or loss of part of receptor	Surface Water: Reduction in WFD class Medium risk of pollution from a spillage Partial loss of productivity of a fishery
		Groundwater: Reduction in WFD class Partial loss, or change to aquifer Medium risk of contamination of groundwater from polluted runoff Partial loss of integrity of groundwater supported wetlands
		Flood Risk Management: Moderate increase in flood risk. This may be an increase in flood depth, flood flow velocities or extent of flooding

Magnitude	Criteria	Descriptor
Substantial adverse	Loss of receptor or loss of quality and /or integrity of receptor	Surface Water: Reduction in WFD class High risk of pollution from a spillage Loss or extensive change to a fishery Loss or extensive change to a designated Nature Conservation Site
		Groundwater: Reduction in WFD class Loss of, or extensive change to an aquifer High risk of contamination of groundwater from polluted runoff Loss of, or extensive change to groundwater supported wetlands Reduction in aquifer recharge
		Flood Risk Management: Significant increase in flood risk. This may be an increase in flood depth, flood flow velocities or extent of flooding

Table 15.4: Estimating the Significance of Potential Effects Matrix

		Magnitude of Change			
		Negligible	Minor	Moderate	Substantial
Importance of Receptor	Very high	Negligible	**Minor /Moderate**	**Moderate**	**Substantial**
	High	Negligible	Minor	**Moderate**	**Moderate/ Substantial**
	Medium	Negligible	Negligible	Minor	**Moderate**
	Low	Negligible	Negligible	Negligible	Minor

Baseline Conditions

Existing Conditions

Surface Water

43. The following surface water features are located within the vicinity of the site as illustrated in Figure 2 of the FRA (refer Appendix 15.1):

- River Calder located approximately 520 m to the north of the eastern portion of the site
- Calder and Hebble Navigation Kirklees Cut (referred to as the Calder and Hebble Navigation for the purposes of this chapter) located approximately 500 m north of the eastern portion of the site
- Bradley Park Dike located approximately 330 m to the north of the western portion of the site
- Deep Dike issues within the western portion of the site near to the northern boundary of the site
- An unnamed watercourse issues within the western portion of the site and flows towards a pond located adjacent to the northern boundary of the site. For the purposes of this chapter, the watercourse is referred to as 'Unnamed Watercourse 1' (UW1)
- A Pond is located between the centre of the site and the southern boundary. An unnamed watercourse flows from the pond towards the southern boundary and is referred to as UW2
- A culverted land drain located within the south-eastern corner of the site
- River Colne located approximately 2.30 km and 1.45 km to the south and south-east of the site respectively
- Huddersfield Broad Canal located approximately 1.75 km and 1.30 km to the south and south-east of the site respectively

River Calder

44. The River Calder flows in a predominantly easterly direction approximately 520 m to the north of the site and in a south-easterly direction approximately 520 m to the east of the site. The Calder and Hebble Navigation is located between the River Calder and the site.

45. According to the Flood Estimation Handbook (FEH) Web Service, the River Calder has a catchment area of approximately 393 km² at a point adjacent to the east of the site.

Calder and Hebble Navigation

46. The Calder and Hebble Navigation spurs off the right bank of the River Calder approximately 500 m north of the site. The navigation re-joins the River Calder approximately 600 m to the north-east of the site.

Bradley Park Dike

47. Bradley Park Dike is a small ungauged tributary of the River Calder. Bradley Park Dike flows predominantly in a north-easterly direction a minimum of approximately 330 m to the north of the western portion of the site.

48. Based on OS Mapping, it is assumed that Bradley Park Dike flows into the Calder and Hebble Navigation approximately 500 m to the north of the eastern portion of the site.

49. According to the FEH Web Service, the catchment of Bradley Park Dike from source to its confluence with the Calder and Hebble Navigation is predominantly rural with a catchment area of 1.67 km^2.

Deep Dike

50. Deep Dike is a small ungauged tributary of Bradley Park Dike issuing within the western portion of the site near to the northern boundary and flows in a north-easterly direction towards its confluence with Bradley Park Dike approximately 380 m to the north of the site.

Unnamed Watercourse 1 and 2

51. UW1 issues within the western portion of the site and flows towards a pond located adjacent to the northern boundary of the site. The FRDA report for Parcel A states that the pond does not appear to have any outfalls, and that based on Flood Risk from Surface Water mapping (refer Figure 4 of the FRA; Appendix 15.1), flow from this pond may follow a route along the northern boundary of the site and then adjacent to the M62 potentially discharging to Bradley Park Dike via a culvert under the M62 to the north.

52. UW2 is indicated to flow from a small pond located at Bradley Park Golf Course. Based on OS mapping the watercourse flows in an easterly direction before flowing in a south-easterly direction towards Bradley Road. According to the FRDA report for Parcel A, UW2 leaves the site via a culverted course between dwellings on Bradley Road near to Redwood Drive, eventually connecting into a watercourse located in Screamer Wood adjacent to Redwood Drive.

53. The FRDA report for Parcel A indicates the presence of a culverted land drain located in the south-eastern corner of Parcel A which is indicated to connect into the public surface water sewer along Tithe House Way.

