A47 Blofield to North Burlingham Dualling

Scheme Number: TR010040

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6.1 Environmental Statement
Chapter 13 – Road Drainage and Water Environment

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CHAPTER 13
ROAD DRAINAGE AND WATER ENVIRONMENT

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13.1. Introduction

13.1.1. As part of the Environmental Impact Assessment (EIA) process, this Environmental Statement (ES) chapter reports the potential significant effects for the road drainage and the water environment as a result of the Proposed Scheme. This assessment includes a review of the existing baseline conditions, consideration of the potential impacts, proportionate mitigation and enhancement and identification of residual effects.

13.1.2. The approach to this assessment follows the Scoping Report (February 2018)[1] and subsequent Scoping Opinion (March 2018) (**TR010040/APP/6.6**) for the Proposed Scheme. It utilises the most up to date guidance in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, LA 113 Road Drainage and the Water Environment (Highways England, 2019).

13.1.3. The main chapter text is supported by Appendices 13.1 to 13.3 (**TR010040/APP/6.2**), and Figures 13.1 to 13.8 (**TR010040/APP/6.3**) which contain:

Appendices

- 13.1 Flood risk assessment
- 13.2 Drainage strategy
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- 13.1 Surface water features, consented discharges and fluvial flood risk
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[1] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010040/TR010040-000009-BLOF%20Scoping%20Report.pdf

13.2. Competent expert evidence

13.2.1. The surface water and flood risk discipline lead (Ph.D., B.Sc. (Hons) has 24 years of experience in the water sector and has successfully delivered many environmental impact assessments and supporting technical assessments for large infrastructure projects.

13.2.2. The hydrogeological discipline lead (M.Sc., B.Sc. (Hons), C.Geol.) has 17 years of experience in groundwater resources, including hydrogeological impact assessments and provision of technical support on large infrastructure projects.

13.3. Legislative and policy framework

National legislation and policy

National Networks National Policy Statement

13.3.1. The National Networks National Policy Statement (NNNPS) (Department for Transport, 2014), sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects on the national road and rail networks in England. It provides planning guidance for promoters of nationally significant infrastructure projects on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State. NNNPS is used as the primary basis for making decisions on development consent applications for national networks nationally significant infrastructure projects in England.

13.3.2. Relevant to the road drainage and the water environment assessment, the NNNPS states:

- With regard to flood risk, if a Flood Risk Assessment (FRA) is required, the applicant should:
- consider the risk of all forms of flooding arising from the project (including in adjacent parts of the United Kingdom), in addition to the risk of flooding to the project, and demonstrate how these risks will be managed and, where relevant, mitigated, so that the development remains safe throughout its lifetime
- take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made
- consider the vulnerability of those using the infrastructure including arrangements for safe access and exit
- include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been considered and demonstrate that this is acceptable for the particular project

- consider if there is a need to remain operational during a worst-case flood event over the development's lifetime
- provide the evidence for the Secretary of State to apply the Sequential Test and Exception Test as appropriate
- The Secretary of State should be satisfied that flood risk will not be increased elsewhere and should 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
- 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 that priority is given to the use of Sustainable Drainage Systems (SuDS)
- With regards to water quality, the Secretary of State should be satisfied that the proposal considers the River Basin Management Plans and the requirements of the Water Framework Directive (WFD) (including Article 4.7) and its daughter directives. This includes requirements on priority substances and groundwater.
- Where a development is subject to EIA and the development is likely to have significant adverse effects on the water environment, the applicant should ascertain its existing status and carry out impact assessments. These are included as part of the environmental statement and describe:
- the existing quality of waters affected by the proposed project
- existing water resources affected by the proposed project and the impacts of the proposed project on water resources
- existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project, and any impact of physical modifications to these characteristics
- impacts of the proposed project on water bodies or protected under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions
- cumulative effects

Water Framework Directive

13.3.3. The key EU legislation covering the water environment which has a bearing on the Proposed Scheme is the Water Framework Directive (WFD) (2000/60/EC), which establishes a framework for the management of water resources throughout the European Union. The WFD was transposed into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which came into force in January 2004. The Water Environment (Water Framework Directive) (England and Wales) Regulations

2017 came into force in April 2017. These replace the 2003 regulations, consolidating amendments made since then, and primarily affect the management of water quality by the Environment Agency.

13.3.4. The key objectives of the WFD, provided for in the area River Basin Management Plan (RBMP), are to:

- Prevent deterioration, enhance and restore bodies of surface water, achieve good chemical and ecological status of such water and reduce pollution from discharges and emissions of hazardous substances.
- Protect, enhance and restore all bodies of groundwater, achieve good chemical and quantitative status of groundwater, prevent the pollution and deterioration of groundwater, and ensure a balance between groundwater abstraction and replenishment.
- Preserve protected areas, including drinking water safeguard zones for groundwater and surface water.

The Environmental Permitting Regulations

13.3.5. The Environmental Permitting Regulations (EPR) 2016, and the 2018 amendment, aim to protect groundwater and surface waters from pollution by controlling the inputs of potentially harmful and polluting substances. The Regulations implement the WFD and the Groundwater Daughter Directive 2006. The EPR replace the Groundwater Regulations and those parts of the Water Resources Act (WRA) 1991 that relate to the regulation of discharges to controlled waters (including groundwater).

The Highways Act

13.3.6. Under the Highways Act 1980 (Section 100), Highways England has a right to discharge runoff from highways into inland and tidal waters, subject to the requirement not to pollute controlled waters. This includes groundwaters, as defined under the Water Resources Act 1991.

The Water Resources Act

13.3.7. Section 93 of the Water Resources Act (1991) provides for the establishment of groundwater protection zones. The requirements of Section 93 are implemented and set out in the Environment Agency's approach to groundwater protection (Environment Agency, 2018a) and the Environment Agency's groundwater protection guides covering: requirements, permissions, risk assessments and controls (Environment Agency, 2017). These replace the Environment Agency's 2013 Groundwater protection: principles and practice (GP3).

13.3.8. The Environment Agency's approach to groundwater protection includes the Environment Agency's position statements, which provide information about its

approach to managing and protecting groundwater. They detail how the Environment Agency delivers government policy for groundwater and adopts a risk-based approach where legislation allows. Many of the approaches set out in the position statements are not statutory but may be included in, or referenced by, statutory guidance and legislation.

13.3.9. Source protection zones are defined for groundwater supplies used for human consumption. The Environment Agency's position statement relating to the use of sustainable drainage systems can be found in The Environment Agency's approach to groundwater protection (Environment Agency, 2018a).

The National Planning Policy Framework

13.3.10. The National Planning Policy Framework (NPPF) applies to this Proposed Scheme under Chapter 14 "Meeting the challenge of climate change, flooding and coastal change" (Ministry of Housing, Communities and Local Government, 2019). This is supported by the Planning Practice Guidance (PPG), in relation to flood risk (Ministry of Housing, Communities and Local Government, 2016). It states that where development is located in areas which are vulnerable to flooding, care should be taken to ensure that risks can be managed.

13.3.11. The Land Drainage Act (1991) and Flood and Water Management Act (2010) are also relevant to manage flood risk for any works within 8m of ordinary watercourses and to the discharge of surface water drainage to ordinary watercourses.

Local Policies

Joint Core Strategy for Broadland, Norwich and South Norfolk

13.3.12. The relevant policies within the strategy in relation to the water environment are summarised below:

- Policy 1: addressing climate change and protecting environmental assets. Development should be located to minimise flood risk and mitigate any such risk through design and the implementation of sustainable drainage. Development should minimise water use and protect groundwater sources.
- Policy 3: energy and water. This policy ensures that, amongst other things, water quality is protected and improved with no significant detriment to areas of environmental performance.

The Broadland District Council Development Management Development Planning Document (DPD)

13.3.13. The relevant policies within the DPD in relation to the water environment are summarised below:

- Policy EN4 – Pollution. Development must include an assessment of potential pollution and provide mitigation, where required. Development will only be permitted where there will be no significant impact upon amenity, human health or the natural environment.
- Policy CSU5 – Surface water drainage. Development should not increase flood risk elsewhere. Developments should not:
- increase the vulnerability of the site, or wider catchment, to flooding from surface water runoff
- wherever practicable, development should have a positive impact on surface water flooding in the wider area

13.4. Assessment methodology

13.4.1. The proposed methodology follows the guidance provided in DMRB LA 113 for assessing the significance of effects of proposed road schemes on the road drainage and the water environment. The procedures and the appropriate methods that must be used when assessing the potential impacts from the road projects on the water environment are described in the DMRB LA 113.

13.4.2. The following proposed methods have been adopted:

- A simple assessment of groundwater levels and flow, as described in Appendix A of LA 113. This is a qualitative assessment that identifies all potential features which are susceptible to groundwater level and flow impacts from the Proposed Scheme, based on a hydrogeological conceptualisation of the surrounding area and the regional groundwater body status.
- A simple assessment of groundwater dependent terrestrial ecosystems, as described in Appendix B of LA 113. This is a stepped, risk-based approach which establishes linkages between potential impacts from the Proposed Scheme on the hydrological and hydrogeological regime and a groundwater dependent terrestrial ecosystem (GWDTE).
- A simple assessment of groundwater quality and runoff, as described in Appendix C of LA 113, and using the groundwater risk assessment matrix provided in Highways England Water Risk Assessment Tool (HEWRAT) for the assessment of routine runoff to groundwater. The groundwater risk assessment matrix is based on the 'source-pathway-receptor' pollutant linkage principle. It considers the annual average daily traffic (AADT), annual average rainfall depth, drainage area ratio, and parameters of the receiving ground conditions to give a banded risk score.
- Assessment of pollution impacts from spillages using (HEWRAT) as described in Appendix D of LA 113. The method initially estimates the risk that there will be an incident causing the spillage of a potentially polluting substance somewhere on the length of road being assessed. It then calculates the risk, assuming a spillage has occurred, that the pollutant will reach and impact on the receiving watercourse or groundwater.

- A Water Framework Directive (WFD) assessment for both surface water and groundwater, as described in LA 113. This identifies how the Proposed Scheme has the potential to impact each of the waterbodies' quantity and quality elements and whether it could lead to non-compliance of the WFD.

13.4.3. The approach to the assessmenttakes into consideration comments from the Planning Inspectorate in response to the Proposed Scheme's Scoping Report (2018).

13.4.4. The Flood Risk Assessment (FRA) (Appendix 13.1(**TR010040/APP/6.2**)) has been undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2016; 2019), and the Environment Agency's climate change allowances (Environment Agency, 2020a).

