A46 Newark Bypass

Scheme Number: TR010065

6.1 Environmental Statement

Chapter 13 Road Drainage and Water Environment

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Rules 2009

March 2025

Volume 6

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Rules 2009

The A46 Newark Bypass

Development Consent Order 202[#]

6.1 Environmental Statement
Chapter 13 Road Drainage and Water Environment

Regulation Number:	**APFP Regulation 5(2)(a)**
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13 Road Drainage and the Water Environment

13.1 Introduction

13.1.1 This Chapter presents the information required by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) to be provided in the Environmental Statement (ES) to enable the identification and assessment of likely significant effects of the Scheme on road drainage and the water environment.

13.1.2 The Scheme has the potential to cause both adverse and beneficial effects. The road drainage and water environment aspect covers three sub-topics. These are:

1. Surface waters including water quality (routine runoff and spillage) and hydromorphology. A list of active discharge consents within the study area can be found in Section 13.8 of this Chapter.
2. Groundwater including water quality (routine runoff and spillage), groundwater levels and flows, and Groundwater-Dependent Terrestrial Ecosystems (GWDTEs). A list of groundwater abstractions within the study area can be found in Section 13.8 of this Chapter.
3. Flood risk, including fluvial, surface water, groundwater, sewer and artificial sources.

13.1.3 This Chapter has been undertaken in compliance with the Planning Inspectorate's EIA Scoping Opinion [APP-189]. Appendix 4.1 (Scoping Opinion Schedule of Comments and Responses) of the Environmental Statement (ES) Appendices [APP-125] contains further information on how each of the matters raised in the EIA Scoping Opinion have been addressed. This Chapter considers both construction and operational phase effects and has been prepared in accordance with the Design Manual for Roads and Bridges (DMRB) LA113[1].

13.1.4 Chapter 2 (The Scheme) of this ES contains a detailed description of the Scheme. The drawings referenced in this Chapter can be found in the ES Figures [contained within Volume 6.2 of this ES], and the technical appendices referred to in this Chapter are presented in the ES Appendices [contained within Volume 6.3 of this ES].

13.2 Competent expert evidence

13.2.1 The surface water discipline lead has a Bachelor's level degree in Environmental Biology, a Master's level degree in Environmental

[1] National Highways (2019) DMRB LA 113 – Road drainage and the water environment, Revision 1 [online] available at: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk) (last accessed December 2023).

Conservation, is a Chartered Scientist and Environmentalist and a full member of CIWEM (Chartered Institution of Water and Environmental Management). The competent expert has 15 years of professional experience in the environmental consultancy field including the preparation of Environmental Impact Assessments (EIA) for the Applicant.

13.2.2 The groundwater discipline lead has a Masters in Hydrogeology and is a chartered member of CIWEM. The competent expert has over 20 years' experience in geosciences, of which the past four have been in the water industry, and is experienced in water resources assessments for infrastructure applications for development consent.

13.2.3 The flood risk discipline lead has a Bachelor's level degree in Environmental Management and is a chartered member of CIWEM, a Chartered Scientist and Chartered Environmentalist. The competent expert has over 16 years' experience in flood risk management, of which the past six years have been in the flood risk management sector of largescale infrastructure projects for submission of planning applications.

13.3 Legislative and policy framework

13.3.1 The principal legislative and planning context for the assessment of the environmental effects of the Scheme on road drainage and the water environment is presented below. The relevant legislation and policies listed below have been taken account of in the assessment.

Legislation

The Environment Act 2021

13.3.2 The Environment Act requires the Secretary of State to set long-term targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water and waste. The Environmental Targets (Water)(England) Regulations 2023 set four targets:

- The levels of total nitrogen, total phosphorous and sediment entering freshwaters in, and coastal waters around, England from agricultural land
- The levels of total phosphorous discharged into freshwaters from relevant discharges from sewerage systems of sewage undertakers
- The length of waters polluted by arsenic, cadmium, copper, lead, nickel and zinc from abandoned metal mines
- The amount of potable water supplied by water undertakers

13.3.3 None of the targets outlined above apply to the Scheme. However, this legislation has been considered for the assessment of water quality.

Flood and Water Management Act 2010

13.3.4 The Flood and Water Management Act's aims are:

- Greater security for people and their property from the risk of flooding and coastal erosion by creating clearer structures and responsibilities for managing that risk, building on the Government's response to Sir Michael Pitt's report following the 2007 floods. It established Lead Local Flood Authorities with responsibilities for the management of risk from local surface water runoff. It enables better planning for and prediction and warning of floods. It also introduces modern risk-based approaches to reservoir safety as well as greater security of water supply in the event of water company failure, and improved protection of essential supplies during drought.
- Better service for people through new ways of delivering major water and sewerage infrastructure projects and improving existing complaints and enforcement procedures.
- Greater sustainability by helping people and their communities adapt to the increasing likelihood of severe weather events due to climate change, encouraging sustainable drainage systems in new developments, protecting communities and the environment better from the risk of flooding, protecting water resources and improving water quality.

13.3.5 This legislation has been considered for the assessment of flood risk.

Environment Agency and climate change adaption – Flood risk assessments (2022)

13.3.6 This guidance ensures flood risk assessments take into account allowances for climate change and therefore minimise vulnerability and provide resilience to flooding and coastal change.

13.3.7 The Environment Agency will check that climate change allowances have been used when providing advice on flood risk assessments and strategic flood risk assessments. This legislation has been considered for the assessment of flood risk.

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

13.3.8 These regulations aim to protect inland and coastal waters and prevent deterioration of aquatic ecosystems, including groundwaters. A key aim of the Water Framework Directive (WFD) is to achieve 'good' ecological status for all waterbodies by 2015, with a secondary aim to gradually reduce the release of pollutants which may pose significant risks to the aquatic ecosystems. The environmental objectives of the WFD are implemented through actions described in the River Basin Management Plans (RBMPs).

13.3.9 The WFD requires a single system of water resource management (through characterisation, protection and enhancement of water

resources) to be considered within the context of a river basin district (RBD). Within England and Wales, 11 RBDs have been identified, including three cross-border RBDs, one of which crosses the borders of England and Scotland. The 2017 Regulations require 'the appropriate agency' (the Environment Agency in England) to prepare RBMPs for each RBD, for the approval of 'the appropriate authority' (the Secretary of State (SoS) in England).

13.3.10 This legislation has been considered for the assessment of water quality.

Environmental Permitting (England and Wales) Regulations 2016 (as amended)

13.3.11 These regulations set out the regulatory framework for the control of water discharge activities through environmental permitting, exempt some water discharge activities form environmental permitting and provide for compliance obligations.

13.3.12 They apply environmental quality standards to waters and certain pollutants and set out measures to prevent discharges of hazardous substances and limit discharges of non-hazardous pollutants into surface and groundwater.

13.3.13 This legislation has been considered for the assessment of water quality.

Nitrate Pollution Prevention Regulations 2015

13.3.14 These regulations consolidate nitrate pollution prevention legislation in England, revoking and replacing a number of statutory instruments. The regulations mainly focus on the impacts on water nitrogen levels through use of nitrogen in fertiliser, however, it also outlines the process for revising or adding to the designation of nitrate vulnerable zones, defined as an area of land that drains into polluted waters and contributes to the pollution of those waters. This legislation has been considered for the assessment of water quality.

Water Act 2014

13.3.15 This act makes provision about the water industry; about compensation for modification of licences to abstract water; about main river maps; about records of waterworks; for the regulation of the water environment; about the provision of flood insurance for household premises; about internal drainage boards; about Regional Flood and Coastal Committees; and for connected purposes. This legislation has been considered for the assessment of water quality.

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009

13.3.16 The Act regulates water resources, water quality, water pollution and flood defence. It provides for the general management of water resources, the standards expected for controlled waters and

prevention and mitigation through flood defence. This legislation has been considered for the assessment of water quality.

The Flood Risk Regulations 2009

13.3.17 These Regulations transposed the European Floods Directive into law for England and Wales and established a framework for assessing and managing flood risk, aimed at reducing negative impact of flooding on human health, the environment, cultural heritage and economic activity. The Regulations require the preparation of flood risk assessments, flood hazard maps, flood risk maps and flood management plans for river basin districts in England and Wales and certain cross-border river basin districts. This legislation has been considered for the assessment of flood risk.

Environmental Damage (Prevention and Remediation) Regulations 2009

13.3.18 These Regulations implement Directive of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage. They apply to damage to protected species, natural habitats, sites of special scientific interest, water and land.

13.3.19 They provide that, for certain economic activities, where there is a imminent risk of environmental damage, the operator must take steps to prevent it, and if it has occurred must prevent further damage. Where damage has occurred the enforcing authority must assess the damage and identify remedial measures. It must then serve a remediation notice on the responsible operator specifying what remediation is required. This legislation has been considered for the assessment of water quality.

The Anti-Pollution Works Regulations 1999

13.3.20 These Regulations prescribe the contents of anti-pollution works notices served under section 161A of the Water Resources Act 1991, the procedure to be followed in relation to appeals against such notices and the compensation for rights of entry in connection with anti-pollution works paid under section 161B of the Water Resources Act 1991. They also amend the Control of Pollution (Applications, Appeals and Registers) Regulations 1996 so as to prescribe the particulars of such matters which are required to be placed on the pollution control registers maintained by the Environment Agency. This legislation has been considered for the assessment of water quality.

Control of Pollution (Applications, Appeals and Registers) Regulations 1996

13.3.21 These Regulations prescribe the procedure to be followed in relation to applications for, or the variation of, consents under Chapter II of Part III of the Water Resources Act 1991 (control of pollution of water resources), including applications made by the Environment Agency.

They also prescribe the procedure to be followed where a discharge consent is granted under paragraph 6 of Schedule 10 to the Water Resources Act 1991, without an application.

13.3.22 The Regulations also prescribe the particulars which are to be entered on water pollution control registers which are maintained by the Environment Agency. They also prescribe when entries are to be made on, require or permit certain particulars to be removed from, and deal with the indexing of, the registers. This legislation has been considered for the assessment of water quality.

The Urban Waste Water Treatment (England and Wales) Regulations 1994

13.3.23 These regulations impose requirements in respect of discharges of industrial waste water to collecting systems or treatment plants, and outline the definitions for 'sensitive areas' and 'high natural dispersion areas' that are designated by the Secretary of State (SoS) for the Environment and the SoS for Wales.

13.3.24 Furthermore, Part IIA of the Environmental Protection Act (EPA) 1990 which came into force in July 2000, provides the legislative framework for the identification and remediation of contaminated land. The legislation introduced a statutory definition of contaminated land and is aimed at addressing land which has been historically contaminated, and which poses unacceptable risks to human health or the wider environment in the context of the current land use. This legislation has been considered for the assessment of water quality.

Land Drainage Act 1991 (as amended)

13.3.25 The Land Drainage Act 1991 requires that a watercourse be maintained by its owner in such a condition that the free flow of water is not impeded. The riparian owner must accept the natural flow from upstream but need not carry out work to cater for increased flows resulting from some types of works carried out upstream, for example a new housing development.

13.3.26 If a riparian owner fails to carry out their responsibilities under the Land Drainage Act, or if anyone else causes a watercourse to become blocked or obstructed, the County and District Councils have powers of enforcement by serving a notice under the Act. If this is ignored, the Council concerned may carry out the necessary works itself and then recharge the person responsible for the full cost incurred.

13.3.27 The Act makes particular provision for duties with respect to Sites of Special Scientific Interest (SSSI). This legislation has been considered for the assessment of water quality.

Ditches and Watercourses Act 1989

13.3.28 This act provides for agreements between landowners to build, widen or deepen ditches to remove run-off from their properties. The

agreements apply to new owners of the same lands until the municipally appointed engineer decides otherwise. The ditch cannot affect other owners' lands without their consent. The Act provides dispute resolution mechanisms for disputes between owners who have entered into these agreements. The municipal clerk is the contact person in the case of disputes. This legislation has been considered for the assessment of water quality.

National policy

National Policy Statement for National Networks

13.3.29 The National Policy Statement for National Networks (NPSNN) sets out the policy which the Scheme should comply with. It is also the basis for informing a judgement on the impacts of the Scheme, for example whether the Scheme is consistent with the requirements of the NPSNN. Compliance of the Scheme with the 2015 NPSNN is detailed within the NPSNN (2015) Accordance Tables [REP6-016].

13.3.30 At the time of the DCO application submission in April 2024, a Draft NPSNN (2024) Accordance Table [APP-192] was submitted with the application which summarised compliance of the Scheme with the draft NPSNN. This was because, even though the NPSNN 2024 was still in draft at that time (having been published for consultation in March 2023), it was still capable of constituting a material consideration in the Secretary of State's decision on the Application. As the 2024 NPSNN was designated on 24 May 2024, the Draft NPSNN (2024) Accordance Table [APP-192] has been superseded by the NPSNN (2024) Accordance Table [REP5-032], which assesses the Scheme against the designated 2024 NPSNN. The application for development consent for the Scheme was accepted for examination on 23 May 2024. As set out in the transitional provisions of the 2024 NPSNN (paragraphs 1.16 and 1.17), the 2015 NPSNN has effect for any application for development consent accepted for examination prior to 24 May 2024 and will inform decisions made by the Secretary of State in relation to those applications. However, it is noted that the 2024 NPSNN may still be an important consideration for the Secretary of State for Transport when determining whether to consent the DCO for this Scheme. Therefore, the NPSNN (2024) Accordance Tables [REP5-032] summarised compliance of the Scheme with the 2024 NPSNN.

13.3.31 The policies of relevance to road drainage and the water environment within the 2015 NPSNN and detail on how they have been addressed in the assessment are provided below.

Flood risk

13.3.32 When determining an application for development consent in relation to flood risk, the policies relating to climate change adaption in

paragraphs 4.36 to 4.47 of the 2015 NPSNN should be taken into account.

13.3.33 Paragraph 5.91 refers to advice in the National Planning Policy Framework (NPPF) (paragraphs 172 to 182) regarding directing development away from areas at highest risk of flooding but where development is necessary, advising that it should be made safe without increasing flood risk elsewhere.

13.3.34 Advice on assessments is given to applicants at paragraphs 5.92 - 5.97 of the 2015 NPSNN which advises that applications for schemes within locations in Flood Zones 2 and 3 (medium and high probability of river and sea flooding), or within Flood Zone 1 (low probability of river and sea flooding) for schemes of 1 hectare or greater or subject to other sources of flooding or critical drainage problems to be accompanied by a Flood Risk Assessment (FRA). This should identify and assess the risks of all forms of flooding to and from the Scheme and demonstrate how these flood risks will be managed, taking climate change into account. Applicants for schemes which may be affected by, or may add to, flood risk are advised to seek sufficiently early pre-application discussions with the Environment Agency and, where relevant, other flood risk management bodies such as lead local flood authorities, Internal Drainage Boards (IDB), and reservoir owners and operators.

13.3.35 Where flood risk is a factor in determining an application for development consent, the Secretary of State should be satisfied, where relevant:

- The application is supported by an appropriate FRA
- The Sequential Test has been applied as part of site selection and, if required, the Exception Test has also been applied

13.3.36 If the Environment Agency has concerns and objects to the grant of development consent on grounds of flood risk, the Secretary of State can grant consent but would need to be satisfied before deciding whether or not to do so that all reasonable steps have been taken by the applicant and the Environment Agency to try and resolve the concerns.

13.3.37 Further advice in paragraph 5.99 of the 2015 NPSNN states that the Secretary of State should be satisfied that flood risk will not be increased elsewhere and only consider development appropriate in areas at risk of flooding where it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location; and
- development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and priority is given to the use of sustainable drainage systems.

13.3.38 If an Exception Test is required, both of the following elements will have to be passed for the development to be consented:

- it must be demonstrated that the Scheme provides wider sustainability benefits to the community that outweigh flood risk
- an FRA must demonstrate that the project will be safe for its lifetime, without increasing flood risk elsewhere and, where possible, will reduce flood risk overall

Water Quality and resources

13.3.39 Infrastructure development can have adverse effects on the water environment. As recorded in paragraph 5.220 of the 2015 NPSNN, the Government's planning policies make clear that the planning system should contribute to and enhance the natural and local environment by, amongst other things, preventing both new and existing development from contributing to, or being put at unacceptable risk from, or being adversely affected by, water pollution. The Government has issued guidance on water supply, wastewater and water quality considerations in the planning system. An application for development consent has to contain a plan with accompanying information identifying waterbodies in a RBMP.

National Planning Policy Framework

13.3.40 The National Planning Policy Framework (NPPF) (December 2024)[2] sets out the Government's planning policy framework for the whole of England, including the Government's expectation for content and quality of planning applications and local plan policy. The overall strategic aims of the NPSNN and NPPF are consistent. The NPPF may be an important and relevant matter but does not form the basis for a decision on an NSIP.

13.3.41 The NPPF states that when determining any planning application, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific FRA. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location
- The development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment

[2] Ministry of Housing, Communities and Local Government (December 2024) National Planning Policy Framework [online] available at: https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf (last accessed March 2025)

- It incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate
- Any residual risk can be safely managed
- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan

13.3.42 Major developments should incorporate sustainable drainage systems (SuDs) unless there is clear evidence that this would be inappropriate. The systems used should:

- Take account of advice from the Lead Local Flood Authority (LLFA)
- Have appropriate proposed minimum operational standards
- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development
- Where possible, provide multifunctional benefits

13.3.43 This policy has been considered for the assessment of flood risk.

Planning Practice Guidance: Flood risk and coastal change

13.3.44 This guidance advises how to take account of the NPPF policies and addresses the risks associated with flooding.

25 Year Environment Plan

13.3.45 The Department for Environment, Food & Rural Affairs (Defra) 25 Year Environment Plan (2018)[3] is a policy paper setting out what the Government will do to improve the environment, including restoring and safeguarding wildlife habitats. This plan is being treated as the first Environmental Improvement Plan required under the Environment Act 2021. The plan sets out aims to achieve clean and plentiful water by improving at least three quarters of England's waters to be close to their natural state as soon as is practicable by:

- Reducing the damaging abstraction of water from rivers and groundwater, ensuring that by 2021 the proportion of waterbodies with enough water to support environmental standards increases from 82% to 90% for surface waterbodies and from 72% to 77% for ground waterbodies.
- Reaching or exceeding objectives for rivers, lakes, coastal and ground waters that are specially protected, whether for biodiversity or drinking water as per RBMPs.
- Supporting ambitions on leakage, minimising the amount of water lost through leakage year on year, with water companies expected to reduce leakage by at least an average of 15% by 2025.
- Minimising by 2030 the harmful bacteria in our designated bathing waters and continuing to improve the cleanliness of our waters; we will

[3] HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK (www.gov.uk) (last accessed December 2023).

make sure that potential bathers are warned of any short-term pollution risks.