River Colne and the Huddersfield Broad Canal

54. The River Colne flows in an easterly direction towards its confluence with the River Calder approximately 1.2 km to the south-east of the site. The Huddersfield Broad Canal is located within close proximity to the north of the River Colne.

55. Both watercourses are located within the same catchment as UW2 and are therefore scoped in within this assessment.

Surface Water Quality

56. In 2009 the EA adopted the European Union (EU) WFD classification of water quality. For surface waters there are two separate classifications for waterbodies: ecological and chemical. For a waterbody to be in overall ‘Good’ status both ecological and chemical status must be at least ‘Good’.

57. Bradley Park Dike, Deep Dike, UW1 and UW2 have not been assessed under the WFD; however, the River Calder, the River Colne, the Calder and Hebble Navigation and the Huddersfield Broad Canal which the aforementioned watercourses outfall in to have.

58. There are no other WFD defined surface waterbodies within the vicinity of the site or upon which the site would impact.

59. The River Calder within the vicinity of the site is referred to within the WFD as the 'Calder from Ryburn Confluence to River Colne' (Humber RBMP waterbody ID: GB104027062642).
60. The current WFD status of the waterbody is summarised below:
    - The current overall status is 'moderate'
    - The current ecological status is 'moderate'
    - The current chemical status is 'fail' due to failing under the priority hazardous substances Polybrominated Diphenyl Ethers (PBDE), Perfluorooctane Sulphonate (PFOS) and Mercury and its compounds
    - There is no current target date for achieving a 'good' overall status
61. The River Colne within the vicinity of the site is referred to within the WFD as the 'Colne from River Holme to River Calder (Humber RBMP waterbody ID: GB104027062550).
62. The current WFD status of the waterbody is summarised below:
    - The current overall status is 'moderate'
    - The current ecological status is 'moderate'
    - The current chemical status is 'fail' due to failing under the priority substance Cypermethrin and priority hazardous substances for PBDE and Mercury and its compounds
    - There is no current target date for achieving a 'good' overall status
63. The Calder and Hebble Navigation within the vicinity of the site is referred to within the WFD as the 'Calder and Hebble Navigation (river and canal sections)' (Humber RBMP waterbody ID: GB70410521).
64. The current WFD status of the waterbody is summarised below:
    - The current overall status is 'moderate'
    - The current ecological status is 'moderate'
    - The current chemical status is 'fail' due to failing under the priority hazardous substances for PBDE and Mercury and its compounds
    - The target date for achieving a 'good' overall status is by 2027
65. The Huddersfield Broad Canal Humber RBMP waterbody ID is GB70410176.
66. The current WFD status of the waterbody is summarised below:
    - The current overall status is 'moderate'
    - The current ecological status is 'Good'
    - The current chemical status is 'fail' due to failing under the priority hazardous substances for PBDE and Mercury and its compounds
    - There is no current target date for achieving a 'good' overall status

Groundwater

Ground Conditions and Hydrogeology

67. A geo-environmental appraisal of Parcel R was undertaken in March 2019 by Lithos (Ref 13). Fieldwork was undertaken between 12 and 14 February 2019 and included 41 No. trial pits up to depths of 3.1 m and soakaway tests within six trial pits.

68. The appraisal report described ground conditions as follows:

- Topsoil: Slightly sandy slightly gravelly clay up to a typical depth of 300 mm
- Cohesive residual soil: Slightly sandy slightly gravelly clay up to a depth of 1.9 m
- Granular residual soil: Slightly clayey sands and gravel/cobble encountered below the cohesive residual soils up to a depth of 3.0 m
- Bedrock: Encountered at the base of each trial pit up to a depth of 3.1 m

69. Groundwater seepages were encountered in six trial pits between depths of 1.2 m and 2.4 metres.

70. Soakaway tests were carried out in general accordance with BRE 365 to determine infiltration rates. Water levels did not fall sufficiently to enable an infiltration rate to be determined in five of the trial pits. It is concluded that soakaways are unlikely to provide a suitable drainage solution for the discharge of surface water runoff at the site.

71. A Phase 1 geo-environmental appraisal was undertaken for Parcel A in October 2018 by Alan Wood and Partners (Ref 14). The report indicates that the underlying bedrock formation comprises Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone) and that no superficial deposits were recorded.

72. As part of the Parcel A FRDA report fieldwork was undertaken comprising of foul trial pits. Ground conditions are described as predominantly clayey up to a depth of 0.8 m bgl underlain by Pennine Lower Coal Measures.

73. BGS mapping of surface geology indicates that the underlying bedrock at the site comprises of a combination of Pennine Lower Coal Measures Formation (mudstone, siltstone and sandstone) and Thick Stone (sandstone). No superficial deposits are recorded.

74. The National Geoscience Data Centre's Single Onshore Borehole Index holds records of two on-site boreholes and a number of boreholes in the vicinity of the site, in particular along the course of the M62. Records indicate that ground conditions comprise of layers of clay, sandstone, siltstone and shale.

75. According to the MAGIC website (Ref 18) the underlying bedrock is classified as a Secondary A aquifer. The site is not shown to be located within a designated groundwater source protection zone.