13.4.5. A Drainage Strategy (Appendix 13.2 (**TR010040/APP/6.2**)) has been undertaken in order to outline the proposed drainage design and mitigation measures to reduce impacts upon the water environment from the Proposed Scheme.

13.4.6. As part of the Drainage Strategy a hydrological assessment has also be undertaken to establish the location and sizing of culverts required to convey surface flow pathways where these pathways are intersected by the Proposed Scheme. This has been undertaken in accordance with the requirements of Norfolk County Council (as the Lead Local Flood Authority (LLFA)).

Update to guidance and scope of assessment

13.4.7. Following the Scoping Report for the Proposed Scheme (2018), an update to DMRB guidance was published in 2019 (DMRB LA 113). The methodology and scope presented in the Scoping Report is still valid for this guidance update and no change is required.

13.4.8. When the Scoping Report was written, the proposed drainage design included the requirement to construct a new outfall to discharge runoff from an attenuation pond to an existing ditch at the tributary of Run Dike. However, the drainage design has developed and now discharges to an infiltration basin and infiltration trenches. As there are no longer any proposed outfalls discharging to surface water, there is no longer a requirement to undertake the DMRB LA 113 - Highways England Water Risk Assessment Tool (HEWRAT) assessment for routine runoff to surface waters.

13.4.9. There shall be no construction or operational activity associated with the Proposed Scheme within the floodplain and within 8m of a main river or ordinary watercourse. There will also be no new discharge associated with the Proposed Scheme to surface water bodies. Therefore, in compliance with DMRB LA 113, a

hydrological assessment is only required to inform the location and sizing of culverts or crossings required to convey surface flow pathways where these pathways are intersected by the Proposed Scheme. In addition to this, a hydromorphological assessment is not required as there will be no impacts to natural river processes.

Determination of baseline conditions

13.4.10. This chapter has been completed based on the following sources of information:

- British Geological Survey (BGS) 1:50,000 superficial and bedrock geological map (BGS, 2020)
- Defra's 'Magic' interactive map (Defra, 2020)
- Environment Agency Catchment Data Explorer (Environment Agency, 2020b)
- Environment Agency Flood Risk Maps for Planning (Environment Agency, 2020d), Surface Water, Reservoir, River and Tidal Flood Risk (Environment Agency, 2020e)
- Environment Agency consented discharges and abstraction data
- Highways Agency Drainage Data Management System (HA DDMS) (Highways England, 2020a)
- The findings of the 2018 ground investigation and previous ground investigations associated with the proposed A47 improvements (BWB, 2018; Geotechnics, 1993; Edmund Nuttall Ltd and Scott Wilson Kirkpatrick & Co Ltd, 2005). Details of these investigations is included in Appendix 13.3 (Groundwater Assessment (**TR010040/APP/6.2**))
- The Norfolk County Council Local Flood Risk Management Strategy (Norfolk County Council, 2015)
- The Greater Norwich Area Strategic Flood Risk Assessment (JBA Consulting, 2017)

Site walkover

13.4.11. A site walkover was carried out in March 2018 and March 2020. The walkovers included ground truthing all surface water features identified within the study area from Ordnance Survey mapping and understanding the hydraulic connectivity across the Proposed Scheme.

Consultation

13.4.12. The Environment Agency, Anglian Water and Norfolk County Council (as LLFA) responded to the EIA Scoping Report via the Planning Inspectorate in March

2018. The Environment Agency, Anglian Water and Norfolk County Council (as LLFA) responses are summarised below:

13.4.13. Environment Agency:

- The assessments must include a consideration of groundwater flooding and necessary mitigation.
- The assessments must include a consideration of climate change on all sources of flooding, including groundwater.
- An assessment of the connections between shallow and deep aquifers and surface water features must be carried out.
- The Environment Agency support the use of SuDS.
- Drainage proposals must be carefully considered, particularly any proposals for infiltration drainage in source protection zones for public water supply.
- The assessment must include the 'Bure Operational' catchment.
- Soakaways, infiltration basins and settlement ponds will require a full hydrogeological impact assessment.
- The Environment Agency also stated it was not appropriate to suggest the environmental impact magnitudes would vary with the WFD status of the water body.

13.4.14. The Environment Agency's comments have been addressed in the Environmental Statement. The majority of these have been addressed in due course by following the approaches set out in DMRB LA 113 and LA 104, although particular attention to the comments has also been made within the overall assessment process.

13.4.15. The drainage design includes the use of infiltration basins and trenches that are deeper than 2m and considered by the Environment Agency as deep drainage. As deep drainage to groundwater is less preferable to the Environment Agency than shallow drainage, further consultation has been undertaken. The Environment Agency provided details of a number of conditions that must be demonstrated for deep infiltration to be accepted. These have been addressed in the Drainage Strategy (Appendix 13.2 (**TR010040/APP/6.2**)) and Annex D to the Drainage Strategy.

13.4.16. The Environment Agency has also been consulted on the draft FRA and have provided comments. These comments have been addressed in the FRA (Appendix 13.1 (**TR010040/APP/6.2**)) subject to agreement by the Environment Agency.

13.4.17. Anglian Water wish to be consulted on the content of the Flood Risk Assessment, if connections to the public sewerage network are required. However, as there are no existing or proposed connections to the public sewerage network no additional consultation has been undertaken on this matter. Anglian Water has also been consulted regarding utilities diversions.

13.4.18. Norfolk County Council (LLFA):

- A Flood Risk Assessment will be required as part of the Environmental Statement.
- Drainage must consider SuDS, where appropriate and provide mitigation for any changes in surface water flow paths through the use of 'dry culverts'.
- Appropriate ground investigation should be carried out to ensure infiltration drainage is feasible, where this is proposed.
- Drainage mitigation should attenuate post-development runoff for a 1 in 100-year event plus an allowance for climate change.
- Ordinary Watercourse Consents will be required for any works in close proximity to watercourses.
- The Drainage Strategy should include a Maintenance and Management Plan.

13.4.19. Norfolk County Council have been consulted on the draft FRA, draft Drainage Strategy (including the catchment hydrology assessment) and the accompanying draft Groundwater Technical Note on Deep Drainage. Comments have been received from Norfolk County Council and these have been addressed in the FRA (Appendix 13.1 (**TR010040/APP/6.2**)) and Drainage Strategy (Appendix 13.2 (**TR010040/APP/6.2**)) subject to agreement by Norfolk County Council.

13.4.20. In response to drainage design development since the Scoping Report was submitted, the Broads Internal Drainage Board were contacted for comment on the proposed drainage strategy. The Broads Internal Drainage Board confirmed in May 2020 that they had no comment assuming any surface water runoff would be discharged to ground via infiltration.

Assessment criteria

13.4.21. This assessment identifies the water features within the study area (including any downstream water bodies) and determines the importance (value) of those features as set out in DMRB LA 113.

Value of receptor

13.4.22. The conservation value of water resources is in part defined by legislation which protects all controlled waters in England and Wales and, in effect, protects all water bodies (surface water or groundwater). Therefore, there cannot be any water feature which has negligible value. The value of controlled waters was defined by considering the use and conservation importance of the waterbody. The criteria used in this assessment to determine the value and importance of each water feature and its attributes are set out in Table 13.1, based on the definitions provided in Table 3.70 in DMRB LA 113.

13.4.23. The value or importance of water environment attributes within the study area are presented within the baseline conditions section of this chapter (13.7) in Table 13.7, based on definitions provided in Table 13.1.

Table 13.1 : Criteria for estimating the importance of water environment attributes

Value		Criteria	Examples
Very High		Nationally significant attribute of high importance	**Surface Water**: Watercourse having a WFD classification shown in a RBMP and Q95 ≥ 1.0m^3/s. Site protected or designated under EC or UK legislation (SAC, SPA, SSSI, Ramsar site, salmonid water) / Species protected by EC legislation Ecology and Nature Conservation. **Groundwater**: Principal aquifer providing a regionally important resource and / or supporting a site protected under EC and UK legislation Ecology and Nature Conservation. Groundwater locally supports GWDTE 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 Ecology and Nature Conservation. **Groundwater**: Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a 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.

Magnitude of impact

13.4.24. Definitions for the magnitude of impact are given in Table 13.2 and are based on values set out in Table 3.71 of DMRB guidance LA 113, and the typical examples should be used as a gauge.

Table 13.2 : Estimating the magnitude of an impact on an attribute

Magnitude	Criteria	Examples
Major adverse	Results in loss of attribute and / or quality and integrity of attribute	**Surface Water** Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT and compliance failure with environmental quality standards (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 water body 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 GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body 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 effect on integrity of attribute, or loss of part of attribute	**Surface Water** Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥1% annually and <2 % annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial, industrial or agricultural supplies. Contribution to reduction in water body 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 to groundwater from routine runoff - risk score 150 to 250. Calculated risk of pollution from spillages ≥1% annually and <2 % annually. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures 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 attribute's quality or vulnerability	**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. Minor effects on water supplies. **Groundwater** Potential low risk of pollution to groundwater from routine runoff - risk score <150. Calculated risk of pollution from spillages ≥0.5% annually and <1%

Magnitude	Criteria	Examples
		annually. Minor effects on an aquifer, GWDTEs, abstractions and structures. **Flood Risk** Increase in peak flood level (> 10mm).
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	The proposed project 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 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 <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 both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually). Contribution to improvement in water body WFD classification. **Groundwater** Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually). Contribution to improvement in water body WFD classification. Improvement in water body catchment abstraction management strategy (CAMS) (or equivalent) classification. Support to significant improvements in damaged GWDTE. **Flood Risk** Creation of flood storage and decrease in peak flood level1 (> 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 water body WFD classification. **Groundwater**

Magnitude	Criteria	Examples
		Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Improvement in water body 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.

Significance

13.4.25. The overall significance of effect was determined using the significance matrix provided in Table 3.8.1 in DMRB guidance LA104 (provided in chapter 4 Environmental Assessment Methodology (**TR010040/APP/6.1**) Table 4.2) using professional judgement to consider site specific factors that may be of relevance. Effects can be beneficial or adverse. Effects that are moderate or above are considered significant effects. Effects that are slight or neutral are not significant.