13.3.46 The plan also aims to reduce the risk of harm to people, the environment and the economy from natural hazards including flooding by:

- Bringing the public, private and third sectors together to work with communities and individuals to reduce the risk of harm.
- Making sure that decisions on land use, including development, reflect the level of current and future flood risk.
- Boosting the long-term resilience of our homes, businesses and infrastructure.

13.3.47 The first revision of the 25 year plan 'Environmental Improvement Plan' was published in February 2023.[4]

13.3.48 This legislation has been considered for the assessment of water quality.

Local policy

Newark & Sherwood Local Development Framework Core Strategy & Allocations

13.3.49 The relevant policies within the document are outlined below:

Core Policy 9 – Sustainable design

13.3.50 The District Council will expect new development proposals to demonstrate a high standard of sustainable design, for water pro-actively managing surface water with Sustainable Drainage Systems (SuDS) and providing resilience against potential impacts of climate change and the varying needs of the community.

Core Policy 10 – Climate change

13.3.51 The District Council is committed to tackling the causes and impacts of climate change and to delivering a reduction in the District's carbon footprint. The District Council will work with partners and developers to:

- Mitigate the impacts of climate change through ensuring that new development proposals minimise their potential adverse environmental impacts during their construction and eventual operation. New proposals for development should therefore:

[4] HM Government (2023) Environment Improvement Plan 2023; First revision of the 25 Year Environment Plan.[online] available at: Environmental Improvement Plan (publishing.service.gov.uk) (www.gov.uk) (last accessed December 2023).

  - Ensure that the impacts on natural resources are minimised and the use of renewable resources encouraged
  - Be efficient in the consumption of energy, water and other resources

- Steer new development away from those areas at highest risk of flooding, applying the sequential approach to its location detailed in Policy DM5 'Design'. Where appropriate the Authority will seek to secure strategic flood mitigation measures as part of new development.
- Where appropriate having applied the Sequential Test move on to apply the Exceptions Test, in line with national guidance. In those circumstances where the wider Exceptions Test is not required proposals for new development in flood risk areas will still need to demonstrate that the safety of the development and future occupants from flood risk can be provided for, over the lifetime of the development.
- Ensure that new development positively manages its surface water runoff through the design and layout of development to ensure that there is no unacceptable impact in runoff into surrounding areas or the existing drainage regime.

Core Policy 10A – Land drainage designations

13.3.52 In order to ensure the appropriate management of flood risk as part of new development, the District Council will work with partners to develop Local Drainage Designations in the following locations:

- Lowdham
- Southwell

13.3.53 These designations will set local drainage standards which specified forms of new development will be required to meet. This is to ensure that development positively manages its surface water runoff through the design and layout of new development, in order that there will be no unacceptable impact from runoff on surrounding areas or the existing drainage regime.

13.3.54 The geographic extent, forms of development which will be subject to the designation and the specific standards that proposals will need to meet will be defined through a Local Drainage Designations Supplementary Planning Document.

13.3.55 Where the evidence to support the development of additional Local Drainage Designations in other locations emerges then the District Council will work with partners, to secure their introduction and subsequent implementation, in line with the above.

13.3.56 This legislation has been considered for the assessment of water quality and flood risk.

National Highways policy

13.3.57 The National Highways Environment Strategy[5] outlines the following objectives for National Highways in relation to road drainage and the water environment:

- To continue to mitigate existing discharges that pose a risk of pollution
- To identify opportunities for restoring waterbodies to a more natural condition and removing obstacles for fish and eel migration
- To update forward programme of water quality Schemes in collaboration with the Environment Agency
- To commission further research to explore microplastic pollution in road runoff, and any associated impacts on the wider environment
- To achieve relevant National Highways' Key Performance Indicators (KPIs) relating to road drainage and the water environment:
    - KPI 4.7 'Water quality': This KPI outlines National Highways' aim to enhance medium, high and very high-risk outfalls as well as other enhancements such as river retraining/rewilding in order to reduce adverse effects on watercourses
    - KPI5: Flooding: The number of high or very high-risk flooding hotspots and priority culverts mitigated
- Water Quality: The number of priority outfalls and soakaways mitigated

13.3.58 In addition, water quality and flooding is one of the environmental topic areas where the six strategic levers of the National Highways' Environment Strategy will be applied. The strategic levers will make a contribution towards National Highways' environment vision. This legislation has been considered for the assessment of water quality and flood risk.

13.4 Consultation

13.4.1 An introductory meeting was held with the Environment Agency on 30 March 2022 to introduce the Scheme and in particular water quality and flood management issues.

13.4.2 Further meetings were held with the Environment Agency on 13 June 2022 to agree proposals for water quality monitoring for the Scheme, both pre-construction (to inform the EIA) and during construction. During this meeting, the proposals outlined within Appendix 13.5 (Surface Water Quality Monitoring Report) of the ES Appendices

[5] Highways England (2015) Environment Strategy Our approach [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy__21___.pdf (Last accessed December 2023).

[APP-180] (locations, parameters and frequency) were agreed with the stakeholders (see section 13.5 of this Chapter). It was also discussed that the frequency of monitoring during construction may change, however, this would be agreed following consultation with the Environment Agency.

13.4.3 An Environment Agency technical meeting was held on the 22 July 2022 to provide an update on the river channel surveys and wider topographical surveys, review the hydraulic modelling approach, discuss floodplain compensation and agree future engagement.

13.4.4 On 8 September 2022, a meeting was held with the Canals and Rivers Trust to discuss the proposed hydroelectric plants along the River Trent. This provided an understanding of whether the baseline fluvial hydraulic model would need to be updated.

13.4.5 A Steering Group meeting was held on the 30 November 2022 during which the proposal to scope out the Farndon Ponds and Devon Park Pastures Local Nature Reserves (LNRs) was discussed. However, it was decided that the two LNRs would remain scoped-in. Numerous Flood and Drainage Steering Group meetings have been held throughout 2022 and 2023. These are outlined in the overarching consultation for the ES in Chapter 4 (Environmental Assessment Methodology) of this ES.

13.4.6 On 13 April 2023, a meeting with the Environment Agency was held to discuss the methodology and outcomes of Appendix 13.1 (Water Framework Directive Compliance Assessment) of the ES Appendices [APP-176]. A subsequent meeting was held with the Environment Agency and Trent Valley Internal Drainage Board on the 20 June 2023 to discuss potential design changes that had been identified and the implications for the WFD assessment. These potential design changes were not carried forward and therefore no changes were made to the WFD assessment.

13.4.7 On the 25 May 2023 groundwater levels were presented to the Environment Agency within the Steering Group Meeting.

13.4.8 The Flood Risk Management Authorities have been consulted throughout the development of the Scheme to ensure the assessment of the flood risk is appropriate for the nature and scale of the Scheme. This is outlined in Appendix 13.2 (Flood Risk Assessment) of the ES Appendices [REP6-010].

13.5 Assessment methodology

13.5.1 The assessment has been undertaken in accordance with the DMRB LA 113 - Road drainage and the water environment.[6]

13.5.2 This Chapter has been informed by the following assessments which have been included as technical appendices to support this Chapter:

- A WFD Compliance Assessment has been undertaken. This considers compliance of the Scheme with the relevant WFD objectives for designated waterbodies that may be affected. The WFD assessment includes whether the Scheme might cause deterioration or prevent the improvement in the overall status (or potential for heavily modified and artificial waterbodies) of these waterbodies. The results are presented in Appendix 13.1 (Water Framework Directive Compliance Assessment) of the ES Appendices [APP-176].
- An FRA has been undertaken given the majority of the Scheme is within Flood Zones 2 and 3. This assesses the flood risk impact of the Scheme during construction and operation. Hydraulic modelling has been undertaken to inform the flood mitigation measures required which compromises of floodplain compensation areas. The results are presented as Appendix 13.2 (Flood Risk Assessment) of the ES Appendices [REP6-010].
- A Highways England Water Risk Assessment Tool (HEWRAT) assessment and the application of the Metal Bioavailability Assessment Tool (M-BAT) has been completed. The outcomes have been used to understand the pollution of routine runoff expected to be discharged into receiving watercourses, ensuring the drainage design (and appropriate mitigation) is compliant with Environmental Quality Standards (EQS). The HEWRAT assessment report is included as Appendix 13.3 (HEWRAT Assessment) of the ES Appendices [APP-178].
- The Drainage Strategy Report has been developed to outline the drainage design and mitigation measures incorporated within the Scheme. This is provided as Appendix 13.4 (Drainage Strategy Report) of the ES Appendices [APP-179].
- A Surface Water Quality Monitoring Report has been produced. This report outlines the ongoing water quality monitoring which is being undertaken as part of the Scheme. At this stage, it is recommended that quarterly sampling be undertaken prior to construction to understand the existing baseline water quality. The first sampling was undertaken in January 2023, with subsequent sampling undertaken in April 2023 and July 2023. These samples will continue to be undertaken pre-construction, continue throughout construction and for

[6] National Highways (2019) DMRB LA 113 – Road drainage and the water environment, Revision 1 [online] available at: https://www.standardsforhighways.co.uk/tses/attachments/d6388f5f-2694-4986-ac46-b17b62c21727?inline=true https://www.standardsforhighways.co.uk/search/d6388f5f-2694-4986-ac46-b17b62c21727 (last accessed December 2023).

a minimum of one year post-construction. It is understood that once construction begins, the frequency of samples may be reviewed in agreement with the Environment Agency. This report is provided as Appendix 13.5 (Surface Water Quality Monitoring Report) of the ES Appendices [APP-180].

13.5.3 Information from groundwater monitoring which formed part of the Ground Investigation (GI) programme in 2021[7] has been used within this Chapter, in combination with the baseline groundwater monitoring, which commenced January 2023.

13.5.4 The assessment excludes aspects that relate to groundwater contamination, as these are considered separately in Chapter 9 (Geology and Soils) of this ES.

13.5.5 Guidance, standards and best practice have been followed, with particular reference to:

- DMRB LA 113 - Road drainage and the water environment[8]
- The Planning Inspectorate's Advice Note Eighteen 'The Water Framework Directive'[9]
- Planning Practice Guidance: Flood risk and coastal change[10]
- The Environment Agency's groundwater protection guides covering requirements, permissions, risk assessments and controls, previously covered by the Environment Agency's groundwater protection: principles and practice[11]

Assessment of sensitivity

13.5.6 Table 13-1 sets out the criteria that has been used to estimate the importance of the receptors as set out in DMRB LA 113.

Table 13-1: Estimating the importance of water environmental receptors

Importance	Typical criteria	Typical examples	
Very high	Nationally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a RBMP and Q95[12] >1. 0m^3/s. Site protected/designated under EC or UK legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), SSSI,

[7] Tetra Tech. (2022). A46 North Newark Bypass. Factual Ground Investigation Report. V1.1.

[8] Highways England (2020) DMRB LA113 – Road drainage and the water environment [online] Available at: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk) (Last accessed December 2023).

[9] The Planning Inspectorate (2020) Advice Note Eighteen: The Water Framework Directive. [online] Available at: Advice Note Eighteen: The Water Framework Directive | National Infrastructure Planning (planninginspectorate.gov.uk) (Last accessed December 2023).

[10] Department for Levelling Up (2022) Planning Policy Guidance: Flood risk and coastal change [online] Available at: Flood risk and coastal change - GOV.UK (www.gov.uk) (Last accessed December 2023)

[11] Environment Agency (2017) Groundwater protection [online] available at Groundwater protection - GOV.UK (www.gov.uk) (Last accessed July 2024).

[12] Q95 is defined as the flow in a watercourse that it is exceeded 95% of the time i.e. the low flow.

Importance	Typical criteria	Typical examples	
			Ramsar site, salmonid water)/ Species protected by EC legislation LA 108 [Ref 1.N][13].
		Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation LA 108 [Ref 1.N]. Groundwater locally supports Ground Water Dependent Terrestrial Ecosystems (GDWTE). Source Protection Zones (SPZ1).
		Flood risk	Essential infrastructure or highly vulnerable development.
High	Locally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a RBMP and Q95 <1. 0m^3/s. Species protected under EC or UK legislation LA 108 [Ref 1.N].
		Groundwater	Principal aquifer providing a locally important resource or supporting river ecosystem. Groundwater locally supports GWDTE. SPZ2.
		Flood risk	More vulnerable development.
Medium	Of moderate quality and rarity	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001m^3/s.
		Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3.
		Flood risk	Less vulnerable development.
Low	Lower quality	Surface water	Watercourses not having a WFD classification shown in a RBMP and Q95 <0.001m^3/s.
		Groundwater	Unproductive strata.
		Flood risk	Water compatible development.

Source: DMRB LA 113 – Road drainage and the water environment Revision 1. Table 3.70

Assessment of magnitude

13.5.7 The magnitude of impact on the receptors from the Scheme has been assessed in accordance with the criteria presented in Table 13-2 below.

Table 13-2: Estimating the magnitude of an impact on an attribute

Magnitude	Criteria	Typical examples	
Major adverse	Results in loss of attribute	Surface water	Failure of both acute-soluble and chronic sediment related pollutants in HEWRAT

[13], Highways England (2020), DMRB LA 103 – Biodiversity. Available at: https://www.standardsforhighways.co.uk/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465'

Magnitude	Criteria	Typical examples	
	and/or quality and integrity of the attribute		and compliance failure with EQS values. Calculated risk of pollution from a spillage >2% annually (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated nature conservation site. Reduction in waterbody WFD classification.
		Groundwater	Loss of, or extensive change to an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff – risk score >250 (Groundwater quality and runoff assessment). Calculated risk of pollution from spillages >2% annually (spillage assessment). Loss of, or extensive change to the GWDTE or baseflow contribution to protected surface waterbodies. Reduction in waterbody WFD classification. Loss or significant damage to major structures through subsidence or similar effects.
		Flood risk	Increase in peak flood level (> 100mm).
Moderate adverse	Results in some measurable change in attributes, quality or vulnerability	Surface water	Failure of either acute-soluble and chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from a spillage >1% annually <2% annually (spillage assessment). Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in waterbody WFD classification.
		Groundwater	Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Potential medium risk of pollution from spillages >1% annually <2% annually (spillage assessment). Partial loss of the integrity of GWDTE. Contribution to reduction in waterbody WFD classification. Damage to major structure through subsidence or similar effects or loss of minor structures.
		Flood risk	Increase in peak flood level (> 50mm).
Minor adverse	Results in some measurable change in attributes,	Surface water	Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages >0.5% annually and <1% annually.

Magnitude	Criteria	Typical examples	
	quality or vulnerability		Minor effects on water supplies.
		Groundwater	Potential low risk of pollution to groundwater from routine runoff – risk score <150. Calculated risk of pollution from >0.5% annually and <1% annually. Minor effects on an aquifer, GWDTEs, abstractions and structures.
		Flood risk	Increase in peak flood level (> 10mm).
Negligible	Results in some measurable change in attributes but of insufficient magnitude to affect the use or integrity	The Scheme is unlikely to affect the integrity of the water environment.	
		Surface water	No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%.
		Groundwater	No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%.
		Flood risk	Negligible change to peak flood level (<+/- 10mm).
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Surface water	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes a pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually).
		Groundwater	Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk is <1% annually). Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
		Flood risk	Creation of flood storage and decrease in peak flood level (>10mm).
Moderate beneficial	Results in moderate improvement of attribute quality	Surface water	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes a pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage >1% annually). Contribution to improvement in waterbody WFD classification.
		Groundwater	Calculated reduction in existing spillage by 50% or more (when existing spillage >1% annually). Contribution to improvement in waterbody WFD classification. Improvement in waterbody catchment abstraction management strategy (or

Magnitude	Criteria	Typical examples	
			equivalent) classification. Support to significant improvements in damaged GWDTE.
		Flood risk	Creation of flood storage and decrease in peak flood level (>50mm).
Major beneficial	Results in major improvement of attribute quality	Surface water	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in waterbody WFD classification.
		Groundwater	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in waterbody WFD classification.
		Flood risk	Creation of flood storage and decrease in peak flood level (>100mm).
No change			No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Source: DMRB LA 113 Road drainage and the water environment Revision 1. Table 3.71

Assessment of significance

13.5.8 The assessment of the significance of effect has been undertaken by combining sensitivity to change of a receptor with an assessment of the magnitude of change put upon it. This allows the prediction of the significance of the effect, as shown in Table 13-3 below. Where there are two potential outcomes, professional judgement is used to determine which is the more appropriate. These effects can be beneficial or adverse, and temporary or permanent, depending on the nature of the development and the mitigation measures proposed.

13.5.9 The assessment of significance has been undertaken in accordance with DMRB LA 113 - Road drainage and the water environment and DMRB LA 104 – Environmental assessment and monitoring. In accordance with DMRB guidance, moderate, large, or very large effects are considered significant in terms of EIA.

Table 13-3: Assessing significance of potential effects

Environmental value (sensitivity)	Magnitude of potential impact (degree of change)					
		No Change	**Negligible**	**Minor**	**Moderate**	**Major**
	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large

	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Source: DMRB LA104 Environmental Assessment Methodology

13.6 Assessment assumptions and limitations

13.6.1 The assumptions made to inform this assessment are as follows:

- The assessment has been based on the Scheme description and construction strategy presented in Chapter 2 (The Scheme) of this ES and has taken into account the lateral limits of deviation illustrated on the Works Plans [REP3-002]and vertical limits of deviation secured in under Article 10 of the draft DCO [REP6-004] to establish a realistic worst case assessment scenario.
- This Chapter has been prepared using publicly available surface and groundwater information. Assessments and surveys outlined in Section 13.5 of this Chapter have been undertaken to support and validate (where applicable) this publicly available information, however, where this is not possible, it is assumed the information provided from these public sources are correct and true to current baseline conditions for the Scheme.

  Borrow pit maximum extents and excavation methodology are described in Chapter 2 (The Scheme) of this ES. Any borrow pit dewatering discharge would be directed to silt lagoons within the borrow pit area for settlement and attenuation before discharge to local watercourses. A groundwater recharge arrangement may also be considered where feasible. Necessary consents for groundwater abstraction and water discharge would be sought and details regarding these consents are detailed in the Scheme Consents and Agreements Position Statement [REP4-007]**)**.
- For the application for development consent, surface water monitoring was undertaken in January, April and July 2023. These represent winter high flow and spring/summer lower flow results, which are considered sufficient for the purposes of this Chapter. Quarterly surface water monitoring will continue pre-construction. Appendix 13.5 (Surface Water Quality Monitoring Report) of the ES Appendices [APP-180] includes details about location, parameters and frequency of monitoring and was discussed with the Environment Agency in June 2022. Proposed locations were based on publicly accessible land and a site visit was undertaken in September 2022 to confirm accessibility. The plan was updated following the meeting with the Environment Agency in June 2022, and the site visit in September 2022.
- Baseline groundwater monitoring commenced January 2023 and provides confirmation of the groundwater level variation identified

during preliminary geotechnical investigations August to December 2021. Based on 2021 and 2023 monitoring data, groundwater levels are conservatively assumed to be shallow for the purposes of this assessment. Groundwater monitoring will however continue pre-construction.