Groundwater Quality

76. The underlying Aire and Calder Carb Limestone/Millstone Grit/Coal Measures groundwater body has been assessed under the WFD (waterbody ID: GB40402G700400).

77. The current WFD status of the waterbody is summarised below:

- The current overall status is 'poor'

- The current quantitative status is 'good'
- The current chemical status is 'poor' due to its chemical dependent surface water body status
- The target date to achieve 'good' chemical dependent surface water body status, and thus a 'good' overall status is 2027

Flood Risk Management

Topography

78. LiDAR data has been used to develop a digital terrain model of the site and surrounding area as illustrated in Figure 3 of the FRA (Appendix 15.1).

79. Ground levels range between approximately 93.8 metres Above Ordnance Datum (m AOD) to 168.5 m AOD with levels generally falling in a north-easterly/easterly direction. The south-eastern portion of the site falls in a south-easterly direction.

Flood Zone Designation

80. According to the Flood Map for Planning (refer Figure 4 of the FRA; Appendix 15.1) the site is located in Flood Zone 1 (low probability of flooding – land having a less than 1 in 1,000 annual exceedance probability (AEP) of river or sea flooding).

Historical Flooding

81. There are no records of historic flooding at the site in the SFRA or in the EA's Recorded Flood Outlines database.

Fluvial Flood Risk

82. The Flood Map for Planning indicates that the site is not at risk of flooding from the River Calder or the River Colne. These watercourses are therefore scoped out from this assessment from a flood risk perspective.

83. The Flood Map for Planning only presents flood outlines for watercourses with a catchment area greater than 3.0 km²; land in the vicinity of watercourses with a smaller catchment area is shown to be in flood zone 1 by default. As such, the flood map may misrepresent fluvial flood risk from small watercourses.

84. The catchment area for Bradley Park Dike (including Deep Dike) is 1.64 km² i.e. below the 3.0 km² mapping threshold. UW1 and UW2 are not recognised on the FEH web service. In instances such as this, the Flood Risk from Surface Water map provides a useful proxy for fluvial flood risk.

85. The Flood Risk from Surface Water map (Figure 5 and Figure 6 of the FRA; Appendix 15.1) indicates that land adjacent to the on-site watercourses are at Low risk of flooding during extreme events, and therefore, there may be some propensity for localised flooding from the on-site watercourses with flood depths predominately less than 300 mm.

Flood Risk from Surface Water

86. The Flood Map from Surface Water map indicates that the site is predominantly at Very Low risk of flooding from surface water. A small number of surface water flow paths are indicated to be present on-site, however, most of the flow paths coincide with the on-site

watercourses and as such, the risk of flooding is assumed to be associated with the watercourses.

87. A surface water flow path is indicated to be present in the south-eastern corner of the site where the natural contours of the land forms a shallow swale feature where overland flow would be directed. The risk and extent of surface water flow paths, however, are reduced during less extreme events (Figure 6 of the FRA; Appendix 15.1).

Flood Risk from Reservoirs, Canals and Other Artificial Sources

88. The site is a minimum of approximately 35 m above ground levels adjacent to the Calder and Hebble Navigation and the Huddersfield Broad Canal. Given the difference in elevation levels, the site is considered not to be at risk of flooding from this source and therefore are scoped out from this assessment from a flood risk perspective.

89. There are two small ponds indicated to be located on site; given the size and location of these ponds the site is assessed not to be at risk of flooding from these sources. No other impounded waterbodies are located within the immediate vicinity of the site.

90. The Flood Risk from Reservoirs map indicates that the site is not at risk of flooding from such sources. The site is therefore not assessed to be at risk of flooding from reservoirs, canals or other artificial sources.

Flood Risk from Groundwater

91. The JBA Groundwater Flood Risk Indicator map (Figure 7 of the FRA; Appendix 15.1) indicates that the site is at Negligible to Very Low risk of flooding from groundwater i.e. peak groundwater levels are at least 5.0 m below the ground surface during a 100 year return period event.

Existing Site Drainage

92. The site is undeveloped greenfield. Given site topography and ground conditions, surface water runoff would be expected to flow overland in a direction determined by local topography and slowly infiltrate where conditions allow.

Water Services Infrastructure

Water Supply

93. Records provided by YW indicate that there are public water mains along Bradford Road, Bradley Road and Tithe House Way. A private water main is indicated to be present in Lamb Cote Road.

Sewers

94. YW sewer records indicate that there are public combined sewers in Bradford Road and Bradley Road, and a public foul water sewer and a public surface water sewer in Tithe House Way. The foul and surface water sewers are indicated to flow into the combined sewer in Bradley Road.

Development Receptor

95. Table 15.5 lists the identified environmental receptors and their assessed importance/scale using criteria presented in Table 15.2 as guidance.