13.5. Assessment assumptions and limitations

13.5.1. This Environmental Statement has been prepared using publicly available information, with references carried out to previous reports and through the use of Highways Agency Drainage Data Management System (HA DDMS), (Highways England, 2020a). The assessment is a desk-based study informed by site walkovers, to ground-truth selected water features, and the previous ground investigations. The 2018 ground investigation provided detailed information on groundwater quality and is considered to be representative of the general conditions. This level of detail is considered appropriate at this stage of the design. Design changes will be subject to environmental review which may include supplementary ground investigations or surveys. This will ensure that any residual effects would not be greater than those reported in the ES.

13.5.2. The groundwater assessment (Appendix 13.3 (**TR010040/APP/6.2**)) is constrained by the information available. The current and historic ground investigations have provided comprehensive data relating to the geology and hydrogeology within the Proposed Scheme's construction footprint. The footprint of the Proposed Scheme is long and narrow, however, and there is limited data outside of the site (the Proposed Scheme boundary). The data collected, therefore, may not fully represent the regional hydrogeological conditions, particularly with respect to hydraulic gradients and direction of groundwater flow. In addition to this, groundwater flooding susceptibility dataset was only available for a 500m corridor around the existing road.

13.5.3. Other uncertainties identified in the groundwater assessment include:

- Groundwater level monitoring was conducted over a relatively dry period and as such the recorded range of levels may not necessarily be reflective of long term seasonal maximums and minimums.
- There is evidence of a groundwater flow divide (i.e. a point where the general groundwater flow direction changes) across the site, but the exact location is not known.
- Groundwater monitoring information focussed on the superficial deposits and the underlying Crag aquifer, but information on the Chalk (groundwater levels or aquifer properties) are not known. This is considered to pose limited risk to the assessment, however, as the Chalk is at depth below site and not intercepted by any below ground structures.

13.5.4. The assessment of flood flows intercepted by the Proposed Scheme and the location and sizing of cross-drains and 'dry culverts' is based on available LiDAR data. A tailored topographic survey will be undertaken at detailed design to reassess and confirm the location and sizing of cross-drains. Otherwise, it is considered that the data limitations identified below do not introduce significant uncertainties with respect to surface water and flooding risks.

13.5.5. The temporary drainage design to be adopted during construction is to be confirmed. A reasonable assumption is that the main site compound runoff will be collected within a ditch surrounding the compound and be redirected to settlement ponds before being discharged to ground or alternatively collected and disposed of off-site. Although it is assumed that satellite compounds and other worksite welfare and compound areas will not have temporary drainage systems, any welfare areas would have their own waste storage that would be cleaned out on a regular basis.

13.5.6. It is assumed that no significant adverse effects are predicted deriving from the vulnerability of the Proposed Scheme to risks of major accidents and / or disasters (for example major road traffic accident, structure collapse, ground instability, terrorist attack, fire, chemical spillage). The design, construction and operation of the Proposed Scheme must comply with relevant health and safety legislation, current design standards and a response to any major incident in accordance with Highways England's Traffic Incident Management and Contingency Planning framework. Therefore, major accidents and disasters were scoped out of the EIA Scoping Report and Scoping Opinion for the Proposed Scheme (2018)(**TR010040/APP/6.6**).

13.6. Study Area

13.6.1. The study area must encompass groundwater and surface water features that would potentially be affected by the Proposed Scheme. The study area is based

on professional judgement to ensure that effects are sufficiently identified and comprises a 1km corridor surrounding the footprint of the site. Where appropriate, the study area has been extended to include features further downstream (surface water features) or down-gradient (groundwater features) that may also be impacted, where a potential pathway or linkage has been identified. This is important for identifying groundwater dependent terrestrial ecosystems that rely on groundwater originating from within the site. The study area is shown in Figures 13.1 to 13.8 (**TR010040/APP/6.3**) along with the key surface water and groundwater features. The surface water and groundwater features included in the assessment are also described in section 13.7.

13.7. Baseline conditions

Surface water

Surface water features

13.7.1. The main surface water features within the study area that have the potential to be either directly or indirectly affected by the Proposed Scheme are shown in Figure 13.1 (Surface water features, consented discharges and fluvial flood risk) (**TR010040/APP/6.3**). A summary of these features is provided below.

13.7.2. Run Dike tributary is an ordinary watercourse which flows east to west from Waterlow at the south of the Proposed Scheme, within the study area. It joins Run Dike, a main river located outside of the study area, at Brundall Road. The annual Q_{95} flow (that is, the flow that is exceeded 95% of the time) for this tributary was estimated to be 0.0120m³/s using Low Flows 2. An ordinary watercourse is usually a smaller river or stream on which lead local flood authorities, district councils or internal drainage boards carry out flood risk management work.

13.7.3. Run Dike tributary (from Braydeston Hall Lane) is located within the Broads Internal Drainage Board boundary and hydrological boundary.

13.7.4. There is no surface water connectivity between Run Dike tributary and the Proposed Scheme. However, overland flood flow pathways may convey water during extreme events due to the existing topography of the land. Flood flow pathways were provided in the Scoping Opinion by Norfolk County Council and are shown on the Environment Agency's Risk of Flooding from Surface Water map (Environment Agency, 2020e). The former also identifies flood flow pathways which may convey water during extreme events between the Proposed Scheme and tributaries of the River Bure, which is located outside of the study area.

13.7.5. The desk-based study using Ordnance Survey (OS) mapping identified a total of six isolated, minor drainage ditches or ordinary watercourses throughout the

study area. However, following the site survey, undertaken in March 2020, additional drainage ditches were identified around the majority of fields running adjacent to roads (Figure 13.1 (Surface water features, consented discharges and fluvial flood risk) (**TR010040/APP/6.3**)). The findings from the desktop assessment using OS mapping and the site survey indicated these drainage ditches were not connected to any ordinary watercourses and the wider river network.

13.7.6. There is a total of 40 isolated ponds located throughout the study area, three of these being within the Site. The pond near to the junction of Lingwood Road and the existing A47, which is approximately 0.07ha in area, lies within the construction footprint of the Proposed Scheme. This pond receives some runoff from the junction with the existing A47,

Water Framework Directive

13.7.7. The study area is split between the following WFD water body catchments:

- Witton Run WFD water body [GB105034051310] covers the western part of the study area and is part of the Yare Operational Catchment and the Broadland Rivers Management Catchment. Run Dike is identified from OS mapping as the main water body in this water body catchment. Run Dike tributary is located within this water body catchment.
- Bure (Horstead Mill to St Benet's Abbey) WFD water body [GB105034050931] covers the central and eastern part of the study area. This water body is part of the Bure Operational Catchment and the Broadland Rivers Management Catchment.

13.7.8. The south-eastern part of the study area is not included as part of a river water body catchment although it is part of the Bure Operation Catchment. All three catchments are within the Anglian River Basin District and their locations are identified in Figure 13.2 (WFD and IDB surface waterbodies) (**TR010040/APP/6.3**).

13.7.9. Table 13.3 summarises the WFD surface water bodies within the study area and indicates their targets and objectives. The current Anglian River Basin Management Plan (RBMP), as shown by the Environment Agency's Catchment Data Explorer (Environment Agency, 2020b) indicates that:

- Witton Run's (GB105034051310) ecological potential is limited to moderate by the biological quality elements (moderate potential for macrophytes and phytobenthos combined) and physico-chemical quality elements (poor potential for dissolved oxygen). Reasons for not achieving good status include drought, urbanisation – urban development, surface and groundwater abstractions and land drainage – operational management. The chemical status fails due to the presence of a priority hazardous

substance, namely, polybrominated diphenyl ethers (PBDE)); all other aspects of chemical quality are at good status. The overall status is expected to remain at moderate due to unfavourable balance of costs and benefits and disproportionate burdens.

- Bure (Horstead Mill to St Benet's Abbey) (GB105034050931) ecological potential is limited to moderate by the supporting elements – surface water (moderate or less for mitigation measures assessment) and physico-chemical quality elements (moderate potential for dissolved oxygen and temperature). Reasons for not achieving good status is currently unknown. The chemical status fails again due to the presence of PBDE. All other elements of chemical quality are at good status. The overall status is expected to reach good by 2027, however, it is noted that there are disproportionate burdens associated with this objective and the cause of the adverse impact is unknown.

Table 13.3 : Summary of WFD surface water bodies within the study area

Water body ID	GB105034051310	GB105034051931
Water body name	Witton Run	Bure (Horstead Mill to St Benet's Abbey)
Operational catchment	Yare	Bure
Management catchment	Broadland Rivers	Broadland Rivers
River basin district	Anglian	Anglian
Type	River	River
Hydromorphological status	Heavily Modified	Heavily modified
Overall classification (cycle 2 – 2019)	Moderate	Moderate
Current ecological quality (cycle 2 – 2019)	Moderate	Moderate
Current chemical quality (cycle 2 – 2019)	Fail	Fail
Ecological objective	Moderate by 2015 (i.e. maintain moderate status)	Good by 2027
Chemical objective	Good by 2015	Good by 2027
Protected area (within the study area)	No	Yes, Drinking Water Protected Area

13.7.10. The northern half of the study area is within the South Walsham Broad Eutrophic Lake (EL108) Nitrate Vulnerable Zone (Environment Agency, 2020c).

Groundwater

13.7.11. The baseline groundwater conditions are based on the hydrogeological conceptual model presented in Appendix 13.3 Groundwater assessment (**TR010040/APP/6.2**).

Geology

13.7.12. The bedrock and superficial geology within the study area is described in detail in chapter 9 Geology and Soils of the Environmental Statement (**TR010040/APP/6.1**).

13.7.13. The majority of the study area has a cover of superficial geology. However, there are areas of no recorded superficial cover to the north-west of Braydeston Hall.

Aquifer Designations

13.7.14. The bedrock geology underlying the study area is the Norwich Crag. This is classified by the Environment Agency as a Principal aquifer and is likely in hydraulic continuity with the underlying Chalk. Principal aquifers supply water resources and / or base flow at a strategic scale.

13.7.15. The Happisburgh Glacigenic Formation Sand is classified by the Environment Agency as a Secondary A aquifer, which are described as formations that provide locally important water resources and may support base flow to rivers (Figures 13.3 (Aquifer designations) and 13.4 (Ground investigation boreholes) (**TR010040/APP/6.3**)).

13.7.16. The Lowestoft Formation Diamicton is classified as a Secondary (undifferentiated) aquifer. It is present across most of the site and likely overlies the Happisburgh Glacigenic Formation Sand. Secondary (undifferentiated) aquifers are classified as such due to the formation previously designated as both a minor aquifer and non-productive strata in different locations due to variable characteristics. The Happisburgh Glacigenic Formation Diamicton is present at the surface to the west of the study area and is classified as unproductive strata.