13.6.2 The current limitations to this Chapter are as follows:

- Q95 values for watercourses within the study area have been obtained from the National River Flow Archive.[14] These values have been taken from the closest available point on the watercourse. 'Unknown' Q95 values are where the Q95 values are not readily available for these watercourses.

13.7 Study area

13.7.1 In relation to surface water and groundwater, the study area for road drainage and the water environment covers a 1 kilometre radius around the Order Limits as shown in Figures 13.1 to 13.4 of the ES Figures [AS-073 to AS-076]. This study area has been determined based on professional judgement as pollutants are expected to disperse and to have been diluted beyond a 1 kilometre radius. Consideration was given to the extension of this study area but as no sensitive features (protected areas) were identified that are capable of being affected by contaminants transported downstream of the Scheme via surface waterbodies or ground waterbodies the study area was not extended.

13.7.2 In relation to fluvial flood risk, the study area is the full extent of the River Trent floodplain between the village of Fiskerton upstream of Newark on Trent and North Muskham downstream.

13.8 Baseline conditions

13.8.1 Information to assist with defining the existing baseline conditions has been obtained from the following sources:

- Environment Agency's Catchment Data Explorer[15]
- Environment Agency's Flood Map for Planning[16]
- Humber RBMP[17]

[14] Q95 values obtained from UK Centre for Ecology & Hydrology, National River Flow Archive (Search Data | National River Flow Archive (ceh.ac.uk)). (Last Accessed December 2023)

[15] Environment Agency (2021) Environment Agency Data Catchment Explorer [online] Available at: https://environment.data.gov.uk/catchment-planning/ (Last accessed December 2023).

[16] Environment Agency (2021) Environment Agency Flood Map for Planning [online] available at: https://flood-map-for-planning.service.gov.uk/ (Last accessed December 2023).

[17] Environment Agency (2016) Humber River Basin Management Plan [online] available at: Humber river basin district river basin management plan - GOV.UK (www.gov.uk) (Last accessed December 2023).

- Defra 'MAGIC' (Multi-agency geographic information for the countryside) interactive map[18]
- Environment Agency's Public registers for environmental permits[19]
- United Kingdom Soil Observatory (UKSO) information[20]
- Newark & Sherwood District Council, Strategic Flood Risk Assessment (SFRA)[21]
- British Geological Survey (BGS) Map[22]
- Environment Agency's Consented Discharges to Controlled Waters with Conditions[23]
- Field data from Scheme surface water sampling and groundwater sampling

13.8.2 The following section identifies the water environment receptors of the Scheme. A sensitivity has been assigned to each identified water environment receptor based on the DMRB LA 113.

Surface water

13.8.3 Figure 13.1 (Surface Water Constraints) [AS-073] and Figure 13.2 (River Waterbody Catchments) [AS-074] of the ES Figures show the surface water baseline features identified within the 1 kilometre study area.

Watercourses

13.8.4 There are four Main Rivers located within the study area. These are:

- River Trent
- Middle Beck
- River Devon
- Slough Dyke (The Fleet)

13.8.5 The existing A46 crosses the River Trent twice, and the Slough Dyke (the Fleet) once. There are also ordinary watercourses[24] within the study area, including the Old Trent Dyke and the Tributary of the Fleet

[18] DEFRA Magic Map. Available at: https://magic.defra.gov.uk/MagicMap.aspx (Last accessed December 2023).

[19] Environment Agency's published data. Available at: Public Registers Online (data.gov.uk) (Last accessed December 2023).

[20] UKSO. Available at: UK Soil Observatory (bgs.ac.uk) (Last accessed December 2023).

[21] Newark and Sherwood District Council, Strategic Flood Risk Assessment [online]. Available at: Strategic Flood Risk Assessment Level 2 Stage 2 | Newark & Sherwood District Council (newark-sherwooddc.gov.uk) (last accessed December 2023).

[22] British Geological Survey Map [online]. Available at: BGS Geology Viewer - British Geological Survey (last accessed December 2023).

[23] Environment Agency (2024) *Consented Discharges to Controlled Waters with Conditions.* Available at: Consented Discharges to Controlled Waters with Conditions (data.gov.uk) (last accessed December 2023).

[24] An ordinary watercourse is any channel that water flows through which is not part of the main river network, as defined by the Environment Agency. These watercourses are managed by the LLFA.

(1), which the A46 crosses. The Scheme is located within the Trent Valley Internal Drainage Board (IDB) area.

13.8.6 Table 13-4 lists the surface watercourse receptors identified within the study area, including distance to the Scheme, following the DMRB LA 113 methodology. Where Q95 flow data is not readily available, a conservative assumption has been made using professional judgement, or 'Unknown' has been used where there was not enough information to make this judgement.

Table 13-4: Surface watercourses within the study area

Watercourse	Approximate distance from Scheme[25]	Is the watercourse a WFD waterbody?	Q95 Levels (m^3/s)[26]	Description
River Trent (southern)	0km - The A46 crosses this watercourse twice.	Yes - Trent from Soar to The Beck waterbody [GB104028053110]	28.9	This waterbody splits into two, upstream of Newark-on-Trent and rejoins downstream of Newark-on-Trent. The River Trent flows in a north-easterly direction. The flow dynamics of the river are smooth, with exception of the Newark Trent Weir and, the Nether Lock and Weir adjacent to the Nether Lock Viaduct. At these locations the flow dynamics are disrupted but the river does return to a smooth flow state after. The WFD catchment area associated with the southern section of the River Trent, which the Scheme crosses, is 'Trent from Soar to The Beck waterbody [GB104028053110]'. This waterbody is a heavily modified waterbody (HMWB) with a length of approximately 71.2km and catchment area of approximately 139.7km^2. According to the Cycle 3[27] (2019) data, the overall status of the waterbody is 'Moderate', ecological status is 'Moderate', chemical status is 'Fail' with nine 'Reasons for Not Achieving Good (RNAG)' identified. There are seven protected areas within the WFD catchment, these are: River Trent from River Soar to Carlton-on-Trent Nitrate Vulnerable Zones (NVZ); River Trent; Causewaye Dyke Catchment (tributary of Trent) NVZ; River Erewash and Erewash Canal; River Soar; River Devon and Car Dyke; and, Colwick Country Park (West Lake). Two of these are within the study area - River Trent from River Soar to Carlton-on-Trent NVZ and the River Trent.

[25] The distance has been taken from the point of the watercourse closest to the Scheme, this is not the hydraulically connected distance.

[26] Q95 values obtained from UK Centre for Ecology & Hydrology, National River Flow Archive (Search Data | National River Flow Archive (ceh.ac.uk)). Q95 values taken from closest point on the watercourse. 'Unknown' Q95 values are where the Q95 values are not readily available for these watercourses.

[27] RBMP are prepared in 5 year cycles, the latest issue of the Humber RBMP is Cycle 2, although data is now being collected by the Environment Agency to inform Cycle 3. The latest available data is therefore referred to within this ES chapter as 'Cycle 3'.

Watercourse	Approximate distance from Scheme[25]	Is the watercourse a WFD waterbody?	Q95 Levels (m^3/s)[26]	Description
Middle Beck	0.7km south-east (upstream) of the southern extent of the Scheme	Yes	Unknown	This waterbody joins the River Devon within the study area. Middle Beck flows in a westerly direction and discharges into the River Devon near the village of Hawton. The WFD catchment associated with this waterbody is 'Middle Beck Catchment (tributary of Devon Waterbody)' [GB104028052633]'. This waterbody has a length of approximately 9.6km and a catchment area of approximately 11.4km^2. It is not a designated artificial waterbody (AWB) or HMWB. According to the Cycle 3 (2019) data, the overall status of the waterbody is classified as 'Moderate', ecological status is 'Moderate', chemical status is 'Fail' with five RNAG identified. There is one protected area within this WFD catchment – Smite R NVZ, which is located within the study area.
River Devon	0.1 km, east (upstream) of the southern extent of the Scheme.	Yes - Devon from Cotham to Trent waterbody [GB104028052632]	0.1	This waterbody joins the River Trent within the study area. The River Devon flows in a northerly direction and discharges into the River Trent at the Newark Marina. The flow dynamics of the river is a combination of smooth and ripples, with dense vegetation in some areas limiting the rate of flow. The WFD catchment associated with the River Devon which is close to the Scheme is 'Devon from Cotham to Trent waterbody [GB104028052632]'. This waterbody has a length of approximately 7.6km and a catchment area of approximately 25.8km^2. It is not a designated AWB or HMWB. According to the Cycle 3 (2019) data, the overall status is classified as 'Poor', ecological status is 'Poor', chemical status is 'Fail' with four RNAG. There are three protected areas within the catchment area: • River Trent from River Soar to Carlton-on-Trent NVZ • SMITE R NVZ, and River Devon and Car Dyke Only Trent from River Soar to Carlton-on-Trent NVZ, and SMITE R NVZ are within the study area of the Scheme.

Watercourse	Approximate distance from Scheme[25]	Is the watercourse a WFD waterbody?	Q95 Levels (m^3/s)[26]	Description
Old Trent Dyke	0km - The A46 crosses this watercourse once.	No	Unknown	This watercourse is a tributary of the River Trent (SK 79870 53878) and is in the land between the two channels of the River Trent. This watercourse flows from the southern leg of the River Trent northwards, under the A46 and the railway line towards Kelham Road. The watercourse splits into two south of Kelham Road, with one section flowing north and is culverted under Kelham Road. The second section meanders eastwards and crosses under the A46 before being culverted under Newark-on-Trent. It is understood this watercourse reappears north of Newark Castle train station and is culverted under the A46 for a third time, before discharging north of the weir at SK 80036 55310.
Unnamed watercourse (1)	0km – The A46 crosses this watercourse once	No	Unknown	This watercourse is a tributary of the River Trent upstream of the B6326 bridge. This watercourse may be a feeder into the Old Trent Dyke. During the site visit in September 2022, this watercourse was not located. Therefore, it is not clear what the relationship between these two watercourses is.
River Trent (northern)	0 km – The FCAs are located adjacent to this watercourse	Yes - Trent Bifurcation Pingley Dyke to Winthorpe waterbody [GB104028053390]	28.9	This waterbody splits into two, upstream of Newark-on-Trent and rejoins downstream of Newark-on-Trent. This section relates to the northern section. The river flows easterly where it rejoins the rest of the River Trent. The flow dynamics of this section of the river are rippled throughout the section. The section of the River Trent which the Scheme is adjacent to is associated with the 'Trent Bifurcation Pingley Dyke to Winthorpe waterbody [GB104028053390]' WFD catchment area. This waterbody has a length of approximately 5.2km and a catchment area of approximately 13.2km^2. It is not designated an AWB or HMWB. According to the Cycle 3 (2019) data, the overall status is classified as 'Moderate', ecological status is 'Moderate', chemical status is 'Fail' with six RNAG. There are three protected areas within the catchment area, these are: River Trent from River Soar to Carlton-on-Trent NVZ; River Trent; and River Trent bifurcation Pingley Dyke to Winthorpe

Watercourse	Approximate distance from Scheme[25]	Is the watercourse a WFD waterbody?	Q95 Levels (m^3/s)[26]	Description
				NVZ. All three of these are within the study area of the Scheme.
Rundell Dyke (Tributary of River Trent)	0.3 km south of the 'Kelham and Averham FCA'	Yes	Unknown	This waterbody joins the River Trent within the study area (SK 76839 54334). This dyke flows easterly where it joins northern section of the River Trent near Averham. The WFD catchment associated with this waterbody is 'Pingley/Rundell Dyke Catch Upper (tributary of Trent) waterbody [GB104028053420]'. This waterbody has a length of approximately 7.7km and a catchment area of approximately 30.4km^2. It is not designated an AWB or HMWB. According to the Cycle 3 (2019) data, the overall status of the waterbody is classified as 'Moderate', ecological status is 'Good', chemical status is 'Fail' with seven RNAG identified. There is one protected area within this WFD catchment (River Trent bifurcation Pingley Dyke to Winthorpe NVZ). This protected area is within the study area of the Scheme. The waterbody is a tributary of the River Trent and it joins approximately 0.3km upstream of the proposed 'Kelham and Averham FCA' and approximately 0.5km downstream of the proposed 'Farndon East and Farndon West FCAs' near Farndon junction.
Broadgate Lane Feeder	0.4km north of the 'Kelham and Averham FCA'	No	Unknown	This ordinary watercourse is an agricultural drain from fields north of Kelham. The watercourse connects to Mission Drain prior to reaching Kelham.
Misson Drain	0.4km north-east (downstream) of the 'Kelham and Averham FCA'	No	Unknown	This ordinary watercourse is an agricultural drain which drains into the River Trent (SK 77558 55647).
Unnamed watercourse (2)	0km – The A46 crosses this watercourse once	No	Unknown	This ordinary watercourse drains into the River Trent downstream of where the northern and southern leg of the River Trent rejoin. This watercourse is culverted under the A46 at SK 80478 55990.

Watercourse	Approximate distance from Scheme[25]	Is the watercourse a WFD waterbody?	Q95 Levels (m^3/s)[26]	Description
Slough Dyke (The Fleet)	0km – The A46 crosses this watercourse immediately west of Brownhills roundabout	Yes	Unknown	This watercourse flows through the north-east of Newark-on-Trent and Winthorpe before joining the River Trent downstream of the Scheme. This watercourse converges downstream of Winthorpe at SK 81443 57026 with the Tributary of the Fleet. These two watercourses converge to become The Fleet which discharges into the River Trent approximately 5.2km downstream. The WFD catchment associated with this waterbody is 'Slough Dyke Catchment (tributary of Trent) waterbody [GB104028053111]'. This waterbody is a HMWB with a length of approximately 8.3km and a catchment area of approximately 19.9km^2. According to the Cycle 3 (2019) data, the overall status of the waterbody is classified as 'Moderate', ecological status is 'Moderate', chemical status is 'Fail' with seven RNAG identified. There is one protected area within this WFD catchment (River Trent from River Soar to Carlton-on-Trent NVZ), this protected area is within the study area.
Tributary of the Fleet (1)	0m – The A46 crosses this watercourse once, and the A17 within the scheme boundary near Winthorpe crosses this watercourse within the Scheme extent.	No	Unknown	This watercourse flows from south to north, under the A17 and A46 and through Winthorpe before joining the Slough Dyke (The Fleet) downstream of Winthorpe at SK 81443 57026. These two watercourses converge to become The Fleet which discharges into the River Trent approximately 5.2km downstream.
Tributary of the Fleet (2)	500m – Winthorpe roundabout is south-east of this watercourse	No	Unknown	This watercourse is located 500m north-west of the Scheme and connects to the Fleet. The existing drainage system of the A46 and A1133 discharges into this watercourse.

Waterbodies

13.8.7 There are no WFD lake waterbodies within the study area, however, there are numerous non-WFD lakes/ponds. These are shown in Table 13-5. These ponds/lakes have been identified as not being groundwater dependent, therefore they are considered to be surface water fed.

Table 13-5: Lakes and ponds identified within the study area

Pond reference	Central grid reference	Approximate distance from Scheme[28]	Description and hydrological connectivity
Farndon Ponds	SK 77002 52617	0.5km west	These ponds are designated as a LNR for its outstanding local wetland which supports a biodiversity of wildlife and fauna. The ponds are located upstream of the Scheme.
Ponds at Staythorpe Power Station	SK 76136 53613	1km south of the 'Kelham and Averham FCA'	Three ponds associated with the power station. These are separated from A46 by the River Trent, and also separated from the Kelham and Averham FCA by roads and a railway track.
Pond 3	SK 76418 54751	Within the 'Kelham and Averham FCA'	Small pond, potentially created as an agricultural irrigation pond. From a review of historical mapping, the pond appears to have been created between 1977 and 1999.
Pond 4	SK 75842 55181	0.6km north-west of the 'Kelham and Averham FCA'	Small pond, potentially created as an attenuation pond. From a review of historical mapping, the pond appears to have been created between 1977 and 1999.
Pond 5	SK 76971 55632	0.2km north of the 'Kelham and Averham FCA'	Small pond, potentially created as an attenuation pond. From a review of historical mapping, the pond appears to have been created between 1977 and 1999.
Pond 6	SK 79705 54878	Adjacent to the Scheme	Large body of water associated with the British Sugar Factory.
Ponds north of British Sugar Factory	SK 79743 55412	0.2km west of Scheme	A collection of waterbodies associated with the British Sugar factory.
Ponds at Smeaton's Lakes Camping Site	SK 79029 55954	1km north-west of Scheme	Three bodies of water associated with the campsite. These are understood to be

[28] The distance has been taken from the closest point of the of the pond/lake to the Scheme, this is not the hydrological connectivity distance.

Pond reference	Central grid reference	Approximate distance from Scheme[28]	Description and hydrological connectivity
			artificially created for leisure purposes.
Nottingham Piscatorial Society waterbodies 2	SK 79765 56987	0.5km west of Scheme	Six bodies of water to north of the River Trent, adjacent to the A1. These are understood to be used by the NPS for leisure purposes. These are separated from the Scheme by the River Trent.

13.8.8 There are three marinas within the study area. Farndon Marina lies approximately 0.8 kilometres west of the Scheme and upstream of the southern point where the A46 crosses the River Trent. Newark-on-Trent Marina is approximately 1 kilometre downstream of where the A46 crosses the River Trent, and 0.6 kilometres downstream of Farndon East FCA. Kings Waterside and Marina is adjacent to the A46 boundary (approximately 2.8 kilometres downstream of the Farndon East FCA boundary with the River Trent, and 0.5km upstream of where the Scheme extent crosses the River Trent near Nether Lock Viaduct).

13.8.9 Data from the Highways Agency Drainage Data Management System (HA DDMS)[29] and other sources confirms there are a number of drainage systems within the area including: agricultural drains, road network drains and residential drains. Due to the large number of these present within the study area, these are identified as a single receptor in the assessment: ‘Drainage system’.

Water quality monitoring

13.8.10 Surface water quality monitoring was undertaken on 16 January 2023, 21 April 2023, and July 2023 at fourteen locations. The methodology, sample locations and results are presented in Appendix 13.5 (Surface Water Quality Monitoring Report) of the ES Appendices [APP-180].

13.8.11 The water quality sampling was undertaken to provide baseline conditions of the identified waterbodies and to determine their overall importance.