Table 15.5: Development Receptors

Impact	Receptor	Nature of Effect	Importance of Receptor
Water quality *Surface water & groundwater*	Bradley Park Dike, Deep Dike, UW1, UW2, River Calder and River Colne	Pollution risk	Medium
	Calder and Hebble Navigation and Huddersfield Broad Canal	Pollution risk	Medium
	Ponds	Pollution risk	Low
	Aquifer	Pollution risk	Medium
Flood risk management *Inc. land drainage*	Bradley Park Dike, Deep Dike, UW1 and UW2	Flood risk	Medium
	Site workers and local residents (Construction phase)	Flood risk	Medium
	Site residents, visitors, local businesses, employees, school pupils, customers and local residents (Operational phase)	Flood risk	Medium
Infrastructure	Water supply infrastructure (Construction phase only)	Service continuity; increase in demand	Medium
	Sewerage infrastructure (Construction phase only)	Service continuity; increase in loading	Medium

Future Baseline

96. The existing flood risk to the site and surrounding area from the identified waterbodies, surface water, and the quality of the receiving surface water and/or groundwater body will remain as existing in the future, potentially improve or potentially deteriorate.

97. The committed or pending developments (discussed within the cumulative effects section of this chapter) within the vicinity of the site, if built out, could affect the future baseline for water resources and this is therefore considered below.

98. In accordance with the NPPF and the supporting NPPG, a site-specific Flood Risk Assessment (FRA) and/or Drainage Assessment (DA) should be undertaken in support of a planning application. This should include an outline surface water drainage strategy demonstrating how runoff will be managed so as not to increase flood risk elsewhere, with betterment provided where possible. Appropriate mitigation should also be incorporated

into the construction and operational phases of the committed scheme in order to ensure that surface water runoff is not contaminated, nor groundwater quality adversely affected.

99. Prior to the construction of all approved schemes, details of the mitigation measures addressing the above would need to be approved in writing by Kirklees Council.

100. Recognising the above, the schemes would be expected to have a Negligible effect on surface water, groundwater, flood risk and land drainage even in the event that all developments are operational. In turn this would be expected to have a Negligible effect on the future baseline scenario.

Assessment of Impact

101. This section summarises the likely effects of the proposed development during the construction and operational phases.

102. Due regard has been given to the parameters plan within the following assessment.

Embedded Mitigation

103. All construction works would be designed in accordance with the latest relevant guidelines including the ADAS Technical Note on Workmanship and Materials for Drainage Schemes (1995) (Ref 19).

During Construction

Surface Water and Groundwater

104. During the construction phase there will be a number of activities which could reduce surface water and groundwater quality and increase the risk of flooding from Deep Dike, Bradley Park Dike, UW1 and UW2 and surface water runoff to the site and elsewhere. These include:

- Materials handling, storage, stockpiling, spillage and disposal
- Earthworks involving manipulation of ground levels and re-engineering of existing made ground if/as necessary
- Excavation and foundation construction within the site and site preparation
- Installation of temporary and permanent infrastructure and roads
- Installation of temporary site accommodation and sanitary facilities
- Construction of proposed buildings
- Construction of water mains and associated apparatus
- Construction of surface water and foul water sewers
- Formation of public spaces, public realm and associated restoration and landscaping
- Movement and use of static and mobile plant/construction vehicles

105. Construction activities may lead to the disturbance and mobilisation of physical contaminants (i.e. dust, sediments and muds). During periods of heavy rainfall, vehicle movements resulting in damage to soil structure may generate increased sedimentation within surface water runoff. In addition, during periods of dry, windy weather, wind-blown dusts may be generated by the excavation of soils.

106. These activities may result in sediments directly or indirectly entering surface water features, thereby affecting the physical, chemical and biological quality of the surface water receptors in the surrounding area.

107. Contaminants, spilled contaminants and suspended sediments have the potential to affect surface and ground water bodies via surface runoff and infiltration.

108. Construction activities such as ground excavation or piling may create new pollutant pathways from the surface to the underlying superficial aquifer.

Flood Risk and Drainage

109. Potential ponding of surface water and accidental runoff to the surrounding area may occur whilst the surface water drainage system is being constructed.

110. On and off-site flood risk may increase due to increased runoff due to soil compaction on site.

111. The realignment of UW2 is under consideration so that it flows around the edge of the development platform. Flood risk may increase during the realignment of this watercourse.

Infrastructure

112. The existing public water mains and sewage infrastructure could also be affected during construction of the new water mains and foul sewer connections(s) from the site by YW and/or the appointed contractor, which has the potential to have a short term effect on local supplies and sewage disposal.

Summary

113. The likely effects of the proposed development during the construction phase prior to the implementation of mitigation measures are summarised in Table 15.6.

Table 15.6: Potential Effect during Construction Phase (Pre-Mitigation)

Impact	Receptor	Potential Effect	Importance of Receptor	Magnitude of Change	Significance of Effect
Water quality *Surface water & groundwater*	Bradley Park Dike, Deep Dike, UW1, UW2, River Calder and River Colne	Pollution risk	Medium	Moderate	Minor adverse
	Calder and Hebble Navigation and Huddersfield Broad Canal	Pollution risk	Medium	Moderate	Minor adverse
	Ponds	Pollution risk	Low	Negligible	Negligible
	Aquifer	Pollution risk	Medium	Moderate	Minor adverse

Flood risk management *Inc. land drainage*	Bradley Park Dike, Deep Dike, UW1 and UW2	Flood risk	Medium	Moderate	Minor adverse
	Site workers and local residents	Flood risk	Medium	Moderate	Minor adverse
Infrastructure	Water supply infrastructure	Connections	Medium	Minor	Negligible
	Sewerage infrastructure	Connections	Medium	Minor	Negligible

During Operation

114. The potential effects of the proposed development during the operational phase are detailed below.

Surface Water and Groundwater

115. The increase in impermeable area and traffic arising from the proposed development would increase the risk of contamination of surface runoff due to spillage of contaminants and from flushing of pollutants from the impermeable surfaces.