13.7.17. To the south of Blofield, the Crag Group and Bytham Sand and Gravel Formation (undifferentiated) and Lowestoft Formation Sand and Gravel are present at surface. These are classified by the Environment Agency as Secondary A aquifers. The Breydon Formation Peat is also present in this area and is classified by the Environment Agency as unproductive strata.

Aquifer properties

13.7.18. The properties of the aquifer define the capacity of the aquifer to release water and the ability of groundwater flow to be transmitted with ease.

13.7.19. The Crag is a locally important aquifer, up to approximately 70m thick, found in parts of East Anglia (Ander, Shand & Wood, 2006). It consists of unconsolidated marine sands which may be locally hard and consolidated. The Crag acts as a source of significant storage for the Chalk when the two formations are in hydraulic continuity. The overlying permeable superficial deposits are also considered to be in hydraulic continuity with the Crag and the Chalk.

13.7.20. Clay-rich horizons within the Lowestoft Till and Happisburgh Glaciogenic formations locally semi-confine the Bytham Sands and Gravels Formation and the Crag.

13.7.21. Sand and gravel horizons within the Lowestoft Till Formation and the Happisburgh Glaciogenic Formation are considered to be permeable, although in the study have been found to be largely dry. This is due to the study area being situated over an interfluve.

13.7.22. Further details of aquifer properties are included in Appendix 13.3 Groundwater assessment (**TR010040/APP/6.2**).

Groundwater levels and flows

13.7.23. Groundwater level monitoring was carried out as part of the 2018 ground investigation. This is detailed further in Appendix 13.3 (Groundwater assessment (**TR010040/APP/6.2**)), with a summary of findings given below. The borehole monitoring locations can be found in Figure 13.4 (Ground investigation boreholes) (**TR010040/APP/6.3**).

13.7.24. Groundwater levels range between 5m and 20m below ground level across the site. They are found to coincide with the boundary between the Happisburgh Glacigenic Formation and Bytham Sands and Gravels Formation and are generally highest in the west, suggesting that groundwater flows within the Bytham Sands and Gravels Formation and Crag Group is towards the east.

13.7.25. At the western extents of the scheme, local hydraulic gradients within the Bytham Sands and Gravels Formation and Crag Group are likely to be towards the Witton Run and ultimately the River Yare. This is to the southwest of the study area, where groundwater from the Crag possibly discharges to surface watercourses. However, due to the linear nature of the Proposed Scheme it is difficult to conclude this groundwater flow direction with any degree of confidence.

Groundwater quality

13.7.26. Soil and groundwater quality sampling were carried out as part of the 2018 Ground Investigation and is presented in Appendix E (Summary of Soil Contamination) of the Ground Investigation Report (Galliford Try Sweco, 2020). A total of 10 water samples were analysed for suites including general inorganics, total phenols, speciated polycyclic aromatic hydrocarbons (PAHs), total PAH, heavy metals, metalloids and petroleum hydrocarbons. There were no noticeable signs of contamination.

Groundwater vulnerability

13.7.27. The bedrock and superficial aquifers have a combined groundwater vulnerability classification of medium to high risk with a small area of low risk in the west. The higher groundwater vulnerability is associated with areas where the superficial Lowestoft Formation and the Happisburgh Glacigenic Formation sands outcrop at surface. The area of low risk correlates areas where the superficial Happisburgh Glacigenic Formation Diamicton outcrops at surface. Where the Crag is outcropping, in the south-west of the study area where the red line boundary crosses Waterlow, that groundwater vulnerability is medium to low.

Surface water features supplied by groundwater

13.7.28. Designated sites, which are potentially hydraulically linked to the 1 km study area are included in this assessment. and illustrated in Figure 13.4 (Ground investigation boreholes) (**TR010040/APP/6.3**).

13.7.29. The following designated sites are situated approximately 1.6km to the southwest study area, down-hydraulic gradient of the scheme:

- The Yare Broads and Marshes SSSI (Site of Special Scientific Interest)
- The Broadland Ramsar site
- The Mid Yare Valley NNR (National Nature Reserve) which includes Strumpshaw Fen

13.7.30. These sites are considered to be groundwater dependent as tributaries of the Witton Run at Braydeston Hall and Red House, (which ultimately discharges to the Yare Broads and Marshes) are likely to receive groundwater from the Bytham Sands and Gravels Formation and the Crag Group.

13.7.31. The following designated sites are situated approximately 3km to the east of the study area, and down-hydraulic gradient of the scheme:

- Damsgate Marshes SSSI
- Decoy Carr SSSI

13.7.32. Decoy Carr is reportedly spring-fed and the Damsgate Marshes overlie fen peats and alluvial clays, which may receive groundwater from the Crag.

13.7.33. There is a likely hydrogeological connection between the study area and the groundwater dependent terrestrial ecosystems, and thus the potential for the Proposed Scheme to impact on these, is discussed further in Appendix 13.3 Groundwater assessment (**TR010040/APP/6.2**).

Water Framework Directive

13.7.34. The study area is found within the Broadland Rivers Chalk and Crag groundwater body (GB40501G400300) and is part of the Broadland Rivers Chalk and Crag Operational Catchment and the Anglian Groundwater Management Catchment. The location of the groundwater body can be seen in, Figure 13.5 (WFD and internal groundwater bodies) (**TR010040/APP/6.3**).

Table 13.4 : Summary of WFD groundwater bodies within the study area

Water body ID	GB40501G400300
Water body name	Broadland Rivers Chalk and Crag groundwater body
Operational catchment	Broadland Rivers Chalk and Crag Operational Catchment
Management catchment	Anglian Groundwater Management Catchment
River basin district	Anglian
Type	Groundwater body
Hydromorphological status	N/A
Overall classification (cycle 2 – 2016)	Poor
Current chemical quality (cycle 2 – 2016)	Poor
Chemical objective	Good (by 2027)
Protected area (within the study area)	Yes, Nitrates Directive

13.7.35. The Broadland Rivers Chalk and Crag groundwater body (GB40501G400300) has poor chemical and quantitative status (2016 cycle 2). The quantitative status is limited by the Groundwater Dependent Terrestrial Ecosystems test which scored poorly due to agricultural abstractions lowering the natural flow and levels of the groundwater. The objective is to achieve ‘good’ quantitative status by 2021. The chemical status is limited by the chemical Drinking Water Protected Area criteria, which scored poorly although data is reportedly suspect. Objectives are to achieve good chemical status by 2027 by natural recovery. The site is located within the Norwich Crag and Gravels groundwater Nitrate Vulnerable Zone.

Licensed and unlicensed abstractions

13.7.36. Details of the source protection zones and licensed and unlicensed abstractions are given in Figure 13.6 (Groundwater abstractions and source protection zones) (**TR010040/APP/6.3**).

13.7.37. The red line boundary of the Proposed Scheme crosses a source protection zone (SPZ) 3 (Total Catchment) at its western extent for approximately 500m. This is associated with groundwater abstractions at Postwick, approximately 4.5km to the west of the Proposed Scheme.

13.7.38. There are five licensed groundwater abstractions within the study area. These are summarised below in Table 13.5.

Table 13.5 : Summary of licensed groundwater abstractions.

Licensed groundwater abstraction	Grid reference	Geology	Use
Borehole, Church Farm, North Burlingham	637030 310010	Chalk	Spray irrigation - direct
Well, Burlingham horticultural station	637050 310050	Glacial sands/gravels	Spray irrigation - direct
Borehole, Burlingham horticultural station	637100 310100	Chalk	Spray irrigation - direct
Borehole at nurseries, Lingwood	637200 309100	Chalk	Spray irrigation - direct
Borehole off A47, east of Blofield	634078 309856	Chalk	Spray irrigation - direct

13.7.39. There are eight unlicensed groundwater abstractions of less than 20m^3/d within the study area. It is not known whether the unlicensed abstractions take water from the Chalk or the overlying superficial deposits.

13.7.40. According to the Environment Agency there are no surface water abstractions licences within the study area. Due to this, attributes associated with this have been scoped out for all surface water features (see Table 13.6).

Consented and unconsented discharges

13.7.41. Data provided by the Environment Agency indicates there are two consented discharges to surface water within the study area. These comprise:

- One discharge of secondary treated sewage effluent to a tributary of Coleman's Drain at OS National Grid Reference (NGR) TG 37010 09923
- One discharge of secondary treated sewage effluent (containing no trade effluent) to an unnamed tributary of the River Yare at OS NGR TG 35999 09387

13.7.42. These consented discharges are located within the Bure (Horstead Mill to St Benet's Abbey) WFD catchment. Due to this, attributes associated with this have been scoped out for all surface water features within Witton Run WFD water body and Run Dike WFD water body (see Table 13.6).

13.7.43. There are three consented discharges to land and groundwater within the study area (Figure 13.1 (Surface water features, consented discharges and fluvial flood risk) (**TR010040/APP/6.3**)). These comprise:

- Two discharges of biologically treated sewage effluent to soakaways at OS NGR TG 3569 1085 and TG 36381084

- One discharge of untreated domestic sewage effluent via a trench arch system at NGR TG 36531 10118

13.7.44. There have been no unconsented discharges identified from consultation.

Existing drainage

13.7.45. HA DDMS (Highways England, 2020a) provides details on the existing drainage network which is summarised below:

- The eastern extent of the A47 within the study area (at Blofield) is drained by a network of carrier drains which outfall to 18 soakaway chambers all classified as low pollution risk (Priority D).
- The western extent of the A47 (at North Burlingham) is drained by a network of carrier drains which outfall to 26 soakaway chambers all classified as low pollution risk.
- The central section of the A47 is drained by a number of grip inlets suggesting runoff from the carriageway is routed locally to an adjacent drainage ditch or grip.

13.7.46. The pond adjacent to Lingwood Road receives some runoff from the junction with the existing A47. No other surface water outfalls or attenuation features were identified within the study area. Furthermore, HA DDMS did not indicate the presence of any pollution control devices or oil and petrol interceptors within the study area.

13.7.47. The majority of the A47 lies within a rural catchment with the western and eastern extents being partly urbanised. In these locations, surface water drainage is governed by local authority surface water and highways drainage networks as well as the Anglian Water sewerage network. Previous consultation with these organisations confirmed that the existing A47 drainage does not connect with the local sewerage or local highways drainage networks.