13.8.12 A summary of the monitoring results is provided in Table 13-6.

[29] Highways England (2013) Highways Agency Drainage Data Management System (HA DDMS) [online] Available at: HA DDMS (Last accessed December 2023)

Table 13-6: Surface water quality monitoring results[30] [31]

Location	Date	pH	BOD (mg/l)	TSS (mg/l)	Copper (mg/l)	Zinc (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Nickel (mg/l)	Chloride (mg/l)	Nitrates (mg/l)	Phosphates (mg/l)	PAH (µg/l)	TPH (µg/l)
River Trent Samples														
Point 1	January 2023	7.9	62.1	10	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	27.5	23.7	< 0.04	0.20	2260
	April 2023	7.4	8.6	15	0.14	< 0.0008	0.0106	0.0302	0.011	45.0	27.9	0.23	0.26	325
	July 2023	7.4*	5.09*	10*	0.020	0.100	<0.0008	0.015	0.0349	53.1*	25.4*	0.73	0.03	87.8
Point 5	January 2023	7.9	46.5	16	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	27.9	23.6	0.13	0.21	1750
	April 2023	7.8	6.0	5.0	0.178	0.049	0.0013	0.0056	0.104	44.6	27.0	0.24	0.18	288
	July 2023	7.6*	5.25*	8.5*	<0.008	0.093	<0.0008	0.009	0.0334	51.7*	25.1*	0.72	< 0.01	484
Point 8	January 2023	7.9	53.3	26	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	28.0	27.4	0.13	0.47	1000
	April 2023	7.9	6.4	28	0.209	0.04	0.0012	< 0.0008	0.023	43.5	29.0	0.21	1.24	229
	July 2023	7.6*	<4.00*	8.0*	0.034	0.316	0.0033	0.027	0.0523	53.3*	26.3*	0.72	< 0.01	<10.0
Point 10	January 2023	7.9	< 4.00	22	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	29.7	28.8	0.16	0.64	< 10.0
	April 2023	7.9	5.9	8.0	0.199	0.037	0.0104	< 0.0008	0.057	40.6	28.2	0.25	0.30	557
	July 2023	7.6*	<4.00*	6.5*	0.017	0.364	0.0010	0.024	0.0874	78.4*	48.9*	0.47	0.08	159
Point 11	January 2023	7.9	29.7	20	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	30.5	26.8	0.23	0.31	634
	April 2023	7.9	3.3	22	0.142	0.067	< 0.0008	< 0.0008	< 0.004	43.0	28.1	0.27	4.26	481
	July 2023	7.7*	<4.00*	12*	0.026	0.179	<0.0008	0.041	0.0168	50.6*	27.2*	0.72	< 0.01	<10.0
Misson Drain														

[30] Samples were collected by Skanska, and laboratory analysis undertaken by Analytical Construction Services (ACS) Testing Limited.

[31] '*' identifies a deviation in the samples and it is possible therefore that the results provided may not be representative of the sample taken. Review the full results within Appendix 13.5 Surface Water Quality Monitoring Report of the ES Appendices [APP-180] to identify what the deviation is.

Location	Date	pH	BOD (mg/l)	TSS (mg/l)	Copper (mg/l)	Zinc (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Nickel (mg/l)	Chloride (mg/l)	Nitrates (mg/l)	Phosphates (mg/l)	PAH (µg/l)	TPH (µg/l)
Point 3	January 2023	7.6	51.3	12	< 0.008	< 0.002	< 0.0008	< 0.004	0.165	51.3	59.8	0.16	0.16	1500
	April 2023	7.4	6.4	9.5	0.138	0.013	< 0.0008	< 0.0008	<0.004	52.9	49.2	< 0.04	0.29	408
	July 2023	7.2*	8.66*	380*	0.024	0.110	0.0009	0.035	0.0104	5.68*	3.37*	0.62	0.45	<10.0
Point 4	January 2023	7.6	< 4.00	6.0	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	56.6	57.5	0.11	0.15	1950
	April 2023	7.3	14.8	310	0.003	< 0.0008	< 0.0008	< 0.0008	< 0.004	82.5	50.3	< 0.04	0.22	79.7
	July 2023	7.0*	17.5*	320*	0.087	0.247	< 0.0008	0.024	0.0110	55.5*	4.86*	0.25	1.82	310
Old Trent Dyke														
Point 6	January 2023	7.6	< 4.00	< 4.0	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	72.0	13.1	< 0.04	0.19	1640
	April 2023	7.3	5.6	13	0.116	< 0.008	0.0053	0.0418	< 0.004	69.5	0.938	< 0.04	0.12	338
	July 2023	7.3*	11.2*	62*	0.045	0.21	< 0.0008	0.04	0.0263	91.5	0.968*	1.27	<0.01	161
River Devon														
Point 7	January 2023	7.7	6.01	16	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	27.5	50.0	< 0.04	0.43	1830
	April 2023	7.7	5.9	9.5	0.179	0.092	< 0.0008	< 0.0008	0.084	37.7	38.8	< 0.04	0.02	359
	July 2023	7.4*	<4.00*	7*	0.024	0.178	0.0021	0.068	0.018	49.1	27.9*	0.66	8.61	113.0
Unknown Watercourse														
Point 12	January 2023	7.8	< 4.00	18	< 0.008	< 0.002	< 0.0008	< 0.004	< 0.0008	258	10.0	< 0.04	0.28	920
	April 2023	7.7	5.9	29	0.226	0.014	< 0.0008	< 0.0008	< 0.0004	416	3.06	< 0.04	1.90	493
	July 2023	7.5*	<4.00*	140*	0.01	0.091	< 0.0008	0.013	0.006	64.1	3.14*	0.19	0.09	< 10.0
The Fleet														
Point 13	January 2023	7.7	18.3	8.0	< 0.008	< 0.002	< 0.0008	< 0.004	0.049	73.9	51.2	< 0.04	0.05	1410
	April 2023	7.8	5.6	7.0	0.322	0.131	0.003	0.0769	0.004	79.1	34.9	< 0.04	0.75	200
	July 2023	7.5*	<4.00*	9.5*	0.023	0.116	< 0.0008	0.025	0.0023	73.7	15.7*	< 0.04	0.001	< 10.0

Location	Date	pH	BOD (mg/l)	TSS (mg/l)	Copper (mg/l)	Zinc (mg/l)	Cadmium (mg/l)	Lead (mg/l)	Nickel (mg/l)	Chloride (mg/l)	Nitrates (mg/l)	Phosphates (mg/l)	PAH (µg/l)	TPH (µg/l)
Point 14	January 2023	7.5	5.46	22	< 0.008	< 0.002	< 0.0008	< 0.004	0.03	69.1	53.6	< 0.04	0.37	< 10.0
	April 2023	7.6	4.9	< 4.0	0.203	0.019	0.0067	0.0124	0.03	70.5	40.7	< 0.04	0.37	392
	July 2023	7.1*	4.15*	14*	0.055	0.072	< 0.0008	0.012	1.323	71	20.9*	< 0.04	<0.01	332

13.8.13 The River Trent samples showed the following trends:

- All pH values were within the Water Quality Standard (WQS) threshold.
- For the biochemical oxygen demand (BOD) concentration, all data sets exceed the WQS threshold limit, however there is a downward trend in concentrations during the year, with the exception of Point 11. The concentrations exceed the threshold for Good Ecological Status.
- None of the Total Suspended Solids (TSS) concentrations exceeded the EQS threshold limit.
- Some samples collected exceeded the WQS threshold for copper, zinc, nickel, nitrate, phosphate and PAH levels. There is no clear correlation between these parameter concentrations and distance downstream, or with time.
- For cadmium levels, the majority of the concentrations recorded across the points are < 0.0008 mg/l suggesting the baseline conditions are below the Limit Of Detection (LOD). There are only six values exceeding this value and four of the six were recorded in April 2023, suggesting these samples were outliers.
- Lead concentrations increased with time, with no clear correlation between concentration and distance downstream.

13.8.14 The Mission Drain samples showed the following trends:

- All pH values were within the WQS threshold.
- Some samples collected exceeded the WQS threshold for BOD, TSS, cadmium, lead, nickel, nitrate, phosphate, and TPH concentrations. There is no clear correlation between these concentrations and distance downstream, or with time.
- Copper levels fluctuated across the year at the two points, however levels recorded at Point 3 in April 2023 and July 2023, and at Point 4 in July 2023 show an increasing trend in concentration with time.
- Zinc levels show a significant difference in concentration between the two points. There is an overall trend of increasing concentration with time.
- Cadmium levels were below LOD values at all points except for Point 3 in July 2023.
- Chloride levels were recorded as below the WQS threshold with no clear correlation between this parameter and distance downstream, or with time.
- PAH concentrations show an increasing trend during the year, with no clear correlation between concentration and distance downstream.

13.8.15 The Old Trent Dyke samples showed the following trends:

- All pH values were within the WQS threshold.
- The majority of the samples recorded below WQS threshold concentrations for the following parameters: BOD, TSS, nickel, chloride, PAH.

- Some samples collected exceeded the WQS threshold for copper, zinc, cadmium, lead, nitrate, phosphate. There is no clear correlation between these parameter concentrations and time.
- The phosphate levels recorded in July 2023 show a significant increase in concentrations which exceeded the WQS threshold. Further monitoring will determine whether this value is an outlier.

13.8.16 The River Devon samples showed the following trends:

- All pH values were within the WQS threshold.
- The majority of the samples recorded below WQS threshold concentrations for the following parameters: BOD, TSS,
- Some samples collected exceeded the WQS threshold for copper, zinc, cadmium, lead, nickel, chloride, nitrate, phosphate and PAH.
- BOD, TSS and chloride concentrations were recorded as showing an increasing trend of concentrations over time.
- Zinc, TPH, and nitrate concentrations were recorded as showing a trend of decreasing concentrations over time.
    - The phosphate levels recorded in July 2023 show a significant increase in concentrations which exceeded the WQS threshold. Further monitoring will determine whether this value is an outlier.

13.8.17 The Unknown watercourse samples showed the following trends:

- All pH values were within the WQS threshold with the pH decreasing over time.
- BOD, TSS, cadmium, lead, and nickel concentrations were below the WQS threshold with no clear correlation between concentrations and time.
- Copper, chloride, nitrate, and PAH concentrations exceeded the WQS threshold with no clear correlation between concentrations and time.
- Zinc concentrations exceeded the WQS threshold with a trend of increasing concentrations over time.
- The phosphate levels recorded in July 2023 show a significant increase in concentrations which exceeded the WQS threshold. Further monitoring will determine whether this value is an outlier.
- TPH concentrations were shown to be decreasing in concentration with time.

13.8.18 The Fleet samples showed the following trends:

- All pH values were within the WQS threshold.
- The majority of the BOD, TSS concentrations were below the WQS threshold with no clear correlation between concentrations and distance downstream.
- Copper, cadmium, nickel, phosphate, and PAH concentrations exceeded the WQS threshold with no clear correlation between concentrations and distance downstream.
- Zinc concentrations exceeded the WQS threshold with a trend of increasing concentrations over time.

- Lead concentrations were recorded as below the threshold for the majority of the samples and showed an increase in concentrations downstream with no clear correlation between concentration and time.
- There is no clear trend visible with TPH concentrations.

13.8.19 Further analysis of the water samples is available in Appendix 13.5 (Surface Water Quality Monitoring Report) of the ES Appendices [APP-180].

Surface water environmental permits/discharge consents

13.8.20 There are 41 active discharge consents (now called Environmental Permits) registered on the Environment Agency's portal[32] within the 1 kilometre study area[33], as of October 2023. These were registered as the following effluent type: one – 'Sewage and Trade combined', 18 – 'Sewage – water company',15 – 'Sewage – not water company', and three – 'Miscellaneous / Sewage – water company'.

13.8.21 The active discharge consents were broken up into the following site types: eight domestic property, one commercial accommodation property, five pumping station on a sewerage network, five commercial trades, 13 storm tank/combined sewer overflow (CSO) on sewerage network, six undefined, and three waste water treatment works.

Flood risk

13.8.22 Figure 13.3 (Flooding Constraints) of the ES Figures [AS-075] shows the Flood Zones identified within the study area.

13.8.23 The Scheme is located across areas within Flood Zone 2 (land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding) and Flood Zone 3 (land having a 1 in 100 or greater annual probability of river flooding). These Flood Zones are associated with the River Trent. The Scheme is not located within an area at risk of tidal flooding.

13.8.24 There are areas of medium risk of surface water flooding (between 1 in 30 and 1 in 100 chance of flooding each year), as defined by surface water flood risk mapping, however the majority of the Scheme is located within areas of very low risk of surface water flooding (between 1 in 100 and 1 in 1000 chance of flooding each year). There is a section in the northern extent of the Scheme, adjacent to Alexander Avenue, where there is an area of medium surface water

[32] Environment Agency's published data. Environmental Permitting Regulations – Discharges to Water and Groundwater, Available at: Environmental Permitting Regulations – Discharges to Water and Groundwater (data.gov.uk) (Last accessed December 2023).

[33] The following postcodes were used for the 1km search radius: NG24 4SW, NG24 4SR, NG24 1FH, NG24 1FW, NG24 2EB, NG24 2EA, NG24 2PQ, NG24 2RB, NG 7RS, and NG23 5QZ. Duplicate records from these postcode searches were removed.

flood risk associated with the ordinary watercourse being culverted under the A46.

13.8.25 Further details on the baseline flood risk are provided in Appendix 13.2 (Flood Risk Assessment) of the ES Appendices [REP6-010].

Groundwater

13.8.26 Figure 13.4 (Groundwater Constraints) of the ES Figures [AS-076] shows the groundwater baseline features identified within the 1 kilometre study area. Historic and authorised landfills are detailed in Chapter 9 (Geology and Soils) of this ES.

13.8.27 British Geological Survey (BGS) superficial deposits data[34] shows Alluvium present along much of the Scheme, interspersed with smaller areas of the Holme Pierrpoint Sand and Gravel member. The Balderton Sand and Gravel Member is present to the north of the Scheme.

13.8.28 The study area is entirely underlain by the Mercia Mudstone Group bedrock which dips to the east. For more detailed information on the superficial deposits and bedrock identified within the study area, see Chapter 9 (Geology and Soils) of this ES.

Groundwater levels

13.8.29 Groundwater monitoring carried out from August to December 2021[35] to provide preliminary geotechnical information, indicated relatively shallow groundwater levels, varying from 0.3 metres to 4.1 metres below ground level. Groundwater levels from the current baseline groundwater monitoring programme, which commenced January 2023, are also within this range.

13.8.30 The groundwater hydraulic gradient appears to be largely topographically controlled. Groundwater levels within alluvium follow the topographic gradient of the river valley of the River Trent and its tributaries, towards the north/north-east. In the topographically elevated area at the north of the Scheme, groundwater levels again follow the topographic gradient west/south-west, likely discharging locally to a tributary of the Fleet watercourse.

Groundwater abstractions

13.8.31 The Environment Agency has provided information on groundwater sources[36] within the study area.

[34] BGS (Accessed 2022). BGS Geology Viewer 0.0.48 (Beta). Retrieved from BGS Geology Viewer: https://geologyviewer.bgs.ac.uk/?_ga=2.142580980.733296288.1669808516-270301649.1669808516. (Last Accessed December 2023)

[35] Tetra Tech. (2022). A46 North Newark Bypass. Factual Ground Investigation Report. V1.1.

[36] In response to Request for information EMD-294943 submitted November 2023.

13.8.32 There are three groundwater abstractions for spray irrigation within the study area. These are associated with a single farm and are located approximately 120 metres to 220 metres outside the Order Limits, to the extreme north of the Scheme.

Groundwater consented discharges

13.8.33 There are four active consented discharges to groundwater via infiltration within the study area. These are for domestic discharge of final or treated sewage effluent.

Aquifer designations and vulnerability

13.8.34 Superficial deposits, where present, are designated by the BGS as a Secondary A aquifer, which can support local water supply or form baseflow to rivers.

13.8.35 The Scheme is underlain entirely by the Mercia Mudstone Group, which is designated by the BGS[37] as a Secondary B aquifer, which may store and yield limited amounts of groundwater through fissures and eroded layers.

13.8.36 The Environment Agency has mapped aquifer vulnerability nationally using information on recharge, soil leaching properties, superficial cover and the unsaturated zone above the groundwater table.[38] Aquifer vulnerability mapping indicates that the Scheme is mostly located in an area of medium to high groundwater vulnerability. Where the Mercia Mudstone Group crops out to the west of Brownhills Roundabout, the aquifer vulnerability is designated as high.

13.8.37 There are two groundwater Source Protection Zones (SPZ) east of the Scheme. The outer protection zones of the SPZs are located approximately 1.5 kilometres east, and 2.8 kilometres south-east of the Scheme.

WFD groundwater status

13.8.38 The Scheme is located entirely within the Lower Trent Erewash – Secondary Combined WFD groundwater body, which has an area of 1,924km^2.

13.8.39 The Lower Trent Erewash – Secondary Combined ground waterbody was at ‘Poor’ overall status until 2019, when it achieved ‘Good’ overall status. The Cycle 3 2019 quantitative and chemical status are both ‘Good’.

[37] BGS. (2022, 07). *Aquifer Designation Map (Bedrock) England*. Retrieved from Magic: https://magic.defra.gov.uk/MagicMap.aspx.

[38] Environment Agency. (2020, 09). *Groundwater Vulnerability Map (England)*. Retrieved from Magic: https://magic.defra.gov.uk/MagicMap.aspx.

13.8.40 River Basin Management Plan mapping[39] indicates that the Scheme is located outside all WFD designated groundwater NVZ and drinking water safeguard zones. The Scheme is located within a WFD drinking water protected area which is designated as “probably not at risk”.

Groundwater flood risk

13.8.41 The majority of the Scheme is located within an area that is considered highly susceptible to groundwater flooding (≥75% chance of suffering from groundwater flooding).

Designated sites

13.8.42 There are no International/National Ramsar sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or SSSIs located within the study area. The Humber Estuary SAC is located approximately 53 kilometres north-east from the Order Limits directly, and 75 kilometres via the River Trent. The impacts on the qualifying features (lamprey) of this SAC have been assessed within Chapter 8 (Biodiversity) of this ES. Therefore, this SAC has not been considered further in this chapter.

13.8.43 There are two LNRs located within the study area

- Farndon Ponds LNR: located approximately 0.5 kilometres west of the Order Limits. Whilst this site is hydraulically connected to the River Trent, it is upstream of the Scheme.
- Devon Park Pastures LNR: located approximately 0.45 kilometres east of the Order Limits. This LNR lies on the River Devon at a point 0.3 kilometres upstream of the River Trent.

13.8.44 No GWDTEs were identified within the study area. As such, GWDTEs will not be considered further within this Chapter.