116. Contaminated surface runoff could enter local water and groundwater bodies via overland flow and infiltration.

Flood Risk

117. Any development or raising of ground levels within areas considered to be at risk of flooding has the potential to increase flood risk to people, property and elsewhere.

118. The large number of residents and users of the proposed development also has the potential to increase the risk of Deep Dike, UW1 and UW2 becoming blocked due to tipping of rubbish in the watercourses.

Land Drainage

119. The impermeable area of the site will increase as a result of the proposed development leading to an increase in peak surface water runoff rates and the total runoff volumes. If discharged to Bradley Park Dike, Deep Dike, UW1 and UW2 this would increase the flow in the receiving body and flood risk downstream if unattenuated.

Summary

120. The likely effects of the proposed development during the operational phase prior to the implementation of mitigation measures are summarised in Table 15.7.

Table 15.7 Potential Effect during Operational Phase (Pre-Mitigation)

Impact	Receptor	Potential Effect	Importance of Receptor	Magnitude of Change	Significance of Effect

Water quality *Surface water & groundwater*	Bradley Park Dike, Deep Dike, UW1, UW2, River Calder and River Colne	Pollution risk	Medium	Moderate	Minor adverse
	Calder and Hebble Navigation and Huddersfield Broad Canal	Pollution risk	Medium	Moderate	Minor adverse
	Ponds	Pollution risk	Low	Negligible	Negligible
	Aquifer	Pollution risk	Medium	Moderate	Minor adverse
Flood risk management *Inc. land drainage*	Bradley Park Dike, Deep Dike, UW1 and UW2	Flood risk	Medium	Moderate	Minor adverse
	Site residents, visitors, local businesses, employees, school pupils, customers and local residents	Flood risk	Medium	Moderate	Minor adverse

Environmental Mitigation Measures / Residual Impact Assessment

Mitigation and Monitoring

During Construction

121. Potential effects on the water environment through the construction phase would be managed by a range of operational, control and monitoring measures that, as a whole, would act to mitigate the potential effects on surface water, groundwater, flood risk, drainage and infrastructure.

General Practices

122. Prior to undertaking permanent and/or temporary works that would affect Deep Dike, Bradley Park Dike, UW1, UW2 or connections to existing public mains water/foul water infrastructure, the appropriate consents and permissions would be obtained from the relevant authority (e.g. Kirklees Council (as lead local flood authority), YW).

123. As a matter of course the following would occur; note the principal contractor may use alternative procedures compliant with their own environmental management system. However, the broad approach and content would as a minimum be comparable to the following:

- A Construction Environmental Management Plan (CEMP) or equivalent would be prepared and agreed with the LPA. The CEMP will set out the methods, including the

minimum requirements as agreed between the construction contractor and the LPA, by which construction will be managed to avoid, minimise and mitigate any adverse effects on the water environment. The CEMP should include details of the following:

- Site security
- Fuel oil storage, bunding, delivery and use
- How both minor and major spillage will be dealt with
- Containment of silt/soil contaminated runoff
- Disposal of contaminated drainage, including water pumped from excavations
- Site induction for workforce highlighting pollution prevention and awareness

- Contractors undertaking earthworks would develop risk assessments and method statements covering all aspects of their work that have the potential to cause physical damage to structures (e.g. water supply and sewerage infrastructure), mobilise large quantities of soil/sediments or block open watercourses. Earth moving operations would be undertaken in accordance with BS 6031: 2009 Code of Practice for Earthworks (Ref 20). These would be incorporated within the CEMP.
- Works affecting soils would follow MAFF's Good Practice Guide for Handling Soils (2000) (Ref 21) which provides comprehensive advice on soil handling including stripping, soil stockpiling and reinstatement.
- Works would comply with DEFRA guidance in the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009) (Ref 22) which provides guidance on the use, management and movement of soil on site. This action should prevent the mobilisation of sediment and prevent pollution of watercourses.
- Good practice guidance on erosion and pollution control would be followed, e.g. CIRIA Environmental Good Practice on Site (C650) (Ref 23) and Control of Water Pollution from Construction Sites (C532) (Ref 24).
- The principal contractor would avoid the storage of plant, machinery fuel or materials (including soil stockpiles) alongside watercourses unless unavoidable. Construction works should be programmed as far as is practicable to minimise soil handling and temporary soil storage.
- The refuelling of plant, storage of fuels and chemicals and overnight storage of mobile plant would be within the designated contractor's compound areas. The compounds would contain appropriate facilities for the storage of fuels and chemicals i.e. bunded and locked storage containers and would also be equipped with spill kits.