Flood risk

13.7.48. According to the Environment Agency's Flood Map for Planning (Environment Agency, 2020d), the majority of the study area, and all of the site, is located within Flood Zone 1. This can be seen in Figure 13.1 (Surface water features, consented discharges and fluvial Flood Risk) (**TR010040/APP/6.3**). Flood Zone 1 is associated with a low risk of flooding from fluvial and coastal sources (an annual probability of less than 1 in 1,000 (0.1%) of river and sea flooding).

13.7.49. A small proportion of the study area, outside of the site, to the south of Blofield is within Flood Zone 2 and 3 (Environment Agency, 2020d):

- Flood Zone 2 is associated with a medium risk of flooding (land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of flooding (1% to 0.1%) or between 1 in 200 and 1 in 1,000 annual probability flooding from the sea (0.5% to 0.1%) in anyone year).
- Flood Zone 3 is associated with high risk of flooding (land assessed as having a 1 in 100-year or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year).

13.7.50. The areas of Flood Zone 2 and 3 are associated with the designated main river of the River Yare, Run Dike and its tributaries and are subject to both fluvial and tidal flooding.

13.7.51. The Strategic Flood Risk Assessment (SFRA) (JBA, 2017) identifies areas of Flood Zone 3 that are classified as Flood Zone 3b. Flood Zone 3b comprises land where water has to flow in times of flood and is known as the functional floodplain. The section of Flood Zone 3b is associated with Run Dike tributary. A very small proportion of the study area to the east is within Flood Zone 2 and 3a. Further details can be found in the FRA, Appendix 13.1 (**TR010040/APP/6.2**).

13.7.52. There are no flood defences, areas benefitting from defences or flood storage areas within the study area (Environment Agency, 2020d). In addition to this, the Proposed Scheme is not within an area that receives flood warning or alerts.

13.7.53. The Environment Agency's Risk of Flooding from Surface Water map (Environment Agency, 2020e), shows the majority of the study area is at very low risk of pluvial (surface water) flooding (Figure 13.7 (Surface water flood risk) (**TR010040/APP/6.3**)). This means there is less than 1 in 1000 (0.1%) chance of flooding in any given year as a result of excess surface water during a heavy rainfall event. It must be noted that the derivation of this map includes general assumptions for drainage which may not be representative of local conditions and hence should be treated with caution.

13.7.54. There are isolated areas of low to high risk of surface water flooding within the study area. The Environment Agency classify the low to high surface water flood risk as:

- Low - each year, the area has between 1 in 1000 (0.1%) and 1 in 100 (1%) chance of pluvial flooding in any given year
- Medium - each year, the area between 1 in 100 (1%) and 1 in 30 (3.3%) chance of pluvial flooding in any given year
- High - each year, the area has greater than 1 in 30 (3.3%) chance of pluvial flooding in any given year

13.7.55. Low surface water flood risk is identified at the western edge of Blofield where a surface water flow path runs in a south west direction towards Run Dike tributary. This surface water flood pathway crosses a section of the existing A47 carriageway. To the west of this, an additional low risk surface water flood flow pathway runs in a southerly direction and joins this. This flood flow pathway also crosses the existing carriageway. During the site survey in March 2020 a small drainage pipe was located in this area, which is assumed to convey the surface water under the carriageway to the ditch on the southern side of the existing A47.

13.7.56. These flood flow paths crossing the A47 were highlighted by the LLFA in the Scoping Opinion. The LLFA provided a flow direction map which confirmed the direction of these surface water flow paths within the catchment and the location where they cross the A47. Further details can be found in the Drainage Strategy Report, Appendix 13.2 (**TR010040/APP/6.2**).

13.7.57. Other surface water flow paths were evident flowing south through Blofield towards Run Dike tributary. Outside of the site area, but within the study area, surface water flow paths were identified to flow towards the River Bure in the eastern and south-eastern corners of the study area.

13.7.58. The remaining areas of low to high risk are isolated and appear to be associated with localised ponding.

13.7.59. The Norfolk Local Flood Risk Management Strategy (Norfolk County Council, 2015) indicates there are less than 10 properties at risk of surface water flooding in Blofield.

13.7.60. The Environment Agency's Historic Flood Map (Environment Agency 2020f) does not indicate any areas of previous flooding within the study area.

13.7.61. The Highways Agency Drainage Data Management System (HA DDMS; (Highways England, 2020a) identified a number of previous flooding events on the A47 carriageway both inside and within 1km of the Proposed Scheme boundary (see Appendix 13.1 (Flood Risk Assessment(**TR010040/APP/6.2**)) for further details):

- Events within Proposed Scheme boundary:
- five very low severity (0-2) flood events between 2012 and 2018 east of North Burlingham where the carriageway and the layby were flooded
- one low severity (3-4) flood event in June 2020 east of North Burlingham where the carriageway and layby were flooded

- these events form part of a wider flooding hotspot with a ‘very high’ risk status which extends east more than 1km away from the Proposed Scheme boundary
- Events outside Proposed Scheme boundary:
- two low severity events in 2013 in the Blofield area where the carriageway was flooded.
- these events form part of a wider flooding hotspot with a ‘not determined’ risk status which extends west, more than 1km away from the Proposed Scheme boundary. This includes the flood event of October 2019 described below.

13.7.62. No further information was available on HA DDMS (Highways England, 2020a) to indicate the cause of flooding except for three events which were known to be caused by blocked gullies.

13.7.63. On 6 October 2019, a section of the A47 in the Blofield area, outside of the Proposed Scheme area was forced to close due to a heavy rainfall event. This was part of much more widespread flooding throughout Norfolk after a wet September (151% of normal expected rainfall) followed by an intense rainfall event (up to 69mm) on the 6 October. During this event, 24 properties within the Lackford Run catchment were flooded internally, including a number of residential properties in Blofield, although these were located outside the Proposed Scheme boundary (Norfolk County Council, 2019b). During the same flood event, the A47 was closed by Norfolk Police due to flooding to the west of Blofield (outside of the Proposed Scheme). The Norfolk County Council Flood Investigation Report (Norfolk County Council, 2019a) recommended that Highways England should examine options to ensure water does not pool on the highway and to review the maintenance regime required to sustain the design efficiency of the drainage system.

13.7.64. Highways England are investigating the known flooding hotspots on HA DDMS to the east and west of the Proposed Scheme, including the October 2019 flooding event, and will review options to remediate the risk of flooding to the existing A47 carriageway. However, these works will be undertaken separately from the Proposed Scheme.

13.7.65. The Greater Norwich SFRA (JBA, 2017) indicates that there have been 14 incidents of flooding from the ‘properties at risk of flooding’ (known as ‘DG5’) register in the Blofield and Strumpshaw postcode area. No further detail on the precise locations, dates or extents of these flood events was available.

13.7.66. The Proposed Scheme is not at risk of flooding from canals, tidal events or as a result of reservoir failure.

Groundwater flooding

13.7.67. The main carriageway of the Proposed Scheme is within an area that has limited potential for groundwater flooding to occur. However, there are three small areas at the eastern and western extents of the study area, and to the south of the site respectively, where there is potential for groundwater flooding of property situated below ground level (Figure 13.8 (Susceptibility to groundwater flooding) (**TR010040/APP/6.3**)). The groundwater flooding susceptibility dataset is only available for a 500m corridor around the existing road. As such there is no information available for the areas to the south of the Proposed Scheme that may be required for the drainage regime.

13.7.68. The Norfolk Local Flood Risk Management Strategy (LFRMS) (Norfolk County Council, 2015) indicates that there are few instances of groundwater flooding likely due to the low groundwater levels maintained through pumping undertaken by the Internal Drainage Boards, although no details are provided of where this occurred.

Aquatic ecology

13.7.69. Through potential impacts on the water environment, the Proposed Scheme has the potential to have an indirect impact on the aquatic ecology of the study area. The impact on such features has been assessed in detail in chapter 8 Biodiversity. The WFD ecological potential for Witton Run is classified as moderate, with moderate classification for macrophytes and phytobenthos and high classification for invertebrates. Witton Run has an objective of maintaining moderate ecological potential. The WFD ecological potential for Bure (Horstead Mill to St Benet's Abbey) is classified as moderate with high classification for macrophytes and phytobenthos and good classification for invertebrates with an objective of reaching good potential.

13.7.70. Four priority habitats associated with the water environment are identified in the south-western section of the study area. The main habitats present are:

- Coastal and floodplain grazing marsh
- Purple moor grass and pasture
- Lowland fens

13.7.71. Within the 1km study area there are no Ramsar sites, Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA), Local Nature Reserves or National Nature Reserves (NNR). Designated sites outside of the 1km study area with a potential hydrogeological link have been identified, however. These include:

- the Yare Broads and Marshes SSSI, the Broadland Ramsar site and the Mid Yare Valley NNR (National Nature Reserve), situated approximately 1.6km to the south-west of the western extents of the study area
- Damgate Marshes SSSI (Natural England, 2002a) and Decoy Carr SSSI (Natural England, 2002b), situated approximately 3km to the east of the study area

13.7.72. Priority habitats are only located within Run Dike and Witton Run WFD water body catchment. They have been allocated an importance value of high as they are nationally significant (as identified in Chapter 8, Biodiversity). Attributes associated with designated habitats have been scoped out for all surface water features within Bure (Horstead Mill to St Benet's Abbey) WFD catchment (see Table 13.6).

13.7.73. Habitat suitability index assessments have been undertaken on ponds within the study area (as discussed in chapter 8 Biodiversity (**TR010040/APP/6.1**)).

Recreation and human health

13.7.74. The Proposed Scheme lies within a largely rural, agricultural area with sporadic farm and residential buildings either adjacent to the A47 or along minor side roads. The villages of Blofield and North Burlingham are present at the western and eastern extents of the Proposed Scheme respectively.

13.7.75. There are no navigable or commercially used watercourses within the study area.

13.7.76. There are a number of isolated ponds in the study area, however, these have not been identified as being used for angling or other recreational purposes.

13.7.77. Due to this, attributes associated with recreation and human health were not considered for all surface water features (see Table 13.6).

Events

13.7.78. The Greater Norwich SFRA (JBA, 2017) provides details on a number of flood events known to have affected the Greater Norwich area between 1273 and 2017. Coastal flooding events affected the Yare and Bure catchments in 1608, 1897, 1953, 1976, 1983, 1993, 2007 and 2013. A rainfall and snowmelt flood occurred in 1878. A number of these floods resulted in fatalities and damage to hundreds or thousands of properties.