13.8.45 There are three NVZs located within the study area, these are:

- River Trent bifurcation Pingley Dyke to Winthorpe NVZ: The ‘Kelham and Averham’ FCA is located within this area. The NVZ is a protected area within the Trent Bifurcation Pingley Dyke to Winthorpe [GB104028053390] WFD waterbody, and Pingley/Rundell Dyke Catch Upper (tributary of Trent) [GB104028053420] WFD waterbody.
- River Trent from River Soar to Carlton-on-Trent NVZ: The majority of the Scheme is located within this NVZ, the A46 between Farndon Junction and Winthorpe. The NVZ is a protected area within the following WFD waterbodies: Trent from Soar to The Beck [GB104028053110], Devon from Cotham to Trent [GB104028052632], Trent Bifurcation Pingley Dyke to Winthorpe [GB104028053390] and Slough Dyke Catchment (tributary of Trent) [GB104028053111].

[39] Environment Agency. (2022, 12). River Basin Management Plan: maps. Available at: Protected Areas | River Basin Management Plan: maps (arcgis.com) (Last accessed December 2023).

- SMITE R NVZ: Part of Farndon Junction and the A46 south of Farndon Junction lie within this NVZ. Farndon Junction is split between this NVZ and River Trent from River Soar to Carlton-on-Trent NVZ. This NVZ is a protected area within the following WFD waterbodies: Middle Beck Catchment (tributary of Devon Waterbody' [GB104028052633], and Devon from Cotham to Trent waterbody [GB104028052632].

Importance of receptors

13.8.46 The key water receptors within the study area as identified in the sections above are summarised in Table 13-7 below.

Table 13-7: Summary of the importance of water receptors

Name	Type of receptor	Sensitivity/ Importance	Justification
Trent from Soar to The Beck waterbody [GB104028053110]	Main River	Very high	The watercourse has a WFD classification and Q95 > 1m^3/s[40].
Devon from Cotham to Trent waterbody [GB104028052632]	Main River	High	The watercourse has a WFD classification but the Q95 < 1m^3/s.
Old Trent Dyke	Ordinary Watercourse	Medium	The watercourse does not have a WFD classification. It is assumed the Q95 > 0.001m^3/s.
Unnamed watercourse (1)	Ordinary Watercourse	Low	This watercourse does not have a WFD classification and appears to be heavily modified (culverted under development). It is assumed the Q95 < 0.001m^3/s.
Trent Bifurcation Pingley Dyke to Winthorpe waterbody [GB104028053390]	Main River	Very high	The watercourse has a WFD classification and Q95 > 1m^3/s[41].
Broadgate Lane Feeder	Ordinary Watercourse	Low	This watercourse does not have a WFD classification and appears to be a drainage channel (potentially for agricultural purposes). It is assumed the Q95 < 0.001m^3/s.
Misson Drain	Ordinary Watercourse	Low	This watercourse does not have a WFD classification and appears to be a drainage channel (potentially for agricultural purposes). It is assumed the Q95 < 0.001m^3/s.
Unnamed watercourse (2)	Ordinary Watercourse	Medium	The watercourse does not have a WFD classification. It is assumed the Q95 > 0.001m^3/s.
Slough Dyke Catchment (tributary of Trent) waterbody [GB104028053111]	Main River	High	The watercourse has a WFD classification. The Q95 level is unknown, however it appears to be culverted under Newark-on-Trent. Assuming it would not have a flow rate higher than the River Devon, it is assumed to have a Q95 < 1m^3/s.
Tributary of the Fleet (1)	Main River	Medium	The watercourse does not have a WFD classification. It is assumed the Q95 > 0.001m^3/s.
Tributary of the Fleet (2)	Main River	Medium	The watercourse does not have a WFD classification. It is assumed the Q95 > 0.001m^3/s.
All ponds	Ponds	Low	None of the ponds identified within the study area are mentioned within the RBMP or are WFD lake waterbodies. For ecological features and importance of these ponds see

[40] The flow in cubic metres per second which is equalled or exceeded for 95% of the flow record.

[41] The flow in cubic metres per second which is equalled or exceeded for 95% of the flow record.

Name	Type of receptor	Sensitivity/ Importance	Justification
			Chapter 8 (Biodiversity) of this ES.
Drainage system	Drains	Low	These are artificial systems associated with the surrounding highways network, urban environment, and agricultural drains. Therefore, they are not mentioned within the RBMP and are not WFD watercourses.
Newark-on-Trent Marina	Marina off River Devon	Low	This receptor is connected to the River Devon, however is not considered a WFD waterbody in itself and is not mentioned within the RBMP.
Kings Waterside and Marina	Marina off River Trent	Low	This receptor is connected to the River Trent, however is not considered a WFD waterbody in itself and is not mentioned within the RBMP.
Superficial aquifers	Groundwater	Medium	This receptor is a Secondary A aquifer (superficial) providing water for agricultural or industrial use with limited connection to surface water, comprising: ● Alluvium ● Holme Pierrepoint Sand and Gravel member ● Balderton sand and gravel member
Bedrock aquifer	Groundwater	Medium	This receptor is a Secondary B aquifer (bedrock), providing water for agricultural or industrial use with limited connection to surface water, comprising: ● Mercia Mudstone Group
Trent Erewash Secondary Combined (GB4042G990300) WFD ground waterbody	Groundwater	Medium	The WFD ground waterbody is designated 'Good' overall status in Cycle 3 (2019). It is a Secondary B aquifer and is therefore considered to be an aquifer providing water for agricultural or industrial use with limited connection to surface water.
Farndon Ponds LNR	Designated site	Medium	The site is designated by the local authority and is considered to be of moderate quality and rarity. Whilst the site is adjacent to the River Trent, it is located upstream of the Scheme and therefore there is no surface water pathway to the Scheme to impact this LNR. For further information on the ecological features and importance of these LNRs, see Chapter 8 (Biodiversity) of this ES.
Devon Park Pastures LNR	Designated site	Medium	The site is designated by the local authority and is considered to be of moderate quality and rarity. Whilst the site does have a surface water connection to the Scheme, it is located more than 450 metres from the Scheme and so it is considered that there is no credible pathway for a change in water quality to impact this LNR. For further information on the ecological features and importance of these LNRs see Chapter 8 (Biodiversity) of this ES.
External residential and commercial receptors	Flood Risk	Medium-	The Scheme is located within an area of Flood Zone 3 associated with the River Trent and the land use within this floodplain is considered to comprise essential infrastructure and highly vulnerable development (e.g., caravans, mobile homes, and park homes intended for permanent residential use, utilities and transport infrastructure).

Name	Type of receptor	Sensitivity/ Importance	Justification
		Very High[42]	
The A46 Scheme	Flood Risk	Very High	The Scheme is considered Essential Infrastructure, resulting in a Very High Importance classification.

[42] External receptors have a range of importance categorisations – these are detailed further in the Flood Risk Assessment. (Appendix 13.2 of the Environmental Statement Appendices [APP-177])

13.9 Potential impacts

13.9.1 The following potential impacts from the Scheme have been identified for both the construction and operational stages.

Construction

Surface water

13.9.2 There is the potential for surface water quality to be affected through contaminants arising from construction activities entering surface watercourses. These activities include excavation, deposition of soils, sediments or other construction materials to accommodate new watercourse crossings, construction and modification of outfalls, the Slough Dyke (the Fleet) realignment (including the infilling and reinstatement activities), spillage of fuels or other contaminating liquids and mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled surface runoff, and the work adjacent to the Tributary of the Fleet (1) as part of the minor riparian habitat enhancement measures.

13.9.3 There is the potential for adverse impacts due to localised damage to channel and riparian features and disruption to the natural hydraulic and sediment transport processes due to the modification and construction of culverts and bridges during construction for the Scheme.

13.9.4 Changes in topography and/or earthworks which could change overland flow paths during storm events have the potential to increase the surface water flooding within the study area.

13.9.5 During construction activities associated with the realignment of the Slough Dyke (The Fleet), the flow of the watercourse would be altered and diverted to allow for the temporary culvert and piping works to be installed. These works have the potential to alter the quantity and dynamics of the flow within the watercourse. The temporary culvert would result in increased shading of the watercourse.

13.9.6 Pond 3 would be destroyed as part of the construction works at Kelham and Averham FCA. The existing pond would be drained utilising pumps and settlement tanks, discharging the water into the adjacent ditch. A replacement pond would be created within the Kelham and Averham FCA boundary to the east of the existing pond. This would allow for the pond to maintain its agricultural function (irrigation).

13.9.7 Table 13-8 provides a summary of surface waterbodies to be considered further in the assessment.

Table 13-8: Summary of the surface water receptors impacted by the Scheme

Waterbody	Approximate distance from Scheme[43]	Considered further?
River Trent (southern) / Trent from Soar to The Beck waterbody [GB104028053110]	0km - The A46 crosses this watercourse twice	Yes - the Scheme crosses the watercourse.
Middle Beck	0.8km south-east (upstream) of the southern extent of the Scheme	No - This waterbody is a tributary of the River Devon and is located approximately 0.5km upstream of the closest potential discharge point (within the River Devon). Therefore, it is not considered necessary to assess this waterbody further within this Chapter as there is no credible pathway for impacts of the Scheme to occur.
River Devon / Devon from Cotham to Trent waterbody [GB104028052632]	0.1km, east (upstream) of the southern extent of the Scheme.	Yes - the Scheme is within close proximity of this waterbody and has the potential to discharge into this waterbody.
Old Trent Dyke	0km - The A46 crosses this watercourse three times	Yes – the Scheme crosses this watercourse and there is the potential for pollutants from construction (e.g., contaminated runoff) to enter the receptor.
Unnamed watercourse (1)	0km - The A46 crosses this watercourse once	Yes - the Scheme crosses this watercourse and there is the potential for pollutants from construction (e.g., contaminated runoff) to enter the receptor.
River Trent (northern) / Trent Bifurcation Pingley Dyke to Winthorpe waterbody [GB104028053390]	0km - The FCAs are located adjacent to this watercourse	Yes – The Order Limits extend into the WFD waterbody and there is the potential for pollutants from construction (e.g., contaminated runoff) to enter the watercourse.
Rundell Dyke (Tributary of River Trent)	0.3km south of the Kelham and Averham FCA	No - The waterbody is a tributary of the River Trent and it joins approximately 0.3km upstream of the new Kelham and Averham FCA and approximately 0.5m downstream of the proposed Farndon East and Farndon West FCAs near Farndon Junction. The Scheme is within the catchment but it is not considered feasible for potential contaminants to travel upstream to the WFD waterbody. Therefore, it is not considered necessary to assess this waterbody further within this Chapter as there is no credible pathway for impacts as a result of the Scheme to occur.

[43] The distance has been taken from the point of the watercourse closest to the Scheme, this is not the hydraulically connected distance.

Waterbody	Approximate distance from Scheme[43]	Considered further?
Broadgate Lane Feeder	0.4km north of the Kelham and Averham FCA	Yes – the Scheme is close to this watercourse and has the potential to discharge into it.
Mission Drain	0.4km north-east (downstream) of the Kelham and Averham FCA	Yes - the Scheme is close to this watercourse and has the potential to discharge into it.
Unnamed watercourse (2)	0km - The A46 crosses this watercourse once	Yes - the Scheme crosses this watercourse and there is the potential for pollutants from construction (e.g., contaminated runoff) to enter the receptor.
Slough Dyke (The Fleet)	0km - The A46 crosses this watercourse immediately west of Brownhills Roundabout	Yes - the Scheme crosses this watercourse and the watercourse would be realigned and temporarily culverted during construction of the Scheme.
Tributary of the Fleet (1)	0km – The A46 crosses this watercourse once, and the A17 within the scheme boundary near Winthorpe crosses this watercourse within the Scheme extent.	Yes – the Scheme crosses the watercourse. Riparian habitat enhancement measures would be incorporated immediately downstream of where the watercourse passes under the A46.
Tributary of the Fleet (2)	500m north-east of Winthorpe Roundabout	Yes - part of Scheme drainage design would discharge into this watercourse.
Farndon Ponds	0.5km west	No - these ponds are not considered to be hydraulically connected to the Scheme, therefore it is not considered for there to be a credible pathway.
Ponds at Staythorpe Power Station	1km south of the Kelham and Averham FCA	No - the ponds are separated from A46 by the River Trent, and then separated from the Kelham and Averham FCA by roads and a railway track. Therefore it is not considered for there to be a credible pathway.
Pond 3	Within the Kelham and Averham FCA	Yes - this pond would be removed as part of the 'Kelham and Averham FCA' works.
Pond 4	0.6km north-west of the Kelham and Averham FCA	No - the ponds are separated from the Scheme by the River Trent, therefore it is not considered for there to be a credible pathway.
Pond 5	0.2km north of the Kelham and Averham FCA	No - the ponds are separated from the Scheme by the River Trent, therefore it is not considered for there to be a credible pathway.
Pond 6	Adjacent to the Scheme	Yes - this pond is adjacent to the Scheme and so pollutants from the associated construction works (e.g., contaminated runoff) have the potential to enter the

Waterbody	Approximate distance from Scheme[43]	Considered further?
		receptor.
Ponds north of British Sugar	0.2km west of Scheme	No - the ponds are separated from the Scheme by the River Trent, therefore it is not considered for there to be a credible pathway.
Ponds at Smeatons Lakes Camping Site	1km north-west of Scheme	No - these ponds are not considered to be hydraulically connected to the Scheme, therefore it is not considered for there to be a credible pathway.
Nottingham Piscatorial Society (NPS) waterbodies 1	0.9km north-west of Scheme	No - these ponds are separated from the Scheme by the River Trent and therefore, it is not considered for there to be a credible pathway.
Nottingham Piscatorial Society waterbodies 2	0.5km west of Scheme	No - these ponds are separated from the Scheme by the River Trent and therefore, it is not considered for there to be a credible pathway.

Fluvial flood risk

13.9.8 There is the potential for an increase in fluvial flood risk within the Scheme extent and the surrounding areas due to the potential for construction activities (i.e. culvert extension, excavation and enabling works, bridge/viaduct construction activities) associated with all aspects of the Scheme to alter the flow paths of surface water or increase the amount of surface water runoff in localised areas. The following risks are also present:

- Risk to the existing assets during construction
- Risk to the assets being constructed
- Risk to construction equipment and facilities used to carry out the construction
- Risk to personnel on site

Groundwater

13.9.9 Excavations for ground and earthworks during construction could impact groundwater flows and levels. There is potential for a temporary and local reduction in groundwater flows and levels due to dewatering in superficial or bedrock aquifers during excavations. Licensed and deregulated groundwater abstractions may also be temporarily impacted by dewatering activities.

13.9.10 There is the potential for adverse impacts from contamination of groundwater by the mobilisation of contaminants within the soils, through accidental spillages or direct contact with construction materials or piling operations which could create pathways to groundwater. In addition, there is the risk of contamination of aquifers through indirect groundwater receptors such as watercourses and/or abstractions.

13.9.11 Temporary culverting of Slough Dyke may have the potential to reduce recharge to the underlying aquifer.

Regulatory compliance

13.9.12 The potential adverse impacts to channels and riparian features, and disruption to the natural hydraulic and sediment transport processes as a result of construction works along the River Trent have the potential to cause deterioration of the WFD status of the waterbodies.

13.9.13 There is a potential for construction related runoff (heavy in sediment-laden metals) to affect water quality and therefore, adversely affect prey abundance or local watercourses inhabited by aquatic species. This has the potential to cause deterioration of the WFD status of the waterbodies.

13.9.14 In addition, the following potential adverse impacts have been identified associated with the realignment of the Slough Dyke (The Fleet) WFD waterbody:

- The flow of the Slough Dyke (The Fleet) would be altered and diverted during construction activities to allow for the temporary culvert and piping works to be installed, and the realignment to be constructed. These works have the potential to alter the quantity and dynamics of the flow within the watercourse.
- The temporary culvert would result in an increase in shading of the watercourse which has the potential to change the temperature.
- Construction activities (including over-pumping system) may disturb aquatic species and require fish rescues.

13.9.15 These adverse impacts have the potential to cause deterioration of the WFD status of the Slough Dyke (The Fleet) waterbody.

13.9.16 The cumulative impact of below ground construction works (in particular piling activities) and potential reduction in recharge of the groundwater due to the presence of temporary culverts have the potential to affect the WFD status of the Lower Trent Erewash Secondary Combined ground waterbody.

Designated sites

13.9.17 Changes to surface water qualities and volumes during construction could adversely affect the LNRs through contaminated surface water runoff. For ecological impacts on these LNRs see Chapter 8 (Biodiversity) of this ES. Further information is also provided in Appendix 13.4 (Drainage Strategy) of the ES Appendices [APP-179].

Operation

Surface water

13.9.18 Pollution of surface water from discharge of routine runoff may lead to long-term degradation of water quality. These contaminants within

road runoff typically include vehicle emissions (including atmospheric deposition), vehicle part wear and vehicle leakages, catalytic converters, road surface erosion, and seasonal and regular maintenance practices.

13.9.19 Possible contaminants include particulate solids, hydrocarbons (diesel, petroleum, lubricating oil leaks, and grease), heavy metals (especially copper and zinc, but also cadmium, iron, lead and chromium in lesser amounts), oxides of nitrogen, sulphates, rubber, asbestos, tyre wear deposits including lead, zinc, and hydrocarbons, and de-icing during cold weather. All these contaminants have the potential to have an adverse effect on the water quality of the receiving watercourse (River Trent, Unnamed watercourse (2), Slough Dyke (The Fleet), and Tributary of the Fleet (1)). The realigned Slough Dyke (The Fleet) would be approximately 10 meters closer to the A1 roadway, however, it is not expected for there to be an increase in risk of surface water run-off entering the watercourse. The access road adjacent to the Slough Dyke (The Fleet) would be made of concrete without a drainage system, therefore surface water runoff from the track would go straight into the watercourse. However, the access road would be used for maintenance purposes only and there would therefore be very infrequent traffic along the track.

13.9.20 The permanent realignment of the Slough Dyke (The Fleet) would result in a minor increase in length and sinuosity of the watercourse. As the realignment is expected to be of a similar dimension as the existing watercourse, it is not anticipated for there to be a change in cross-sectional dimensions and/or the flow dynamics. The watercourse would be reinstated to existing riparian habitat with scour protection in the form of buried gabion baskets incorporated, however this would not alter the flow dynamics of the watercourse.

13.9.21 The borrow pits at Farndon East would form a large lake with maximum depths of 4 metres, thus creating a new waterbody within the area. This would be groundwater fed, and therefore no impacts on surface water are expected.

13.9.22 The Tributary of the Fleet (1) would be enhanced immediately downstream of where it passes under the A46. These enhancements could include addition of semi-natural habitat in the bank top zone, and felled timber from the Scheme to be placed on the bank top to enhance the riparian habitat. These enhancements have the potential to improve the watercourse by improving habitat quality within the riparian zone, however it is not expected there would be a change in water quality. Further information of these biodiversity enhancements can be found in Chapter 8 (Biodiversity) of this ES.