124. The adoption of best practice construction methods and construction management processes would significantly mitigate many of the identified potential environmental effects of the construction phase of the proposed development.

125. Surface water runoff during the construction phase will be carefully controlled with temporary drainage.

126. Connections to the public sewer from welfare facilities, should be made where possible. Where this is not possible hygienic portable facilities will be used. Foul water from the temporary staff welfare facilities would be contained within sealed storage vessels and

disposed of off-site to minimise the risk of surface or groundwater contamination. Welfare facilities would only be used for the disposal of domestic wastewater.

127. The principal contractor would avoid the storage of plant, machinery or materials in areas at risk of flooding wherever possible.

During Operation

128. Potential effects on the water environment through the operation phase would be managed by a package of mitigation measures as set out in the following section.

Surface Water, Groundwater and Land Drainage

129. Surface water runoff from the proposed development will, insofar as is possible, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development.

130. An outline surface water drainage strategy is presented in Section 6 of the FRA report (Appendix 15.1). The design principles of the strategy comprise the following:

- Infiltration testing has been undertaken within Parcel R. The results show that soakaways are unlikely to provide a suitable drainage solution for the discharge of surface water runoff. Based on ground conditions for the remainder of the site, including Parcel A, the disposal of surface water via infiltration is unlikely to be feasible; however, infiltration tests have not been undertaken at this stage and may be undertaken at the detailed design stage.
- It is proposed to direct all runoff from the developed site to existing watercourses and the culverted land drain (see Figure 8 of the FRA report (refer Appendix 15.1).
- Peak discharge rates from the proposed development will be restricted to QBAR (6.3 litres/second/hectare).
- For Parcel R, it is proposed to restrict surface water runoff to the existing 1 in 1 AEP event rate of 28.8 l/s.
- For Parcel A, a discharge rate of 13.5 l/s has been agreed with Kirklees Council. Land to the west of Parcel A (refer Figure 8 of the FRA report; Appendix 15.1) is also accounted for within the agreed discharge rate.
- The attenuation storage has been sized to store the 1 in 100 annual probability event including a 30% increase in rainfall intensity in order to allow for climate change.
- SuDS components will be used as part of the surface water drainage strategy in order to provide the necessary surface water attenuation required to restrict runoff rates from the proposed impermeable areas. SuDS are designed both to manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement. Therefore, SuDS objectives are to minimise the effects from a development on the quantity and quality of runoff and maximise amenity and biodiversity opportunities. The use of SuDS within the proposed development will reduce pollutant concentrations in stormwater, thus protecting the quality of the receiving waterbody and will also act as a direct buffer for accidental spills by preventing a direct discharge of high concentrations of pollutants to the receiving waterbody.

131. The pipe network, designed to SSG (Sewerage Sector Guidance) Appendix C - Design and Construction Guidance (DCG) v2.0 (March 2020), may be adopted by YW.

132. The storage and controlled release of surface water at a peak rate that is significantly less than existing, and the provision of SuDS facilities will provide betterment.

Flood Risk Management

Finished Floor Levels

133. Finished floor levels should be set at a minimum of 0.15 m above adjacent ground levels following any reprofiling at the site.

134. This would, subject to the implementation of an appropriately designed surface water drainage scheme, enable any potential surface water to be conveyed safely across the Application Site without affecting property in accordance with the approach promoted within DEFRA's Making Space for Water (2005) (Ref 25).

Bridge Design Principle

135. The conveyance capacity of any new culverts or bridges over Deep Dike and/or UW2 should maintain existing channel conveyance capacity so as not to increase flood risk; further details are to be provided at the detailed design stage.

Drain Maintenance

136. The realignment of UW2 is under consideration so that it flows around the edge of the development platform (refer Figure 8 of the FRA; Appendix 15.1).

137. A minimum 8 m undeveloped buffer should be provided from the top of bank of Deep Dike, UW1 and UW2. This will allow sufficient access for future maintenance and also ensure that any works do not increase flood risk, or harm the environment, or wildlife.

138. A maintenance regime would be implemented to prevent the build-up of debris and/or rubbish in Deep Dike, UW1 and UW2, which would have the potential to become blocked and cause localised flooding.

Residual Effects

139. The magnitude of effects during the construction and operational phases following the application of the identified mitigation measures (i.e. the residual effect) has been assessed with reference to the extent, magnitude and duration of the effect; performance against environmental quality standards and other relevant criteria; receptor criteria; receptor sensitivity and compatibility with environmental policies.

During Construction

140. The potential effects on the water environment during the construction phase of the proposed development will be managed through a range of control and monitoring measures that, as a whole, will act to mitigate the potential effects on surface water, groundwater, flood risk, land drainage and infrastructure.

141. The adoption of best practice construction methods and construction management processes will mitigate the potential environmental effects of the construction phase of the proposed development and therefore the proposed development will have a Negligible residual effect on the water environment.

142. Table 15.8 provides a summary of the significance of effects resulting from the proposed development following implementation of the mitigation measures identified in the previous section.