13.7.79. Heavy rainfall caused flooding within the Yare and Bure catchments in 1762, 1912, 1968, 1981, 1993, 2014 and 2017 where between tens and hundreds of properties were flooded.

13.7.80. The Greater Norwich SFRA (JBA, 2017) indicates that there have been 14 incidents of flooding from the 'DG5' register in the Blofield and Strumpshaw postcode area. No further detail on the precise locations, dates or extents of these flood events was available.

13.7.81. As mentioned in Section 13.4.60 there is little recorded information on instances of groundwater flooding.

Climate change

13.7.82. The Met Office regional climate summary for eastern England (Met Office, 2016) indicates the current climate baseline within the study area to be:

- Mean annual temperatures ranging from 9.5°C to around 10.5°C in the low-lying areas with mean daily minimum temperatures of 1°C in winter and mean daily temperatures of 20°C to 23°C in summer.
- Average annual sunshine durations over eastern England range from over 1,600 hours in Norfolk, Suffolk and Essex to less than 1,450 hours in East Yorkshire and Lincolnshire.
- Eastern England has a more even annual distribution of rainfall when compared with the rest of the UK with an average of 30 rain days in winter and less than 25 days in summer.
- The average number of days with snow falling is about 20 per year in low lying areas.
- Eastern England is one of the more sheltered parts of the UK in terms of wind.

13.7.83. Climate change predictions suggest that the future annual recharge volumes for groundwater are broadly stable although the groundwater recharge season is likely to condense into a shortened period, leading to more variable groundwater levels and a greater drought vulnerability.

Sensitivity of receptors

13.7.84. The following receptors or features have been identified that could potentially be affected by the construction and operation of the Proposed Scheme. In accordance with DMRB LA 113 guidance, the importance of these features in terms of their attributes are summarised in Table 13.6 below.

13.7.85. Watercourses and water features that are understood to be hydrologically isolated from the Proposed Scheme have not been included in this assessment. Run Dike tributary has been included as it is deemed there is a hydrological connection due to the surface flood flow pathway.

13.7.86. Although Run Dike tributary is located within the Witton Run WFD water body catchment, it has been addressed separately from the other ordinary watercourses and ditches within this catchment. This is to highlight the distinction between the connected flowing water body, and the disconnected ordinary watercourses and drainage ditches within the area.

13.7.87. Unnamed ordinary watercourses, ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey) WFD water body catchment and the Bure Operational Catchment have been considered together as they all lie within the same Operational Catchment.

13.7.88. The licensed and unlicensed abstractions and groundwater dependent terrestrial ecosystems have been assessed as indirect receptors of the aquifers (direct receptors). These are considered attributes of the Principal and Secondary aquifers listed in the table below.

Table 13.6 : Importance of water environment attributes in study area

Feature	Attribute	Importance	Reason for assigned value
Run Dike tributary (Broads IDB)	Water supply and quality	Medium	No known abstractions within the study area. WFD fail chemical status.
	Value to economy	Medium	No known abstraction. Limited known usage of watercourses. Possibly agricultural use for drainage of land.
	Conveyance of flow	High	Proposed Scheme is in Flood Zone 1, however, there are areas of Flood Zones 2 to 3b within the study area although outside the site area. Q95 flow = 0.012m^3/s. Floodplain includes areas of 'more vulnerable' receptors (that is, residential properties).
	Biodiversity	High	Priority habitats within the study area. WFD moderate ecological potential.
Unnamed ordinary watercourses, drainage ditches and ponds in the Witton Run WFD Water body catchment	Value to economy	Medium	No known abstractions. Limited known usage of watercourses. Possibly agricultural use for drainage of land.
	Conveyance of flow	Low	Flood Zone 1 with a small number of residential properties. Q95 flow is assumed to be ≤0.001m^3/s as the drainage ditches and watercourses are isolated and disconnected.
	Biodiversity	High	Priority habitats within the study area. WFD moderate ecological potential.
Unnamed ordinary watercourses, ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey)	Dilution and removal of waste products	High	Consented discharges within study area. Q95 flow is assumed to be ≤0.001m^3/s as the drainage ditches and watercourses are isolated and disconnected.
	Value to economy	Medium	No known abstractions. Limited known usage of watercourses. Possibly agricultural use for drainage of land.

Feature	Attribute	Importance	Reason for assigned value
WFD water body catchment and the Bure Operational Catchment	Conveyance of flow	Low	Flood Zone 1, however, there is a very small area of Flood Zones 2 to 3a within the study area although this is remote and hydrologically disconnected from the Proposed Scheme. There are a small number of residential properties.
Broadland Rivers Chalk and Crag	Water supply and quality	High to very high	Principal aquifer, objectives for good status by 2027. A number of licensed and unlicensed abstractions are located within the study area.
	Soakaway	Low	Soakaways and consented discharges identified in study area and along existing road likely discharge to overlying superficial deposits
	Vulnerability	High	Combined aquifer groundwater vulnerability of medium to high
	Economic Value	Very high	Principal aquifer providing a regionally important resource.
	Conveyance of flow	Very high	The route crosses Witton Run and Bure (Horstead Mill to St Benet's Abbey) WFD surface water bodies, and therefore there are hydraulic pathways to surface waters via base flow. In addition, the Decoy Carr SSSI and Damgate Marshes SSSI are approximately 3km to the east.
Secondary Superficial Aquifers	Water supply and quality	Medium	Secondary Aquifers supporting local water supply
	Soakaway	High	Soakaways and consented discharges identified in study area and along existing road. Receiving aquifers include permeable horizons in the Happisburgh Glacigenic Formation and the Lowestoft Formation.
	Vulnerability	High	Combined aquifer groundwater vulnerability of medium to high
	Economic value	Medium	Supports local abstractions.
	Conveyance of flow	High	In hydraulic continuity with the Broadland Rivers Chalk and Crag. May locally support base flow to Witton Run and Bure (Horstead Mill to St Benet's Abbey) WFD surface water bodies indirectly via underlying groundwater bodies.

13.8. Potential impacts

13.8.1. This section considers the potential impacts on surface water, groundwater and flood risk receptors, prior to the implementation of mitigation measures.

13.8.2. Where the effect of the Proposed Scheme on a receptor will result in significant impact, this has been assessed below. This assessment is based on the design elements provided in chapter 2 (The Proposed Scheme (**TR010040/APP/6.1**)).

Construction

Above ground construction activities

13.8.3. Construction activities, including the demobilisation of site compounds, increase the risk of a pollution incident from accidental spillages or leakage of fuels, oils, chemicals, wastewater, concrete or cement admixtures used. Such accidental spillages are unlikely to impact directly on surface water features (such as Run Dike tributary) as the local ordinary watercourses and drainage ditches are disconnected. However, there may be an impact on the disconnected ordinary watercourses and drainage ditches local to the Proposed Scheme where the works are in close proximity. This is due to the potential for mobilisation of sediment and contaminants from surface water runoff reaching local drainage ditches and ponds from construction activities such as earthworks, construction dewatering (if required), plant and vehicle washing. They could also impact upon direct and indirect groundwater receptors, including the Secondary A aquifers, should these occur in areas of permeable ground or where areas of hardstanding have been removed.

13.8.4. During construction there will be an increase in new hardstanding areas, including the main site and satellite compounds, which, if not mitigated, would increase the flow rate and volume of runoff from the construction areas. This could result in the increased localised flooding to the Proposed Scheme and other flood-sensitive downstream receptors. Additionally, this could adversely impact upon surface water features such as unnamed watercourses, ditches and ponds, Run Dike tributary and tributaries of the River Bure. This, in turn, may have a negative impact on the dilution of consented discharges and downstream aquatic environments.

13.8.5. During construction, there is an increased risk of flooding during and following extreme rainfall events, including those areas identified as at risk of surface water flooding. Works may lead to temporary changes in the surface water runoff regime by the alteration of ground elevations, pond infilling and diversion of drainage ditches, alteration of overland flow pathways or the construction of new structures. This could cause localised flooding to the Proposed Scheme and nearby receptors due to changes in surface water flood flow pathways. Indirectly, overloading of the temporary drainage system could adversely impact on surface water features. This could include local unnamed watercourses, ditches and ponds, Run Dike tributary and tributaries of the River Bure due to overloading of the potential flood flow pathway connection. This, in turn, may have a negative impact on downstream flood-sensitive receptors, consented discharges and downstream aquatic environments.

13.8.6. The construction of the Proposed Scheme would also result in the loss of the pond near to the junction of Lingwood Road and the existing A47. This pond

receives some runoff from the junction with the existing A47, so it is not assumed to be a highly valuable feature. However, the loss of this surface water feature would result in the loss of any aquatic biodiversity associated with this feature.

Below ground construction activities

13.8.7. Below ground construction activities have the potential to adversely impact direct groundwater receptors (the groundwater bodies) and indirect groundwater receptors dependent on groundwater supply, in terms of groundwater levels and flow. These construction activities include placement of foundations, and excavations for cutting sections or pipeline diversions, for example.

13.8.8. The placement of below ground structures may also affect groundwater quality. This is by direct contact with construction materials, down-drag of contaminants, generation of suspended solids and / or creation of preferential pathways between aquifers. Excavation works for cutting sections or for pipeline diversions also have the potential to create a contamination pathway from the open excavation to underlying groundwater, resulting in groundwater contamination due to accidental spillages or leakages.

Operation

Surface water

13.8.9. The Proposed Scheme could lead to a change in the surface water runoff regime by the alteration of ground elevations, infilling of Lingwood Road pond and diversion of drainage ditches or the alteration of overland flow pathways. This could result in the diversion of flood flow pathways, increased localised flooding next to the scheme with potential increased flood risk to the Proposed Scheme and to others. Indirectly, this would potentially affect downstream aquatic environments and dilution of consented discharges. This would potentially adversely impact upon surface water features such as unnamed watercourses, Run Dike tributary and tributaries of the River Bure.

13.8.10. The Proposed Scheme, through creation of the new carriageway hardstanding areas, will result in an increase in impermeable area which, if not mitigated, would increase the flow rate of runoff and volume from the carriageway. This could result in the increased localised flooding to the Proposed Scheme and others downstream. Additionally, this would potentially adversely impact upon surface water features such as unnamed watercourse, ditches and ponds, Run Dike tributary and tributaries of the River Bure.

13.8.11. The construction of the Proposed Scheme would also result in the loss of the pond near to the junction of Lingwood Road and the existing A47. The loss of

this surface water feature would result in the loss of any aquatic biodiversity with this feature.