Fluvial flood risk

13.9.23 There is a potential for an increase in flood risk within the Scheme extent and the surrounding areas due to:

- The presence of permanent infrastructure within the floodplain and the resultant decrease in the floodplain.
- The increase in impermeable surfacing and changes in surface water runoff as a result of changes in topography or flow patterns.

Groundwater

13.9.24 Permanent below-ground infrastructure, including permanent excavations for floodplain compensation areas and permanent realignment of Slough Dyke, may cause a change in existing groundwater flow regime, resulting in an interruption to flow. This may lead to the loss of water supply to watercourses.

13.9.25 The final use of the Farndon East and Farndon West FCAs would include groundwater-fed wetlands, ponds and a lake which may cause a change in existing groundwater flow regime.

13.9.26 Increased impermeable surfacing and new drainage systems have the potential to reduce recharge to underlying aquifers.

Regulatory compliance

13.9.27 Infrastructure associated with the viaduct crossings (piers and scour protection) adjacent to watercourses have the potential to cause direct adverse morphological impacts, which could result in a less dynamic flow, loss of sediment continuity, increased sedimentation, habitat severance, potential barriers for fish migration, and loss of habitats for macrophytes through shading. These adverse impacts could affect the WFD status of the watercourse.

13.9.28 The permanent realignment of the Slough Dyke (The Feet) would result in a minor increase in length and sinuosity of the watercourse. As the realignment is expected to be of a similar dimension as the existing watercourse, it is not anticipated for there to be a change in cross-sectional dimensions and/or the flow dynamics. The operational nature of the realignment is not anticipated to affect the WFD status of the watercourse.

13.9.29 Below ground infrastructure associated with the viaducts have potential to impact groundwater flow and levels in the WFD groundwater waterbody.

Designated sites

13.9.30 Changes to surface water qualities and volumes during operation could adversely affect the LNRs through contaminated surface water runoff or increased surface water flood risk. For ecological impacts on these LNRs, see Chapter 8 (Biodiversity) of this ES [APP-052].

13.10 Design, mitigation and enhancement measures

Design measures

13.10.1 The development of the Scheme design has been an iterative process undertaken through an integrated design team to adhere to the principles of the design and mitigation hierarchy outlined in DMRB LA 104. The first principle being to avoid potential adverse effects, if at all possible, before seeking to minimise or mitigate for any unavoidable impacts through a well-developed mitigation strategy. Embedded mitigation, incorporated throughout the development of the Scheme design to date, is outlined in Chapter 2 (The Scheme) of this ES. Embedded mitigation measures incorporated in the Scheme design include incorporation of Sustainable Drainage Systems (SuDS), avoidance of permanent structures within the watercourse, and provision of scour protection to reduce the risk of bank erosion. These features are described below and shown on Figure 2.3 (Environmental Masterplan) of the ES Figures [AS-026].

Mitigation measures – construction

13.10.2 A First Iteration Environmental Management Plan (EMP) [REP6-012] has been prepared for the Scheme and forms part of the application for development consent The First Iteration EMP acts as a mechanism to aid the delivery for the mitigation measures required during construction to manage potential effects of the Scheme on water resources and to demonstrate compliance with environmental legislation. These measures are known to be effective in managing the risk of pollution. This will be developed into a Second Iteration EMP for implementation during construction of the Scheme. Details on the First and Second Iteration EMPs, including how mitigation is secured within the draft DCO [REP6-004], is provided within Section 4.4 of Chapter 4 (Environmental Assessment Methodology) of the ES.

13.10.3 Rigorous groundwater protection measures, which are standard practice to prevent contamination, and as specified in the First Iteration EMP [REP6-012], would be implemented during construction. Such measures would mitigate the mobilisation of contaminants through accidental spillage or direct contact with construction materials, as discussed in Chapter 9 (Geology and Soils) of this ES [REP3-009].

13.10.4 Construction activities would be managed by best practice measures in accordance with Construction Industry Research and Information Association (CIRIA) Guidelines, including the following:

- CIRIA's 'Environmental good practice on site'[44]

[44] Audus, Charles and Evans (2010) Environmental Good Practice on Site (Third Edition) (C692).

- CIRIA's 'Control of water pollution from linear construction projects; Technical Guidance'[45]
- Environment Agency's 'Protect groundwater and prevent groundwater pollution'[46]
- Environment Agency's Pollution Prevention Guidelines PPG5 'Works and maintenance in or near water', PPG6 'Working at Construction and Demolition Sites', PPG7 'The safe operation of refuelling facilities', and PPG13 'Vehicle washing and cleaning[47]

13.10.5 The following documents are to be produced prior to construction and incorporated within the Second Iteration EMP:

- A Pollution Prevention Plan, including emergency spill procedures and incident control plan
- An Erosion and Sediment Management Plan
- An Invasive Non-Native Species (INNS) Management Plan
- An Emergency Response Plan for Flood Events

13.10.6 Piling will be required during construction. As detailed in Chapter 9 (Geology and Soils) of this ES, Piling Works Risk Assessments would be undertaken, if deemed necessary, prior to construction of the Scheme. In addition, method statements detailing piling operations would cover the potential to cause pollution to the underlying aquifer and potential mobilisation of contaminated soil.

13.10.7 A "no derogation" agreement[48] would be made with the owner/operator of any private groundwater supply potentially impacted by dewatering. This legal agreement would ensure that measures, such as a tankered supply, would be taken to maintain a supply throughout the period in which the groundwater source was affected.

Culvert extensions

13.10.8 The construction strategy outlines the methodology on how the culvert extensions to be provided under the existing A46 would be constructed, in summary:

- Existing water flow would be diverted during construction to provide a dry working environment. This would be done by intercepting the flow using a temporary dam and sump, then the water would be pumped through the existing culvert.

[45] Murnane, Heap and Swain (2006) Control of water pollution from linear construction projects; Technical Guidance.

[46] Environment Agency (2017) Protect groundwater and precent groundwater pollution [online] available at: Protect groundwater and prevent groundwater pollution - GOV.UK (www.gov.uk) (last accessed December 2023).

[47] The Environment Agency PPGs were formally withdrawn on 17 December 2015, however, they nonetheless provide clear and useful best practice advice. The archived PPGs are available at: [ARCHIVED CONTENT] Environment Agency - Pollution prevention advice and guidance (PPG) (nationalarchives.gov.uk) (last accessed December 2023).

[48] A "no derogation agreement is a legal agreement to ensure continuity of water supply in the unlikely event that a private water supply is adversely impacted by dewatering.

- The concrete walls would be demolished using a mechanical excavator.

Watercourse realignment

13.10.9 An over-pumping system would be required to create a dry working area for the working platform, and realignment construction works. This would require a consent to carry out the work; all necessary consents would be sought and details regarding these consents are detailed in the Scheme Consents and Agreements Position Statement [REP4-007]. It is expected that the flow would be pumped at a suitable quantity and velocity as to not alter the flow dynamics of the watercourse.

13.10.10 Silt/sediment traps would be required during construction works within the channel to reduce the risk of mobilisation of sediment.

Water quality monitoring during construction

13.10.11 Surface water monitoring and groundwater monitoring would be undertaken during construction to ensure there is no deterioration in water quality as a result of the Scheme. It is recommended that sampling be undertaken four times a year (summer, autumn, spring, and winter) during construction. This monitoring would include in-situ measurements and laboratory analysis as outlined in Appendix 13.5 (Surface Water Quality Monitoring Report) of the ES Appendices [APP-180].

Mitigation measures – operation

13.10.12 Alterations to the road network would provide adequate drainage to accommodate potential changes in surface runoff, including allowance for climate change in accordance with the DMRB CG 501 – Design of highway drainage systems[49] standards and through consultation with the Environment Agency and the LLFA (Nottinghamshire County Council). Engagement with stakeholders occurred throughout the development of the drainage strategy, as outlined in Chapter 4 (Environmental Assessment Methodology) of the ES. Key discussions included the relaxation of surface water storage requirements, and departure from standards. However, following discussions, the Volume Impact Assessment (undertaken as part of Appendix 13.4 (Drainage Strategy Report) of this ES Appendices [APP-179]) concluded the attenuation exceedance would be managed in the landscape to mimic the pre-development flow paths. Therefore, the drainage design does not result in a relaxation of storage, or departure from standards.

[49] National Highways (2020) DMRB CG 501 – Design of highway drainage systems. Available at: 6355ee38-413a-4a11-989b-0f33af89c4ed (standardsforhighways.co.uk) (last accessed December 2023).

Floodplain compensation areas

13.10.13 Three floodplain compensation areas (Kelham and Averham Floodplain Compensation Area (FCA), Farndon East FCA and Farndon West FCA) have been incorporated within the design to compensate for a loss of floodplain storage as a result of the Scheme. These are discussed in detail in Section 3.2 of Appendix 13.2 (Flood Risk Assessment) of the ES Appendices [REP6-010]**.** The justification for the selection of these sites is also provided in Appendix G of the Flood Risk Assessment.

13.10.14 Farndon East FCA would be designed and landscaped to be a permanent lake with grass planting around the edges where possible, which drains into the Old Trent Dyke. Farndon West FCA would be designed to comprise of residual ponds formed in post-borrow pit excavations with floodplain grazing marsh created in the northern extent of the site. Both the Farndon East and Farndon West FCAs would incorporate fish escape passages to mitigate the risk of fish entrapment as flood water recedes. The optioneering process and preferred option for the design of the fish escape passages are set out in the Fish Escape Passage Technical note, appended to the HRA [REP3-024].

13.10.15 Kelham and Averham FCA would be designed to drain into an existing highways and agricultural drain to the south of the FCA via a culvert under the A617. This agricultural/highways drain discharges into the River Trent.

Enhancement measures

13.10.16 No enhancement measures have been identified for road drainage and the water environment.

13.11 Assessment of likely significant effects

13.11.1 The assessment of likely significant effects considers effects on surface water and groundwater receptors that are directly hydrologically connected/linked to the Scheme during construction and operation. These effects are determined following the incorporation of the essential mitigation measures outlined in section 13.10 of this Chapter and embedded mitigation measures in Chapter 2 (The Scheme) of this ES.

Construction

13.11.2 The assessment of effects is provided in Table 13-9, the sections below provide further information to support the assessment.

Surface water

13.11.3 Where construction activities would be adjacent to, within, or over waterbodies, there is a potential for direct adverse effects on water quality due to the mobilisation of sediment and contaminants (such as suspended soils, fuel, oil, concrete liquors, and hydrocarbons) through surface water run-off. Construction activities also have the potential to disturb and release excess sediment and suspended solids which could contaminate surface water run-off.

13.11.4 Construction and modification of culverts and bridges as part of the Scheme along River Trent, Old Trent Dyke, and Unnamed watercourse (2) have the potential to cause localised damage to channel and riparian features, and cause disruption to the natural hydraulic and sediment transport.

13.11.5 During construction activities associated with the realignment of the Slough Dyke (The Fleet), the flow of the watercourse would be altered and diverted to allow for the temporary culvert and piping works to be installed. These works have the potential to alter the quantity and dynamics of the flow within the watercourse. The temporary culvert would result in an increase in shading of the watercourse.

13.11.6 There is a potential for construction activities to alter flow paths of surface water through changes in topography, and/or earthworks, and diversion of run-off.

13.11.7 Pond 3 would be removed to allow for the creation of the Kelham and Averham FCA, however this would be replaced within the same field as the existing pond. Therefore, the loss of the pond and its agricultural function (irrigation) would be temporary.

Fluvial flood risk

13.11.8 Temporary works structures would increase flood depths by up to 0.05m in a 3.33% AEP flood event due to displacement of flood waters. This would have a minor adverse impact on three residential receptors, leading to a slight or moderate effect, according to Table 3.8.1 in DMRB LA104.

Groundwater

13.11.9 As discussed in Chapter 9 (Geology and Soils) of this ES, a contamination hotspot was identified adjacent to Nether Lock. A Piling Risk Assessment would be undertaken, if deemed necessary, after the detailed design has been finalised. There are no identified contaminants at other piling locations.

13.11.10 Dewatering of excavations for ground and earthworks during construction may cause temporary short-term changes in groundwater flows and levels within the vicinity of the excavation. Necessary consents for groundwater abstraction and water discharge would be sought and details regarding these consents are detailed in

the Scheme Consents and Agreements Position Statement [REP4-007]. Once dewatering ceases, groundwater flows and levels are expected to recover quickly.

13.11.11 Licenced and deregulated private groundwater abstractions may also be temporarily impacted by dewatering activities. The Environment Agency's approach to groundwater protection discusses SPZs and indicates that 'All abstractions, including private water supplies, used for drinking water supply or food production purposes are, by default, in an SPZ1 or SPZ2' [50]. For private abstractions these zones equate to a minimum 50 metre radius for SPZ1. In some cases, a default SPZ2 with a minimum radius of 250 metres applies. The three private groundwater abstractions within the study area are located 120 metres to 220 metres outside the Order Limits. Construction dewatering is not anticipated within 250 metres of these groundwater sources. Likewise construction dewatering would not be expected to significantly affect the designated SPZs located 1.5 kilometres east, and 2.8 kilometres south-east of the Scheme.

Designated sites

13.11.12 Farndon Pond LNR is upstream of the Scheme and therefore there would be no significant effects from the Scheme on this LNR. Similarly, whilst Devon Park Pastures LNR is downstream of parts of the Scheme on the River Trent, the LNR is upstream of the confluence of River Devon and River Trent. As a result, it is not considered for the LNR to have a credible pathway of interaction with the Scheme and there would be no significant effects from the Scheme on Devon Park Pastures LNR.

[50] Environment Agency. (2019). Manual for the production of Groundwater Source Protection Zones. Available at: Manual for the production of Groundwater Source Protection Zones (publishing.service.gov.uk) Last accessed: July 2024

Table 13-9: Assessment of likely significant effects during construction

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
Surface water					
Trent from Soar to The Beck waterbody [GB104028053110]	Very high	The Scheme crosses this waterbody three times at Windmill Viaduct, Nether Lock Viaduct and the temporary construction access bridge. Construction works for these watercourse crossings will be adjacent to the receptor. Discharge of contaminated surface water runoff from construction materials, washing of plant, and cleaning areas of hardstanding, and uncontrolled releases of fuels/oils/chemical/concrete liquors. This could cause a temporary, localised effect on water quality. Imported material for the pier and Scour protection works have the potential to introduce INNS to the	• No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP (developed prior to construction) would include an INNS Management Plan, a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events.	Negligible	Slight Adverse

[51] For the efficiency of reading, the potential impacts will be written in full under the first mention of the potential impacts (underlined headings) and where effects are similar across the receptors, the heading will only be shown. Any additional effects relevant to the individual receptor will be highlighted.

[52] For the efficiency of reading, the mitigation measures will be written in full under the first mention of the measures (underlined headings) and where mitigation measures are similar across the receptors, only the heading will be shown. Any additional mitigation measures relevant to the individual receptor will be highlighted.

[53] With mitigation measures, as outlined in Section 13.10.

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
		watercourse.	• Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. • Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180], and the Second Iteration EMP.		
		Construction activities along the riverbank associated with the viaduct works will require vegetation clearance and bank stability works, including scour protection at the toe of the new piers at Windmill Viaduct and Nether Lock Viaduct. In-channel working will not be carried out, however construction will result in an alteration in the bank near these viaducts. This work will result in temporary, localised damage to the riparian zone.	• Vegetation clearance will be undertaken in line with the mitigation measures outlined in Chapter 8 (Biodiversity) of this ES. • Riparian vegetation will be reinstated, as close as possible to the Scheme extents. • The Second Iteration EMP (developed prior to construction) would include an INNS Management Plan, a Pollution Prevention Plan, an	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events. The Second Iteration EMP will include an INNS Management Plan and biosecurity measures.		
		Construction activities have the potential to mobilise sediment, and result in contaminated surface water runoff. This has the potential to result in a short-term, localised effect on water quality.	● No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. ● The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events ● Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. ● Surface water quality monitoring will be carried	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.		
Devon from Cotham to Trent waterbody [GB104028052632]	High	Farndon Roundabout and the southern section of the A46 is located within this catchment, therefore construction work associated with this part of the Scheme has the potential to result in contaminated surface water runoff from construction materials, washing of plant, and cleaning areas of hardstanding. This has the potential to cause short-term, localised effects on the water quality.	• No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP (developed prior to construction) would include an INNS Management Plan, a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events • Placement of construction materials away from surface water receptors (8m from a watercourse) where possible.	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			• Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180]and the Second Iteration EMP.		
Old Trent Dyke	Medium	Culvert extensions and works within both 'Farndon East and Farndon West FCAs' have the potential to affect this watercourse. Construction works associated with these activities may result in a temporary change in quantity of water within the watercourse during construction, as well as a potential risk of scouring from temporary over-pumping. This has the potential to alter the flow within the watercourse, however this would be short-term and localised.	• Compliance with CIRIA Guidance and best practice, as detailed within the First Iteration EMP [REP6-012]. The Second Iteration EMP will include a Pollution Prevention Plan , Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events.	Negligible	Slight Adverse*[54]

[54] '*' identifies categories where the significance may be neutral or slight in the significance matrix. For the purpose of this assessment, the worst case scenario has been chosen