Table 15.8 Residual Effects During Construction

Impact	Receptor	Potential Effect	Importance of Receptor	Significance of Effect; Pre-Mitigation	Mitigation	Residual Significance of Effect
Water quality *Surface water & groundwater*	Bradley Park Dike, Deep Dike, UW1, UW2, River Calder and River Colne	Pollution risk	Medium	Minor adverse	Operational, control and monitoring measures including a CEMP	Negligible
	Calder and Hebble Navigation and Huddersfield Broad Canal	Pollution risk	Medium	Minor adverse		Negligible
	Ponds	Pollution risk	Low	Negligible		Negligible
	Aquifer	Pollution risk	Medium	Minor adverse		Negligible
Flood risk management *Inc. land drainage*	Bradley Park Dike, Deep Dike, UW1 and UW2	Flood risk	Medium	Minor adverse		Negligible
	Site workers and local residents	Flood risk	Medium	Minor adverse		Negligible
Infrastructure	Water supply infrastructure	Connections	Medium	Negligible		Negligible
	Sewerage infrastructure	Connections	Medium	Negligible		Negligible

During Operation

143. The implementation of the flood risk mitigation measures and an appropriately designed surface water drainage scheme, including the storage and controlled release of surface water at a peak rate that is significantly less than existing and the provision of SuDS facilities will provide betterment in respect of both water quality and flood risk.

144. The proposed development therefore has the potential to have a Minor Beneficial residual effect on flood risk during more extreme events in respect of the Bradley Park Dike, Deep Dike and the unnamed watercourses.

145. Table 15.9 provides a summary of the significance of effects resulting from the proposed development following implementation of the mitigation measures identified in the previous section.

Table 15.9 Residual Effects During Operation

Impact	Receptor	Potential Effect	Importance of Receptor	Significance of Effect; Pre-Mitigation	Mitigation	Residual Significance of Effect
Water quality *Surface water & groundwater*	Bradley Park Dike, Deep Dike, UW1, UW2, River Calder and River Colne	Pollution risk	Medium	Minor adverse	Surface water drainage strategy including SuDS	Negligible
	Calder and Hebble Navigation and Huddersfield Broad Canal	Pollution risk	Medium	Minor adverse		Negligible
	Ponds	Pollution risk	Low	Negligible		Negligible
	Aquifer	Pollution risk	Medium	Minor adverse		Negligible
Flood risk management *Inc. land drainage*	Bradley Park Dike, Deep Dike, UW1 and UW2	Flood risk	Medium	Minor adverse	Flood risk mitigation measures Surface water	Minor Beneficial (during more extreme events)

Impact	Receptor	Potential Effect	Importance of Receptor	Significance of Effect; Pre-Mitigation	Mitigation	Residual Significance of Effect
	Site residents, visitors, local businesses, employees, school pupils, customers and local residents	Flood risk	Medium	Minor adverse	Drainage strategy	Negligible

Cumulative Effects

146. In accordance with the NPPF and the supporting NPPG, a site-specific FRA has been undertaken for the proposed development including a FRDA for Parcel R and Parcel A. Other schemes (including development and additional schemes under consideration by Kirklees Council) should also undertake a FRA and/or DA as part of its respective planning application. This should include an outline surface water drainage strategy demonstrating how runoff will be managed so as not to increase flood risk elsewhere, with betterment provided where possible. Appropriate mitigation measures should also be incorporated into the construction and operational phases of the committed scheme in order to ensure that surface water runoff is not contaminated, nor groundwater quality adversely affected

147. Prior to the construction of all approved schemes, details of the mitigation measures addressing the above would need to be approved in writing by the LPA (Kirklees Council).

148. Recognising the above, the schemes would be expected to have a Negligible effect on surface water, groundwater, flood risk and land drainage. In turn, this would be expected to have a Negligible effect on the proposed development.

149. A number of the schemes would utilise the same water supply source and Wastewater Treatment Works (WwTW) for the provision of a potable water supply and foul sewage treatment respectively, and the existing associated water main and public combined sewer network. This will reduce the capacity of the existing potable water supply and foul sewerage infrastructure.

150. However, as part of the detailed design process, YW must demonstrate that any proposed scheme, including any off-site reinforcement works required, does not have an adverse effect on the environment. This would include using best practice construction methods. Furthermore, any increase in the treated effluent from the WwTW would comply with the Urban Waste Water Treatment (England and Wales) Regulations 1994. As such, any works would be expected to have a Negligible effect.

Summary and Conclusions

151. The Water Environment chapter presents information related to surface water, groundwater, flood risk management and infrastructure (water supply and wastewater treatment and sewerage), as part of the EIA. The assessment covers both the construction and operational phases of the proposed development.

152. Information from a variety of sources has been assessed to provide a baseline review of hydrology and hydrogeology, including a desktop study and site-specific Flood Risk and Drainage Assessments (site wide, Parcel R and Parcel A).

153. From this, receptors of potential environmental effects from the proposed development have been identified, the effects of the proposed development have been assessed and where required mitigation measures proposed, and residual effects have been identified and evaluated.

154. The construction and operational phases of the proposed development have the potential to reduce surface water and groundwater quality and increase flood risk, the demand for potable water and foul water discharges to the public sewer network.