Groundwater

13.8.12. Structures extending below the water table, such as overbridge and retaining wall foundations or cuttings, have the potential to impede groundwater flow and possibly locally raise groundwater levels up-gradient and lower groundwater levels down-gradient of the structure. Subsurface structures may also create contamination pathways from surface to groundwater, and between aquifer units.

13.8.13. The Proposed Scheme would result in a change to the road drainage. This coupled with the associated increase in traffic volumes will result in an increase in pollutant loads in highway runoff. This could result in a long-term increase in diffuse pollution and subsequent deterioration in the water quality of groundwater receptors. This may, in turn, result in impacts on downstream aquatic ecology.

13.8.14. There is an increased risk of pollution to groundwater resulting from accidental spillage or pollution incidents as a result of the increase in the volume of traffic. This may result in short term impacts on water quality and downstream aquatic ecology.

13.9. Design, mitigation and enhancement measures

13.9.1. This section provides details of the following measures:

- ‘Essential mitigation’ measures – these are critical for the delivery of the Proposed Scheme and that can be acquired through statutory powers. They are generally incorporated into construction activities, through the appropriate selection of construction methods and materials, adoption of best practice measures and monitoring, and also long term maintenance.
- ‘Embedded mitigation’ measures – these are incorporated into the project design in order to avoid or prevent adverse environmental effects. They are generally incorporated into operation of the Proposed Scheme, as part of the design.

13.9.2. An overview of embedded mitigation is also reported in chapter 2 The Proposed Scheme (**TR010040/APP/6.1**).

Construction

13.9.3. During construction, best practice methods for pollution prevention and water management would be implemented as part of the overall Environmental Management Plan (EMP) (**TR010040/APP/7.7**). Guidance on best practice in relation to pollution prevention and water management is set out in CIRIA

guidelines (Charles and Edward, 2015; Gaba *et al.* 2017; Murnane *et al*., 2006) and the Environment Agency's approach to groundwater protection (Environment Agency, 2017a) and groundwater protection guides (Environment Agency, 2017b). Best practice methods specific to the identified potential impacts are discussed further below.

Above ground construction activities

13.9.4. The design and construction of all above ground structure should aim to minimise the potential to impact on surface water features and flood risk. Specific mitigation measures to achieve this include both embedded and essential mitigation and are described below.

13.9.5. The potential for impacts to occur as a result of contamination from accidental spillages should be minimised by the following measures:

- Appropriate storage of construction materials, including bunding of storage tanks, use of silt fencing and covering stockpiles.
- Spill kits should be located on sites near to ordinary watercourses or drainage ditches and within the works compounds and staff should be trained in their use.
- Emergency response procedures included in the EMP (**TR010040/APP/7.7**)to handle any leakages or spillages of potentially contaminating substances.

13.9.6. There are construction activities planned immediately adjacent to a number of ordinary watercourses or drainage ditches. As such, consent from Norfolk County Council may be required. There are no works proposed within 8m of a designated main river and as such, no consent (in the form of a Flood Risk Activity Permit) would be required from the Environment Agency. In addition to this, there are no works proposed immediately adjacent to a watercourse managed by an Internal Drainage Board, and therefore no consent is required from the Internal Drainage Board.

13.9.7. No pollution pathways should be created between the construction sites, including material lay down areas, and ordinary watercourses or drainage ditches. Measures shall be implemented to prevent surface water runoff containing suspended sediment reaching ordinary watercourses or drainage ditches through overland flow during rainfall events. This shall include an appropriate treatment train to prevent accidental spillages reaching groundwater, remove sediment and other contaminants as well as attenuating runoff. This shall be specified as part of a temporary surface water drainage strategy within the EMP (**TR010040/APP/7.7**).

13.9.8. Temporary drainage from the main construction compound would typically be collected within a ditch surrounding the compound and redirected to settlement ponds before being discharged to either a surface watercourse or ground. As discharge to a surface watercourse is not feasible, the temporary drainage is likely to discharge to ground. Infiltration features must be suitably designed considering the ground conditions. Discharges to groundwater (or sewer and surface water) must only be made with the appropriate consents or permits in place. Any non-compliant discharges would be collected and disposed of off-site at a licensed facility.

13.9.9. Where works will lead to temporary changes in the surface water runoff regime by the alterations of ground elevations and overland flow pathways, a temporary surface water drainage strategy shall be incorporated into the EMP (**TR010040/APP/7.7**). This will ensure that there will be no increase in runoff or pollutant load to groundwater during construction.

13.9.10. Increased flood risk and negative impacts on surface water receptors caused by extreme rainfall events and or by the compaction of soils, pond infilling, an increase in hardstanding area, alteration of ground elevations and alteration of overland flow pathways. This can lead to an increase in the flow rate and volume or a change in the direction of surface water runoff which shall be managed by the implementation of a construction-phase drainage system. This shall also include the construction of 'dry culverts' or cross drains to maintain natural flood flow pathways where they are intercepted by the Proposed Scheme. A temporary surface water drainage strategy shall be incorporated into the EMP (**TR010040/APP/7.7**) to prevent increased flood risk to people and property elsewhere, and to manage pollution risks most commonly associated with increased sediment loading. Drainage will be constructed in the early stages of the Proposed Scheme.

13.9.11. The potential impact from the loss of a water feature due to the in filling of the pond at Lingwood Road shall be mitigated by the provision of a replacement pond which shall be 0.08ha or larger in area (location within the Site to be determined at the detailed design stage). Surveying for great crested newts at the Lingwood Road pond will be completed as part of pre-construction surveys. This has been discussed, along with detailed mitigation requirements of the replacement pond in chapter 8, Biodiversity (**TR010040/APP/6.1**).

Below ground construction activities

13.9.12. The design and construction of all below ground structures should aim to minimise the potential to impact on either groundwater supply or groundwater quality. Specific mitigation measures to achieve this include both embedded and essential mitigation:

- The piling design should be selected to appropriately minimise disturbance to groundwater flows and thus supply to indirect receptors.
- The piling method should minimise the generation of suspended solids that may impact nearby indirect receptors.
- A piling risk assessment shall be undertaken prior to commencement of the works. Environment Agency guidance on minimising pollution risk due to piling should be adhered to (Environment Agency, no date; 2001; and Westcott *et al.,* 2001).
- Construction materials should be chosen appropriately to minimise groundwater contamination via direct contact.

13.9.13. These measures are particularly important for the overbridge and retaining wall foundations, all of which extend to or below the saturated aquifer.

13.9.14. Although excavations for the gas main diversion are not anticipated to encounter the saturated aquifer, construction design and site management should include measures to minimise the risk of the creation of a contamination pathway from within the open excavation. Furthermore, no materials hazardous to controlled waters shall be included in backfill material.

Operation

Surface water

13.9.15. The potential effects of the operation of the Proposed Scheme on the water environment are generally addressed through embedded mitigation.

13.9.16. The Drainage Strategy (Appendix 13.2 (**TR010040/APP/6.2**)) confirms there shall be no surface water outfalls discharging to local watercourses and all road drainage will drain by infiltration methods.

13.9.17. As the Proposed Scheme option has a footprint greater than 1ha, a Flood Risk Assessment (FRA Appendix 13.1(**TR010040/APP/6.2**)) has been prepared to demonstrate there is no increase in flood risk as a result of the Proposed Scheme.

13.9.18. To mitigate against the potential effects of changes to the surface water runoff regime, wherever possible existing surface water pathways for overland flows have been maintained or facilitated through interception using appropriately designed collection drains and cross-drains, also known as ‘dry culverts’. Cross-drains shall be designed to convey a 1 in 100-year flow including an additional 65% climate change allowance in order to maintain connectivity of surface water flooding pathways, to minimise the ponding of water upstream of the Proposed Scheme and to minimise the increase in flood risk to nearby receptors. Where it was not possible to connect directly with existing surface water pathways,

infiltration via clean water soakaways have been proposed, which have been designed to accommodate a 1 in 10-year flow plus 20% climate change allowance. Diversion of overland flows through the clean water soakaway trenches shall dissipate flow velocities and provide greater attenuation than the existing overland pathway.

13.9.19. Where the Proposed Scheme has diverted surface water pathways away from their natural drainage route such that it poses an increase in flood risk to downstream receptors, the flood flows from the diverted catchment shall be attenuated by the clean water soakaways to a 1 in 100-year event including an allowance for climate change; this applies to clean water soakaways SC2 and SC3 which attenuate natural catchment runoff around the proposed South Walsham Road junction. Further details can be found in the Flood Risk Assessment (Appendix 13.1(**TR010040/APP/6.2**)).

13.9.20. Exceedance from the clean water soakaways, and directly from cross-drains shall meet existing overland pathways downstream of the Proposed Scheme. The locations of existing overland pathways and the clean water soakaways can be found in the Drainage Strategy (Appendix 13.2 (**TR010040/APP/6.2**)).

13.9.21. The potential impact on the surface water runoff regime from infilling the pond near to Lingwood Road is mitigated through the design noting that existing highway drainage is considered to be a source of water for this pond. The loss of the pond shall be mitigated by the provision of a replacement pond of 0.08ha or larger (location within the Site to be determined at the detailed design stage). The replacement pond would also mitigate the negative impact on biodiversity and aquatic ecology caused by the loss of this water feature. Surveying for great crested newts at the Lingwood Road pond will be completed as part of pre-construction surveys. This has been discussed, along with detailed mitigation requirements of the replacement pond in chapter 8 Biodiversity (**TR010040/APP/6.1**).

13.9.22. The increase in surface water runoff rate and volume originating from the highway drainage shall be mitigated by an infiltration basin and soakaway trenches that are designed to attenuate a 1 in 100-year rainfall event including a 20% climate change allowance. Water levels would not exceed ground levels of the infiltration trenches or the capacity of the infiltration basin for the 1 in 100-year storm event including a 40% climate change allowance. Exceedance events greater than the 1 in 100-year rainfall event (including climate change) will be routed safely, along existing overland flow pathways to avoid flooding the road and minimise impact on others. Further details can be found in the Drainage Strategy (Appendix 13.2 (**TR010040/APP/6.2**)).

13.9.23. Consultation on the drainage design and flood risk is ongoing with Norfolk County Council.

Groundwater

13.9.24. The potential for the overbridge and retaining wall foundations to impact on the underlying aquifer, and hence groundwater levels and flows, has been mitigated against through embedded mitigation; individual reinforced concrete piles will be spaced so as do not to impede groundwater flow.