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
		Construction works adjacent to the watercourse (in particular associated with culvert extension and construction of 'Farndon East and Farndon West FCA' have the potential to mobilise sediment, and result in contaminated surface water runoff. This has the potential to result in a short-term, localised effect on water quality.	• No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP (developed prior to construction) would include an INNS Management Plan, a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events • Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. • Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			180]and the Second Iteration EMP.		
		Construction activities within the watercourse associated with the culvert extension have the potential to introduce INNS to the watercourse.	• The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP will include an INNS Management Plan and biosecurity measures.	Negligible	Slight Adverse*
Unnamed watercourse (1)	Low	This watercourse is believed to be a feeder into the Old Trent Dyke and is not directly crossed by the Scheme, however construction traffic along Great North Road has the potential to result in contaminated surface water runoff. This has the potential to result in a short-term, localised effect on water quality.	• The First Iteration EMP [REP6-012] includes pollution prevention measures, including vehicle wash down prior to leaving works areas, appropriate covers on vehicles etc.	Negligible	Slight Adverse*
Trent Bifurcation Pingley Dyke to Winthorpe waterbody [GB104028053390]	Very high	Excavation works associated with Farndon West FCA have the potential to expose sediment which could be mobilised following rainfall events. In addition, there is a potential for construction activities	• No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
		to result in contaminated surface water runoff from plant machinery. This has the potential to result in a short-term, localised effect on water quality.	emergency response procedures. ● The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events. ● Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. ● Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.		
Broadgate Lane Feeder	Low	Excavation works associated with Kelham and Averham FCA have the potential to expose sediment which could be mobilised following rainfall events. In addition, there is a potential for construction	● No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
		activities to result in contaminated surface water runoff from plant machinery. This has the potential to result in a short-term, localised effect on water quality.	emergency response procedures. ● The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events. ● Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. ● Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.		
Misson Drain	Low	Broadgate Lane Feeder connects to this watercourse in Kelham, which then drains into the River Trent. No works are located close to this watercourse, therefore the only potential effect on this	● Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
		watercourse is associated with dispersion of potential contaminants from works upstream (within Broadgate Lane Feeder). A pollution event upstream could affect water quality.	Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.		
Unnamed watercourse (2)	Medium	A site compound and material stockpile would be located approximately 135m north of the watercourse, and Brownhills Borrow Pit is adjacent to the watercourse. There is the potential for contaminated surface water runoff during rainfall events from the compounds and the stockpile. This has the potential to result in a short-term, localised effect on water quality	• The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment, and an Emergency Response Plan for Flood Events. • Placement of construction materials away from surface water receptors (8m from a watercourse) in line with best practice measures for pollution prevention. • Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.		
		Culvert extension works may result in a temporary change in quantity of water within the watercourse during construction, as well as a potential risk of scouring from temporary over-pumping. This has the potential to alter the flow and within the watercourse, however this would be short-term and localised.	• Compliance with CIRIA Guidance and best practice, as detailed within the First Iteration EMP [REP6-012]. • The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan, and an Emergency Response Plan for Flood Events	Negligible	Slight Adverse*
		Construction activities within the watercourse associated with the culvert extension have the potential to introduce INNS to the watercourse.	• The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP will include an INNS Management Plan and biosecurity measures.	Negligible	Slight Adverse*
Slough Dyke Catchment (trib of Trent) waterbody [GB104028053111]	High	The realignment of the watercourse could change the current flow dynamics of the watercourse to allow for the	• The First Iteration EMP [REP6-012] includes pollution prevention	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
		temporary culvert and piping works to be installed. The over-pumping system would ensure the water continues to flow in a controlled manner at a rate similar to the current watercourse. This has the potential to result in a localised effect on water quality but is expected to be limited to the construction phase.	measures and emergency response procedures. ● The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan, and an Emergency Response Plan for Flood Events.		
		The temporary culvert would result in an increase in shading of the watercourse which has the potential to result in a decrease in temperature. However, this would be limited to the construction phase and localised.	● Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.	Negligible	Slight Adverse
		Construction activities within the watercourse associated with the temporary culvert and realignment have the potential to introduce INNS to the watercourse.	● The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. ● The Second Iteration EMP will include an INNS Management Plan and biosecurity measures.	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			• Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. • Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.		
		Construction activities (in particular those associated with the infilling and re-instatement of the watercourse post-construction) have the potential to mobilise sediment, and result in contaminated surface water runoff. This has the potential to result in a short-term, localised effect on water quality.	• No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan, and an Emergency Response Plan for Flood Events.	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			• Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. • Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP.		
Tributary of the Fleet (1)	Medium	Construction works adjacent to the watercourse (in particular the riparian habitat enhancement works upstream of the A46) have the potential to mobilise sediment, and result in contaminated surface water runoff. This has the potential to result in a short-term, localised effect on water quality.	• No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP (developed prior to construction) would include an INNS Management Plan, a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			Emergency Response Plan for Flood Events ● Placement of construction materials away from surface water receptors (8m from a watercourse) where possible. ● Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180]and the Second Iteration EMP.		
		Construction activities along the bank top associated with habitat creation have the potential to introduce INNS to the watercourse.	● The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. ● The Second Iteration EMP will include an INNS Management Plan and biosecurity measures. ● Placement of construction materials away from surface water receptors	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			(8m from a watercourse) where possible. ● Surface water quality monitoring will be carried out during construction as outlined within Appendix 13.5 (Surface Water Monitoring Report) of the ES Appendices [APP-180] and the Second Iteration EMP		
Tributary of the Fleet (2)	Medium	The existing drainage system connected to the Scheme discharges into this watercourse. As such, there is a potential for discharge of contaminated surface water runoff from construction materials, washing of plant, and cleaning areas of hardstanding, and uncontrolled releases of fuels/oils/chemical/concrete liquors.	● The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. ● The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan and an Emergency Response Plan for Flood Events. ● Placement of construction materials away from surface water receptors (8m from a watercourse) where possible.	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
Pond 3	Low	This pond will be infilled and destroyed.	• The pond would be replaced within the 'Kelham and Averham FCA' boundary to the east of the existing pond. • Compliance with CIRIA Guidance and best practice, as detailed within the First Iteration EMP [REP6-012] to protect surrounding watercourses (Broadgate Lane Feeder). • The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan, and an Emergency Response Plan for Flood Events	Major adverse	Slight Adverse[55]
Pond 6	Low	Construction activities have the potential to mobilise sediment, and result in contaminated surface water runoff. This has the potential to result in a short-term, localised effect on water quality.	• No direct discharge to watercourses. The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures.	Negligible	Slight Adverse

[55] Slight adverse effect has been chosen for this based on professional judgement, as although the pond will be destroyed, a replacement pond will be created.

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			• The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan, and an Emergency Response Plan for Flood Events • Placement of construction materials away from surface water receptors (8m from a watercourse) where possible.		
Drainage system	Low	There is an existing established drainage system associated with the road network, as well as the surrounding urban developments throughout the Scheme boundary. Therefore, construction works have the potential to result in contaminated surface water runoff from construction materials, washing of plant, and cleaning areas of hardstanding. This has the potential to result in a temporary, localised reduction in water quality.	• The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan, and an Emergency Response Plan for Flood Events.	Negligible	Slight Adverse*
Newark-on-Trent Marina	Low	This marina is located downstream of Windmill Viaduct. Therefore, construction activities associated with the pier works and scour protection have the potential to	• The First Iteration EMP [REP6-012] includes pollution prevention	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
		result in contaminated surface runoff (including introduction of INNS). This could result in a temporary, localised reduction in water quality.	measures and emergency response procedures. • The Second Iteration EMP will include a Pollution Prevention Plan, an Erosion and Sediment Management Plan, and an Emergency Response Plan for Flood Events. • An INNS Management Plan will be implemented on imported materials.		
Kings Waterside and Marina	Low	Construction activities to the north of the marina (approximately 75m). However, as there is an existing drainage ditch and vegetation separating the A46 from the marina, it is not considered credible for contaminated surface water runoff to reach this marina.	• The First Iteration EMP [REP6-012] includes pollution prevention measures and emergency response procedures. • The Second Iteration EMP will include a Pollution Prevention Plan, and an Erosion and Sediment Management Plan.	No change	Neutral
		Construction traffic along the temporary access road adjacent to the marina has the potential to result in contaminated surface water runoff. This has the potential to result in a short-term, localised effect on water quality.	• The First Iteration EMP [REP6-012] includes pollution prevention measures, including vehicle wash down prior to leaving compound areas,	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
			appropriate covers on vehicles etc. • The Second Iteration EMP will include a Pollution Prevention Plan, and an Erosion and Sediment Management Plan.		
Fluvial flood risk					
External residential and commercial receptors	Medium-Very High[56]	Temporary works structures would increase flood depths by up to 0.05m in a 3.33% AEP flood event due to displacement of flood waters. .	Floodplain Compensation Areas are designed to mitigate this risk as far as practicable.	Minor adverse	Slight adverse (receptors affected are categorised as High importance.)
The Scheme	Very High	• Risk to the existing asset during construction. • Risk to the asset being constructed. • Risk to construction equipment and facilities used to carry out the construction. • Risk to personnel on site.	Mitigation measures outlined in the First Iteration EMP. [REP6-012]	Negligible	Neutral
Groundwater					
Superficial aquifers	Medium	Dewatering of excavations for ground and earthworks during		Minor adverse	Slight Adverse

[56] External receptors have a range of importance categorisations – these are detailed further in the Flood Risk Assessment. (Appendix 13.2 of the Environmental Statement Appendices [REP6-010])

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
Bedrock aquifer	Medium	construction may cause temporary short-term changes in groundwater flows and levels.	• Necessary consents would be sought and details regarding these consents are detailed in the Scheme Consents and Agreements Position Statement [REP4-007]. • A “no derogation” agreement would be made with the owner/operator of any private groundwater supply which may be temporarily impacted by dewatering.	Minor adverse	Slight Adverse
Trent Erewash Secondary Combined (GB4042G990300) WFD ground waterbody	Medium			Minor adverse	Slight Adverse
Private groundwater sources	High			Minor Adverse	Slight Adverse
Superficial aquifers	Medium	Temporary culverting of Slough Dyke may reduce recharge to the underlying aquifer.	None required. • Any temporary impact on aquifer recharge will be very local in scale and have little impact on the wider aquifer. Effect would be temporary while the culvert is in place.	Minor Adverse	Slight Adverse
Bedrock aquifer	Medium			Minor Adverse	Slight Adverse
Trent Erewash Secondary Combined (GB4042G990300) WFD ground waterbody	Medium			Minor Adverse	Slight Adverse
Superficial aquifers	Medium	Contamination of groundwater by mobilisation of contaminants through accidental spillages or direct contact with construction materials or piling operations.	• Rigorous groundwater protection measures as specified in EMP.	Negligible	Slight Adverse*
Bedrock aquifer	Medium			Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance	Potential impact[51]	Mitigation measures[52]	Magnitude of impact[53]	Significance of effect
WFD ground waterbody	Medium		• Contaminant risk within the vicinity of Nether Lock is noted in Chapter 9 (Geology and Soils) of this ES. Piling Works Risk Assessment will be undertaken, if deemed necessary, after the detailed design has been finalised.	Negligible	Slight Adverse*
Designated sites					
Farndon Pond LNR	Medium	None, this receptor is upstream of the Scheme.	N/A	No change	Neutral
Devon Park Pastures LNR	Medium			No change	Neutral

Operation

13.11.13 The assessment of effects is provided in Table 13-10, the sections below provide further information to support the assessment.

Surface water

13.11.14 There is a potential for surface water receptors to be affected by contaminated surface water runoff due to traffic and discharge, in particular in relation to the realignment of the Slough Dyke (The Fleet) as this watercourse would be moved closer to the A1. Initially all outfalls failed the HEWRAT Assessment due to the high concentration of copper measured in the receiving watercourses. Further details are provided in Appendix 13.3 (HEWRAT Assessment) of the ES Appendices [APP-178]. An M-BAT assessment was carried out and concluded the Scheme would not lead to an exceedance of EQS or sediment accumulation with the mitigation outlined in the drainage strategy, and the spillage assessment concluded the mitigation within the drainage design would be sufficient to not cause a significant adverse effect on the receiving watercourses. Incorporation of the mitigation measures outlined within the drainage design would be considered to provide an improvement in pollution treatment, compared to the existing system. The scale of water quality improvement that would be provided by the system is outlined within Appendix 13.3 (HEWRAT Assessment) of the ES Appendices [APP-178], however the majority of the outfalls within the design would not be considered to achieve an improvement in line with Table 3.71 in DMRB LA113 standards and definitions. Outfall 7 and Outfall 8 (as described within Appendix 13.3 (HEWRAT Assessment) of the ES Appendices [APP-178]) discharge into a drainage network adjacent to the British Sugar Factory to the north of the A46, which eventually discharges into the River Trent downstream of Nether Lock Viaduct. These two outfalls show an improvement (baseline conditions (Step 2) of the sediment chronic impact assessment concludes a ‘fail’, whereas with the Scheme mitigation measures (Step 3) concludes a ‘pass’). However, the drainage network has not been assessed individually due to the high quantity of drainage systems within the area. The access road adjacent to the Slough Dyke (The Fleet) would be made of concrete and drainage has not been incorporated within the design. Therefore any surface water runoff would directly enter the Slough Dyke (The Fleet). However as the road would be used for maintenance and traffic is expected to be infrequent (on average once a month), the potential for the runoff to contain pollutants is very low.

13.11.15 FCAs have been incorporated within the design to compensate for the construction of the road embankments, where this embankment would result in a reduction in volume of the floodplain at existing elevations. In the event of flooding, receding floodwater at Farndon

East FCA and Farndon West FCA will flow into the Old Trent Dyke. The Old Trent Dyke flows into the River Trent downstream, therefore, this minimal redirection of surface water (limited to a flooding event) is not anticipated to change the resultant volume of water within the River Trent. Given the nature and purpose of the FCAs, these assets are not considered to have any operational effects on the identified surface waterbodies.

13.11.16 Appendix 13.2 (Flood Risk Assessment) of the ES Appendices [REP6-010] has concluded that through appropriate drainage mitigation (as outlined within the drainage strategy), surface water flood risk to sensitive receptors is not increased as a result of the Scheme. Therefore, the magnitude of flood risk on the surface waterbodies, groundwater and protected areas are considered to be Negligible.

13.11.17 The Slough Dyke (The Fleet) would be realigned with similar cross-sectional dimensions and riparian habitat as currently in place with the addition of buried scour protection. Therefore, it is not anticipated that there would be a change in flow dynamics/riparian habitat or biodiversity conditions. However, the permanent realignment of the watercourse would result in a minor increase in length and sinuosity of the watercourse creating a more natural channel. This has the potential to result in a slight beneficial effect for the waterbody hydromorphology because it is currently classified as 'heavily modified' in WFD status, and the Scheme would result in a more natural channel than currently present.

13.11.18 Pond 3 would be destroyed and replaced during the construction works. However, as it is an irrigation pond and a replacement pond would be created within the same field (to the east of the existing pond location), there would be no operational effect.

Fluvial flood risk

13.11.19 The Scheme would be raised above the design flood level, although the local access roads and junctions connecting into the A46 route would be inundated in 1% AEP plus climate change flood event.

13.11.20 The Scheme would have negligible impact to displacement of flood water and no impact to conveyance of flooding. FCAs would be constructed to accommodate lost floodplain volume.

Groundwater

13.11.21 The Scheme would increase impermeable surfacing which may result in reduced infiltration to the underlying aquifers. In contrast, as outlined in Appendix 13.4 (Drainage Strategy Report) of the ES Appendices [APP-179], soft-engineering methods for drainage would be implemented where feasible, using SuDS as a primary principle to drain, treat and attenuate runoff, with nature-based solutions incorporated where achievable. Use of soft-engineering methods for

drainage is considered beneficial to aquifer recharge compared to the hard-engineered drainage of the existing A46. It is not possible to quantify the difference between the adverse impact of increased impermeable surfacing against the benefit of soft-engineered drainage. However, it is expected that the effect on overall aquifer recharge would be limited.

13.11.22 The HEWRAT assessment in Appendix 13.3 (HEWRAT Assessment) of the ES Appendices [APP-178] considers contamination risk from highway run-off. The groundwater assessment within the HEWRAT demonstrates a medium groundwater risk, but does not consider mitigation measures embedded into drainage design of the Scheme. The pollutant load and overall risk to groundwater are likely to be overestimated by the method.

13.11.23 Permanent below ground structures such as concrete bored piling, sheet piling for retaining walls and permanent excavations for floodplain compensation areas, have the potential to cause localised disruption to the groundwater flow regime. Below-ground structures are discussed in more detail below.

Concrete Bored Piling

13.11.24 Concrete bored piling would be located at:

- Windmill Viaduct
- Nottingham to Lincoln Line Eastern & Western Railway Crossing
- Cattle Market Junction
- Nether Lock Viaduct
- Nether Lock Railways Crossing
- Brownhill Junction Bridge
- A1/A46 Crossing

13.11.25 The indicative arrangement of concrete bored piles is unlikely to provide a significant barrier to groundwater flow. It is expected that groundwater will simply flow around the piles.

13.11.26 As discussed in Chapter 9 (Geology and Soils) of this ES, a contamination hotspot was identified adjacent to Nether Lock, however following completion of the Contaminated Land Risk Assessment and consultation with the Environmental Health Technical Officer, it has been agreed that the identified hotspot area of contamination would be left in-situ.

13.11.27 Piling Risk Assessments would be undertaken, if deemed necessary, prior to construction of the Scheme. There are no identified contaminants at other piling locations.

Retaining Walls

13.11.28 Retaining walls would be located at:

- Farndon

- Brownhills Junction
- Nottingham to Lincoln Line Western Railway Crossing
- Nether Lock Viaduct

13.11.29 The construction method and depth of retaining wall elements, including sheet piling, below ground level, would be determined at detailed design. However, outline design indicates that retaining walls are unlikely to provide a significant barrier to groundwater flow due to their alignment sub-parallel to the regional groundwater gradient.

Floodplain Compensation Areas

13.11.30 As discussed in Appendix 13.2 (Flood Risk Assessment) of ES Appendices [REP6-010], flood compensation areas would be located at:

- Farndon East
- Farndon West
- Kelham and Averham

13.11.31 FCAs are unlined excavations of up to 4 metres depth below ground level. There is potential for groundwater ingress into FCAs, particularly at times of year when groundwater is close to ground level.

13.11.32 Farndon East FCA would include the remnants of borrow pit excavation which is anticipated to results in a lake of up to 4m depth. Given the maximum depth of excavation, it is expected that some groundwater would be present within the FCA throughout the year, other than when groundwater levels are very low. Groundwater is therefore expected to provide baseflow to the lake. Groundwater levels within Farndon East FCA may be expected to vary seasonally and groundwater flow would be unimpeded.

13.11.33 Farndon West FCA would be less than 1.4 metres deep. However, ground lowering for wetlands and ponds within Farndon West FCA may be up to 3 metres below ground level. Groundwater may be intercepted within the FCA and is expected to provide baseflow to the wetland habitats and ponds. Groundwater levels within the FCA, wetlands and ponds may be expected to fluctuate seasonally and groundwater flow will be unimpeded.

13.11.34 At Farndon West FCA, flood water would drain down to the Old Trent Dyke to allow flood water conveyance. There is potential that flood water conveyed to Old Trent Dyke could include a groundwater element from Farndon East and West FCAs and their associated groundwater-fed wetlands, ponds and lakes.

13.11.35 Kelham and Averham FCA would be designed to conduct flood water via gravity drainage to adjacent watercourses. Kelham and Averham FCA would discharge any intercepted groundwater south-east to the River Trent, largely replicating the existing groundwater flow direction.

13.11.36 Kelham and Averham FCA would direct any intercepted groundwater to the River Trent, approximately 1 kilometre downstream of expected current groundwater discharge conditions. Therefore, on occasions when groundwater levels are sufficiently high to be intercepted by Kelham and Averham FCA, there may be a temporary reduction in groundwater baseflow to an approximate 1 kilometre reach of the River Trent. However, this very minor groundwater component would in effect be added back to the River Trent at the FCA discharge location approximately 1 kilometre downstream, and therefore the overall impact on River Trent baseflow would be minor, at most.

Designated sites

13.11.37 Farndon Pond LNR is upstream of the Scheme and there would therefore be no operational effects from the Scheme on this LNR. Similarly, whilst Devon Park Pastures LNR is downstream of parts of the Scheme on the River Trent, the LNR is upstream of the confluence of River Devon and River Trent. There would therefore be no operational effects from the Scheme on Devon Park Pastures LNR.