155. During the construction phase this would be managed through a range of control and monitoring measures including best practice construction methods that, as a whole, would act to mitigate the potential effects on surface water, groundwater, flood risk, land drainage and infrastructure.

156. The likely significant effects during the operational phase of the proposed development would be managed by a package of mitigation measures comprising the implementation of a surface water strategy (including the incorporation of SuDS), raising finished floor levels to cater for event exceedance, considering design bridge principles, and the monitoring and maintenance of Deep Dike, UW1 and UW2.

157. The identified mitigation measures will result in a residual significance of environmental effects on the water environment which is assessed to be Negligible with Minor Beneficial in respect of the flood risk from Bradley Park Dike, Deep Dike UW1 and UW2.

References

2. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 - Establishing a framework for Community action in the field of water policy', available at: http://ec.europa.eu/environment/water/water-framework/index_en.html
3. Flood and Water Management Act, 2010. Available at: www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf
4. National Planning Policy Framework, Department of Community and Local Government, 2019, available at: https://www.gov.uk/guidance/national-planning-policy-framework
5. National Planning Practice Guidance, Department of Community and Local Government, 2019 available at: https://www.gov.uk/government/collections/planning-practice-guidance
6. The Building Regulations - Drainage and Waste Disposal, Approved Document H, Published 2010, Amended 2015, CIRIA, Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf
7. The SuDS Manual, Report 753, CIRIA, 2015
8. Sustainable Drainage Systems: Non-Statutory Technical Standards for Sustainable Drainage Systems, Department for Environment, Food and Rural Affairs, 2015, Available at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards
9. Sewerage Sector Guidance Appendix C - Design and Construction Guidance v2.0, March 2020, Available at: https://www.water.org.uk/sewerage-sector-guidance-approved-documents/
10. River Basin Management Plan - Humber River Basin District, 2015. Available at: https://www.gov.uk/government/publications/humber-river-basin-district-river-basin-management-plan
11. Kirklees Council (April 2016), Calder Catchment Strategic Flood Risk Assessment Volume I, available at: https://www.kirklees.gov.uk/beta/planning-policy/pdf/flood-risk/strategic-flood-risk-assessment-1.pdf
12. Kirklees Council (July 2016) Calder Catchment SFRA Volume II (Kirklees Council), available at: https://www.kirklees.gov.uk/beta/planning-policy/pdf/flood-risk/strategic-flood-risk-assessment-2.pdf
13. British Geological Society website, available at: http://www.bgs.ac.uk/data/mapViewers/home.html
14. Geo-environmental Appraisal, Land at Bradley Villa Farm, Huddersfield, Report no: 3319/1, Lithos, March 2019
15. Phase 1 Geo-environmental Appraisal, Tithe House Way, Bradley Park, Huddersfield, Alan Wood and Partners, October 2018

16. Bradley Villa Farm, Bradley Road, Bradley, Huddersfield - Flood Risk Assessment, Final Report, v1.0 (January 2021) Weetwood Services Ltd, Ref: 4937/FRA/BVF/Final/v1.0/2021-01-13

17. Bradley Villa Farm (phase of development), Bradley Road, Bradley, Huddersfield - Flood Risk and Drainage Assessment, Final Report, v1.0 (January 2021) Weetwood Services Ltd, Ref: 4937/FRDA/BVF Phase 1/Final/v1.0/2021-01-13

18. Flood Risk and Drainage Assessment, Land at Tithe House Way, Bradley Park, Huddersfield, West Yorkshire, Alan Wood and Partners, November 2018

19. MAGIC website. Available at: https://magic.defra.gov.uk/MagicMap.aspx

20. Technical Note on Workmanship and Materials for Drainage Schemes, 1995, ADAS

21. BS 6031: 2009 Code of Practice for Earthworks, December 2009. Available from: http://shop.bsigroup.com/en/ProductDetail/?pid=000000000030234058

22. Good Practice Guide for Handling Soils, Ministry of Agriculture Fisheries and Food, 2000, Available at: http://webarchive.nationalarchives.gov.uk/20090306103114/http:/www.defra.gov.uk/farm/environment/land-use/soilguid/index.htm

23. Code of Practice for the Sustainable Use of Soils on Construction Sites, Department for Environment, Food and Rural Affairs (2009). Available at: https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites

24. Environmental Good Practice on Site, CIRIA, Report C692, 3rd Edition. Available at: www.ciria.org/service/Web_Site/AM/ContentManagerNet/ContentDisplay.aspx?Section=Web_Site&ContentID=8982

25. Control of Water Pollution from Construction Sites, CIRIA Report C532, 2001. Available at: http://www.orkneywind.co.uk/advice/SEPA%20Pollution%20Advice/ciria%20c532.pdf

26. Making Space for Water - Taking Forward a New Government Strategy for Flood and Coastal Erosion Risk Management in England, First Government Response to the Autumn 2004 Consultation Exercise, Department for Environment, Food and Rural Affairs, 2005). Available at: http://archive.defra.gov.uk/environment/flooding/documents/policy/strategy/strategy-response1.pdf