Table 13-10: Assessment of likely significant effects (Operation)

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
Surface water					
Trent from Soar to The Beck waterbody [GB104028053110]	Very high	There is a potential for contaminated surface water runoff to be discharged into surface waterbodies if the drainage design is overloaded. However, following the results of the HEWRAT and M-BAT assessment, as well as the spillage assessment, the risk of this was concluded as acceptable. Therefore, potential effects on water quality are considered to be short-term, and localised.	• Incorporation of drainage strategy within the design (i.e. toe swales and penstocks). This has passed the HEWRAT assessment with M-BAT, and the spillage assessment. Therefore, there is no requirement for further mitigation. • Maintenance of the drainage network to reduce the risk of blockages which may lead to overflow of the system and result in contaminated runoff.	Negligible	Slight Adverse
Devon from Cotham to Trent waterbody [GB104028052632]	High			Negligible	Slight Adverse
Old Trent Dyke	Medium			Negligible	Slight Adverse*[59]
Unnamed watercourse (1)	Low	This watercourse is not located adjacent to the A46	N/A	No change	Neutral

[57] For the purpose of this assessment, where the flood risk sensitivity/importance and surface water sensitivity/importance differ in Section 13.7, a precautionary approach has been taken and the highest sensitivity value has been considered.

[58] With mitigation measures, as outlined in previous column and in Section 13.1.

[59] '*' identifies categories where the significance may be neutral or slight in the significance matrix. For the purpose of this assessment, the worst case scenario has been chosen

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
Trent Bifurcation Pingley Dyke to Winthorpe waterbody [GB104028053390]	Very high	Scheme, therefore no operational effects are anticipated.	N/A	No change	Neutral
Broadgate Lane Feeder	Low		N/A	No change	Neutral
Mission Drain	Low		N/A	No change	Neutral
Unnamed watercourse (2)	Medium	There is a potential for contaminated surface water runoff to be discharged into surface waterbodies if the drainage design is overloaded. However, following the results of the HEWRAT and M-BAT assessment, as well as the spillage assessment, the risk of this was concluded as acceptable. Therefore, potential effects on water quality are considered to be a short-term, and localised.	• Incorporation of drainage strategy within the design (i.e. toe swales and penstocks). This has passed the HEWRAT assessment with M-BAT, and the spillage assessment. Therefore, there is no requirement for further mitigation. • Maintenance of the drainage network to reduce the risk of blockages which may lead to overflow of the system and result in contaminated runoff.	Negligible	Slight Adverse*
Slough Dyke Catchment (trib of Trent) waterbody [GB104028053111]	High	There is a potential for contaminated surface water runoff to be discharged into surface waterbodies if the drainage design is overloaded. However, following the results of the HEWRAT	• Incorporation of drainage strategy within the design (i.e. toe swales and penstocks). This has passed the HEWRAT assessment with M-BAT, and the spillage assessment. Therefore, there is no requirement for further mitigation.	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
		and M-BAT assessment, as well as the spillage assessment, the risk of this was concluded as acceptable. Therefore, potential effects on water quality are considered to be a short-term, and localised. The permanent realignment of the watercourse would be approximately 10m closer to the A1 roadway, however it is not expected that this would result in an increase in risk of polluted surface water run-off from the roadway.	• Maintenance of the drainage network to reduce the risk of blockages which may lead to overflow of the system and result in contaminated runoff.		
		The permanent realignment of the watercourse would result in a minor increase in length and sinuosity. This has the potential to result in a slight beneficial effect for the waterbody hydromorphology because it is currently classified as 'heavily modified' in WFD	No mitigation measures identified	Negligible	Slight beneficial

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
		status, and the Scheme would result in a more natural channel than currently present. As the watercourse would be realigned with similar cross-sectional dimensions and riparian habitat as currently in place with the addition of buried scour protection, it is not anticipated that there would be a change in flow dynamics/riparian habitat or biodiversity conditions.			
		The realigned watercourse would be open-channel, however the proposed bridge across the watercourse would increase the shading of the watercourse. This has the potential to change the temperature, however as the watercourse is classified as 'heavily modified', it is not anticipated that this increase in shading would affect the watercourse at a	No mitigation measures identified	Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
		waterbody scale.			
		The access road adjacent to this watercourse would not have a drainage system, therefore, surface water runoff would enter the watercourse directly. The access road would be used for maintenance purposes only (on average once a month), therefore the potential for runoff to contain pollutants is very low.	No mitigation measures identified	Negligible	Slight Adverse
Tributary of the Fleet (1)	Medium	There is a potential for contaminated surface water runoff to be discharged into surface waterbodies. However, following the results of the HEWRAT and M-BAT assessment, as well as the spillage assessment, the risk of this was concluded as acceptable. The HEWRAT and M-BAT assessment provides evidence of an improvement in water quality where the sediment	• Incorporation of drainage strategy within the design (i.e toe swales and penstocks). This has passed the HEWRAT assessment with M-BAT, and the spillage assessment. • Maintenance of the drainage network to reduce the risk of blockages which may lead to overflow of the system and result in contaminated runoff.	Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
		chronic impact values shows a 'fail' at Step 2, and a 'pass' at Step 3 of assessment.			
		The habitat enhancements immediately upstream of the A46 have the potential to improve the riparian functions (i.e providing habitat and food, filtering storm runoff, and reducing stream bank erosion) of the watercourse.	No mitigation measures identified	Minor beneficial	Slight beneficial
Tributary of the Fleet (2)	Medium	There is a potential for contaminated surface water runoff to be discharged into surface waterbodies. However, following the results of the HEWRAT and M-BAT assessment, as well as the spillage assessment, the risk of this was concluded as acceptable.	• Incorporation of drainage strategy within the design (i.e toe swales and penstocks). This has passed the HEWRAT assessment with M-BAT, and the spillage assessment. • Maintenance of the drainage network to reduce the risk of blockages which may lead to overflow of the system and result in contaminated runoff.	Negligible	Slight Adverse*
Pond 3	Low	None – this is an irrigation pond which will be reinstated. Therefore, no operational effects are anticipated.	N/A	No change	Neutral
Pond 6	Low	There is a potential for		Negligible	Slight Adverse

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
Drainage system	Low	contaminated surface water runoff to be discharged into surface waterbodies if the drainage design is overloaded. However, following the results of the HEWRAT and M-BAT assessment, as well as the spillage assessment, the risk of this was concluded as acceptable. Therefore, potential effects on water quality are considered to be a short-term, and localised. At Outfall 7 and Outfall 8, the HEWRAT and M-BAT assessment provides evidence of an improvement in water quality where the sediment chronic impact values show a 'fail' at Step 2, and a 'pass' at Step 3 of assessment. Therefore, at this point in the drainage network, it shows a localised, minor beneficial impact. However, given the	• Incorporation of drainage strategy within the design (i.e. toe swales and penstocks). This has passed the HEWRAT assessment with M-BAT, and the spillage assessment. • Maintenance of the drainage network to reduce the risk of blockages which may lead to overflow of the system and result in contaminated runoff.	Negligible	Slight Adverse*
Newark-on-Trent Marina	Low			Negligible	Slight Adverse*
Kings Waterside and Marina	Low			Negligible	Slight Adverse*

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
		size of the drainage network in the area, the resultant impact is considered Negligible.			
Fluvial flood risk					
External residential and commercial receptors	Medium-Very High[60]	New or increased flooding to receptors.	Drainage Strategy Floodplain Compensation Areas	Negligible	Slight Adverse
The A46 Scheme	Very High	The presence of permanent infrastructure within the floodplain and the resultant decrease in the floodplain. The increase in impermeable surfacing and changes in surface water runoff as a result of changes in topography or flow patterns.	Drainage Strategy Floodplain Compensation Areas	Negligible	Slight Adverse

[60] External receptors have a range of importance categorisations – these are detailed further in the Flood Risk Assessment. (Appendix 13.2 of the Environmental Statement Appendices [REP6-010])

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
Groundwater					
Superficial aquifers	Medium	Permanent below-ground infrastructure such as piling and retaining walls may cause a change in the groundwater flow regime.	None required. It is expected that groundwater will simply flow around the subsurface structures.	Minor Adverse	Slight Adverse
Bedrock aquifer	Medium			Minor Adverse	Slight Adverse
Trent Erewash Secondary Combined (GB4042G990300) WFD ground waterbody	Medium			Minor Adverse	Slight Adverse
Superficial aquifers	Medium	Excavated borrow pits and FCAs and the permanent realignment of Slough Dyke have the potential to intercept and disrupt groundwater flow. Groundwater intercepted at Kelham and Averham FCA will be discharged by gravity drainage to the River Trent. Groundwater intercepted at Farndon West FCA will contribute to wetland habitats and ponds. At	None required.	Minor Adverse	Slight Adverse*

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
		Farndon East FCA, groundwater is expected to form baseflow to the proposed lake. Groundwater flow and seasonal groundwater level fluctuation at Farndon East and West FCAs will be unimpeded. In a flood event, flood water will be conveyed to Old Trent Dyke from Farndon East and West FCAs, and this may include a groundwater element from the associated wetlands, pond and lakes, Groundwater levels and flow within the vicinity of Slough Dyke are expected to quickly recover following permanent realignment.			
Superficial aquifers	Medium	Change in impermeable surfacing and drainage may reduce recharge to the underlying aquifer.	None required. Impact on recharge from increased impermeable surfacing is expected to be offset by soft engineered drainage systems.	Minor Adverse	Slight Adverse*
Bedrock aquifer	Medium			Minor Adverse	Slight Adverse

Receptor	Receptor sensitivity/ importance [57]	Potential impact	Mitigation measures	Magnitude of impact[58]	Significance category
Trent Erewash Secondary Combined (GB4042G990300) WFD ground waterbody	Medium			Minor Adverse	Slight Adverse
Designated sites					
Farndon Pond LNR	Medium	None, this receptor is upstream of the Scheme.	N/A	No change	Neutral
Devon Park Pastures LNR	Medium	None, this receptor is upstream of the Scheme.	N/A	No change	Neutral

13.12 Monitoring

13.12.1 Although no likely significant residual effects are predicted, surface water quality and groundwater monitoring are proposed during and post construction to ensure that mitigation measures are being implemented effectively.

13.12.2 A surface water quality monitoring report has been produced to outline the requirements of monitoring pre, during, and post construction (see Section 13.8 Baseline conditions of this Chapter). Samples will be taken at the locations quarterly prior to construction. Three rounds of sampling have been undertaken to date, which provide results during winter high flow, and spring and summer lower flow conditions, which are considered sufficient for the purposes of this ES. However, monitoring will continue pre and throughout construction and for a minimum of one year post-construction to assess whether there are any changes to the baseline conditions. It is understood the frequency of monitoring may change following consultation with the Environment Agency. During the construction phase of works, and in accordance with Requirement 3 of the draft DCO [REP6-004] a Second Iteration EMP will secure the monitoring requirements and procedures to reduce or eliminate impacts on the environment.

13.12.3 As detailed in Section 13.8 Baseline conditions of this Chapter, the baseline groundwater monitoring programme commenced in January 2023. Monthly baseline groundwater monitoring will be undertaken for twelve months from January 2023 to January 2024. Groundwater monitoring would continue pre-construction, during construction, and post-construction, to assess changes relative to baseline conditions. Upon completion of baseline groundwater monitoring, the frequency of groundwater monitoring may change, following consultation with the Environment Agency.

13.13 Conclusions

13.13.1 The likely significant effects for each road drainage and water environment receptor is reliant on the embedded mitigation outlined in Chapter 2 (The Scheme) of this ES and essential mitigation outlined in Section 13.10 of this Chapter being implemented. Embedded mitigation includes the developed drainage strategy incorporated within the design, and the construction of the FCAs prior to an increase in above ground embankment. Essential mitigation is detailed within the First Iteration EMP [REP6-012].

13.13.2 It is anticipated that the Scheme would not result in any significant adverse effects to road drainage and the water environment receptors during both construction and operation.

13.14 References

[1] National Highways (2019) DMRB LA 113 – Road drainage and the water environment, Revision 1 [online] available at: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk) (last accessed December 2023).

[2] Ministry of Housing, Communities and Local Government (December 2024) National Planning Policy Framework [online] available at: https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf (last accessed March 2025).

[3] HM Government (2018) A Green Future: Our 25 Year Plan to Improve the Environment [online] available at: 25 Year Environment Plan - GOV.UK (www.gov.uk) (last accessed December 2023).

[4] HM Government (2023) Environment Improvement Plan 2023; First revision of the 25 Year Environment Plan.[online] available at: Environmental Improvement Plan (publishing.service.gov.uk) (www.gov.uk) (last accessed December 2023).

[5] Highways England (2015) Environment Strategy Our approach [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/605063/Environment_Strategy__21___.pdf (Last accessed December 2023).

[6] National Highways (2019) DMRB LA 113 – Road drainage and the water environment, Revision 1 [online] available at: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk) (last accessed December 2023).

[7] Tetra Tech. (2022). A46 North Newark Bypass. Factual Ground Investigation Report. V1.1.

[8] Highways England (2020) DMRB LA113 – Road drainage and the water environment [online] Available at: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk) (Last accessed December 2023).

[9] The Planning Inspectorate (2020) Advice Note Eighteen: The Water Framework Directive. [online] Available at: Advice Note Eighteen: The Water Framework Directive | National Infrastructure Planning (planninginspectorate.gov.uk) (Last accessed December 2023).

[10] Department for Levelling Up (2022) Planning Policy Guidance: Flood risk and coastal change [online] Available at: Flood risk and coastal change - GOV.UK (www.gov.uk) (Last accessed December 2023).

[11] Environment Agency (2017) Groundwater protection - GOV.UK (www.gov.uk) (Last accessed July 2024).

[12] [Clarification note]

[13] Highways England (2020), DMRB LA 103 – Biodiversity. Available at: https://www.standardsforhighways.co.uk/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465'

[14] Q95 values obtained from UK Centre for Ecology & Hydrology, National River Flow Archive (Search Data | National River Flow Archive (ceh.ac.uk)). (Last Accessed December 2023)

[15] Environment Agency (2021) Environment Agency Data Catchment Explorer [online] Available at: https://environment.data.gov.uk/catchment-planning/ (Last accessed December 2023).

[16] Environment Agency (2021) Environment Agency Flood Map for Planning [online] available at: https://flood-map-for-planning.service.gov.uk/ (Last accessed December 2023).

[17] Environment Agency (2016) Humber River Basin Management Plan [online] available at: Humber river basin district river basin management plan - GOV.UK (www.gov.uk) (Last accessed December 2023).

[18] DEFRA Magic Map. Available at: https://magic.defra.gov.uk/MagicMap.aspx (Last accessed December 2023).

[19] Environment Agency's published data. Available at: Public Registers Online (data.gov.uk) (Last accessed December 2023).

[20] UKSO. Available at: UK Soil Observatory (bgs.ac.uk) (Last accessed December 2023).

[21] Newark and Sherwood District Council, Strategic Flood Risk Assessment [online]. Available at: Strategic Flood Risk Assessment Level 2 Stage 2 | Newark & Sherwood District Council (newark-sherwooddc.gov.uk) (last accessed December 2023).

[22] British Geological Survey Map [online]. Available at: BGS Geology Viewer - British Geological Survey (last accessed December 2023).

[23] Environment Agency (2024) *Consented Discharges to Controlled Waters with Conditions.* Available at: https://environment.data.gov.uk/dataset/5fe5ab2e-d465-11e4-8a42-f0def148f590 (last accessed December 2023).

[24] [Clarification note]

[25] [Clarification note]

[26] UK Centre for Ecology & Hydrology, National River Flow Archive (Search Data | National River Flow Archive (ceh.ac.uk)

[27] [Clarification note]

[28] [Clarification note]

[29] Highways England (2013) Highways Agency Drainage Data Management System (HA DDMS) [online] Available at: HA DDMS (Last accessed December 2023)

[30] [Clarification note]

[31] [Clarification note]

[32] Environment Agency's published data. Environmental Permitting Regulations – Discharges to Water and Groundwater, Available at: Environmental Permitting Regulations – Discharges to Water and Groundwater (data.gov.uk) (Last accessed December 2023).

[33] [Clarification note]

[34] BGS (Accessed 2022). BGS Geology Viewer 0.0.48 (Beta). Retrieved from BGS Geology Viewer: https://geologyviewer.bgs.ac.uk/?_ga=2.142580980.733296288.1669808516-270301649.1669808516. (Last Accessed December 2023)

[35] Tetra Tech. (2022). A46 North Newark Bypass. Factual Ground Investigation Report. V1.1.

[36] [Clarification note]

[37] BGS. (2022, 07). *Aquifer Designation Map (Bedrock) England*. Retrieved from Magic: https://magic.defra.gov.uk/MagicMap.aspx.

[38] Environment Agency. (2020, 09). *Groundwater Vulnerability Map (England)*. Retrieved from Magic: https://magic.defra.gov.uk/MagicMap.aspx.

[39] Environment Agency. (2022, 12). River Basin Management Plan: maps. Available at: Protected Areas | River Basin Management Plan: maps (arcgis.com) (Last accessed December 2023).

[40] [Clarification note]

[41] [Clarification note]

[42] [Clarification note]

[43] [Clarification note]

[44] Audus, Charles and Evans (2010) Environmental Good Practice on Site (Third Edition) (C692).

[45] Murnane, Heap and Swain (2006) Control of water pollution from linear construction projects; Technical Guidance.

[46] Environment Agency (2017) Protect groundwater and precent groundwater pollution [online] available at: Protect groundwater and prevent groundwater pollution - GOV.UK (www.gov.uk) (last accessed December 2023).

[47] The Environment Agency PPGs were formally withdrawn on 17 December 2015, however, they nonetheless provide clear and useful best practice advice. The archived PPGs are available at: [ARCHIVED CONTENT] Environment Agency - Pollution prevention advice and guidance (PPG) (nationalarchives.gov.uk) (last accessed December 2023).

[48] [Clarification note]

[49] National Highways (2020) DMRB CG 501 – Design of highway drainage systems. Available at: CG 501 - Design of highway drainage systems - DMRB (standardsforhighways.co.uk) (last accessed December 2023).

[50] Environment Agency. (2019). Manual for the production of Groundwater Source Protection Zones. https://assets.publishing.service.gov.uk/media/5d41a020e5274a0a0bf7757c/Manual-for-the-production-of-Groundwater-Source-Protection-Zones.pdf (last accessed July 2024)

[51] [Clarification note]

[52] [Clarification note]

[53] [Clarification note]

[54] [Clarification note]

[55] [Clarification note]

[56] [Clarification note]

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[59] [Clarification note]

[60] [Clarification note]