13.9.25. The drainage design for the Proposed Scheme will replace the existing drainage network for both new and existing carriageways and will discharge to groundwater via an infiltration basin and infiltration trenches. Any potential impact to groundwater quality as a result of the increased areas of hardstanding and traffic volumes shall be addressed through embedded mitigation:

- The initial treatment for the runoff shall be provided in the filter drains, where present. The catch-pits shall capture the initial sediment accumulations which shall also serve to collect other potential pollutants, adhering to the sediment.
- Secondly the runoff from the new road shall discharge to an infiltration basin or soakaway trenches, providing further treatment of the runoff.
- The infiltration basin shall include a shallow lined settlement basin / forebay at the inlet to the infiltration basin to capture first flush discharges.
- A penstock shall be provided at all outfalls which will allow the outfall to be shut off manually in the event of a spillage, before flows enter the soakaways or the infiltration basin. This will provide further protection to the groundwater.

13.9.26. In addition to the above treatment train, the infiltration basin shall be vegetated to improve the effectiveness of the infiltration process. This will also provide enhancements to biodiversity.

13.9.27. Routine maintenance of the road drainage, including the infiltration basin and trenches, shall be included in the maintenance and operation plan.

13.9.28. The reduction in the number of junctions (including at-grade junctions) in the Proposed Scheme reduces collision risk and therefore also spillage risk to the water environment.

13.9.29. Consultation on the drainage design, and especially the use of the deep infiltration features, is ongoing with the Environment Agency. Consultation is ongoing with Norfolk County Council regarding the drainage and flood risk.

13.10. Assessment of likely significant effects

13.10.1. Potential effects on surface water and groundwater receptors during construction are summarised in Table 13.7, together with residual impacts after mitigation. The mitigation measures described in Table 13.7 are discussed in detail in Section 13.6. These impact assessments include potential receptors identified in the individual groundwater assessments for groundwater levels and flow, and groundwater dependent terrestrial ecosystem assessments (see Appendix 13.3 Groundwater assessment (**TR010040/APP/6.2**)).

13.10.2. Potential effects on surface water and groundwater receptors during operation are summarised in Table 13.8, together with residual impacts after mitigation. The mitigation measures described in Table 13.8 are discussed in detail in Section 13.6. These impact assessments include potential receptors identified in individual groundwater assessments. They also take into consideration the results of the routine runoff and accidental spillages on groundwater assessments (see Appendix 13.3 Groundwater assessment (**TR010040/APP/6.2**)).

13.10.3. Where potential impacts have multiple receptors (direct and indirect) the highest importance value has been listed in the table and used for the assessment.

13.10.4. The impact of the Proposed Scheme on the Water Framework Directive status of the affected water bodies is also considered in this section.

13.10.5. No significant residual effects on surface water and groundwater receptors are anticipated during construction or operation of the Proposed Scheme.

Table 13.7 : Potential effects on groundwater and surface water receptors during construction of the Proposed Scheme

Construction Activity	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
Accidental leakage or spillages	Direct Receptors Pollution of surface watercourse due to placement of construction materials, washing of plant, cleaning areas of hardstanding etc. (suspended solids and dissolved contaminants) Indirect Receptors Pollution of environmental receptors and potential loss of aquatic habitat.	Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Value to economy	Medium	No direct discharge to watercourses. EMP (pollution prevention measures in the construction drainage design, emergency response procedures and provision of spill kits).	Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary watercourses and ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey) WFD water body catchment and the Bure Operational Catchment	Dilution and removal of waste products	High		Negligible	Slight adverse
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
Works adjacent or close to watercourses or ponds	Direct Receptors Pollution of surface watercourse due to placement of construction materials, washing of plant, cleaning areas of hardstanding etc. (suspended solids	Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Value to economy	Medium	No direct discharge to watercourses. EMP (Pollution prevention measures in the construction drainage design).	Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary	Value to economy	Medium		Negligible	Neutral

Construction Activity	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
	and dissolved contaminants) <u>Indirect Receptors</u> Pollution of environmental receptors and potential loss of aquatic habitat.	watercourses and ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey) WFD water body catchment and the Bure Operational Catchment	Conveyance of flow	Low		Negligible	Neutral
Drainage of construction areas, including excavations, and site compounds	Discharge of surface water contaminated by construction materials and surface contaminants to groundwater (including accidental spillages and leakages)	<u>Direct receptors</u> Secondary superficial aquifer <u>Indirect receptors</u> Broadland Rivers Chalk and Crag Licensed abstractions Unlicensed abstractions Yare Broads and Marshes SSSI Decoy Carr SSSI Damgate Marshes SSSI Broadland Ramsar	Water supply and quality	Medium	EMP (construction drainage strategy) including appropriate design of soakaways for site compound drainage.	Negligible	Neutral
			Soakaway	High		Negligible	Slight adverse
			Vulnerability	High		Negligible	Slight adverse
			Economic Value	Medium		Negligible	Neutral
			Conveyance of flow	High		Negligible	Slight adverse

Construction Activity	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
		Mid Yare Valley NNR					
Alteration of ground elevations, filling of Lingwood Road pond, diversion of drainage ditches or the alteration of overland flow pathways.	Direct Receptors Changes in surface water flood flow pathways, drainage ditches being disconnected causing ponding and increased localised flooding to the Proposed Scheme. Indirect Receptors Downstream flood-sensitive receptors. Downstream consented discharges. Downstream aquatic environments.	Run Dike tributary (Broads IDB)	Water supply and quality	Medium	Construction design and EMP (including a temporary surface water drainage strategy). Construct drainage and culverts in the early stages to maintain flood flow pathways. Replacement of Lingwood Road pond. Refer to chapter 8, Biodiversity for detailed mitigation. Location to be confirmed at detailed design.	Negligible	Neutral
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	High		Negligible	Slight adverse
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary watercourses and ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey) WFD water body catchment and the Bure Operational Catchment	Dilution and removal of waste products	High		Negligible	Slight adverse
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral

Construction Activity	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
Drainage of additional hardstanding areas	Direct Receptors Increased localised flooding. Changes in surface water flood flow pathways resulting in overloading of drainage systems and / or surface watercourses / drainage ditches. Indirect Receptors Downstream flood-sensitive receptors. Downstream consented discharges. Downstream aquatic environments.	Run Dike tributary (Broads IDB)	Water supply and quality	Medium	Construction design and EMP (including a temporary surface water drainage strategy and flood management plan).	Negligible	Neutral
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	High		Negligible	Slight adverse
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary watercourses and ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey) WFD water body catchment and the Bure Operational Catchment	Dilution and removal of waste products	High		Negligible	Slight adverse
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral

Construction Activity	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
Infilling of Lingwood Pond	Removal of biodiversity habitat and ecology	Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Biodiversity	High	Replacement of Lingwood Road pond. Refer to chapter 8 Biodiversity for detailed mitigation. Location to be confirmed at detailed design.	Negligible	Slight adverse
Earthworks within the saturated aquifer, including excavations, ground improvement, pilings and cuttings	<u>Direct receptors</u> Impede GW flow and/or cause GW mounding if structures are perpendicular to GW flow. Down-drag of contaminants from surface or between aquifers Creation of contamination pathways Generation of suspended solids/turbidity within the saturated aquifer <u>Indirect receptors</u>	<u>Direct receptors</u> Broadland Rivers Chalk and Crag Secondary superficial aquifer <u>Indirect receptors</u> Licensed abstractions Unlicensed abstractions Yare Broads and Marshes SSSI Decoy Carr SSSI Damgate Marshes SSSI	Water supply and quality	High – Very High	Best practice methods for piling and subsurface works to minimise contamination pathways and generation of suspended solids Piling design to ensure no impedance of groundwater flow EMP	Negligible	Slight adverse
			Soakaway	High		Negligible	Slight adverse
			Vulnerability	High		Negligible	Slight adverse
			Economic Value	Very High		Negligible	Slight adverse

Construction Activity	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
	Reduction of GW flow to GW dependent abstractions Transport of contaminates from aquifer to GW dependent abstractions	Broadland Ramsar Mid Yare Valley NNR	Conveyance of flow	Very High		Negligible	Slight adverse

Table 13.8 : Potential effects on groundwater and surface water receptors during operation of the Proposed Scheme

Operational Aspect	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
Alteration of ground elevations, filling of Lingwood Road pond, diversion of drainage ditches or the alteration of overland flow pathways.	Direct Receptors Increased localised flooding. Changes in surface water flood flow pathways resulting in overloading of drainage systems and surface watercourses and drainage ditches. Indirect Receptors Effects on flood-sensitive receptors near to overloaded systems and downstream. Downstream consented discharges. Downstream aquatic environments.	Run Dike tributary (Broads IDB)	Water supply and quality	Medium	Proposed Scheme design - surface water flooding flow pathways maintained through 'dry culverts' designed to convey 1 in 100 year event including 65% climate change allowance in order to maintain connectivity of surface water flooding pathways, to minimise the ponding of water upstream of the Proposed Scheme and to minimise the increase in flood risk to nearby receptors. Clean water soakaways designed to attenuate 1 in 10-year event including 20% climate change allowance. Any exceedance would be redirected towards existing pathways at a lower rate and volume than the existing overland flow pathway due to attenuation provided. Where the Proposed Scheme has diverted a natural catchment, flood flows shall be attenuated by the clean water	Negligible	Neutral
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	High		Negligible	Slight adverse
			Biodiversity	High		Negligible	Slight adverse

Operational Aspect	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
					soakaways to avoid an increase in flood risk to downstream receptors. Replacement of Lingwood Road pond. Refer to Chapter 8, Biodiversity for detailed mitigation. Location to be confirmed at detailed design.		
		Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Value to economy	Medium	Proposed Scheme design - surface water flooding flow pathways maintained through 'dry culverts' designed to convey 1 in 100-year event including 65% climate change allowance in order to maintain connectivity of surface water flooding pathways, to minimise the ponding of water upstream of the Proposed Scheme and to minimise the increase in flood risk to nearby receptors. Clean water soakaways designed to attenuate 1 in 10-year event including 20% climate change allowance. Where required to avoid	Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary watercourses and ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey) WFD water body catchment and the	Dilution and removal of waste products	High		Negligible	Slight adverse
			Value to economy	Medium		Negligible	Neutral

Operational Aspect	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
		Bure Operational Catchment	Conveyance of flow	Low	downstream flood risk, the clean water soakaways (SC2 and SC3) attenuate the natural catchment runoff that intercepts the Proposed Scheme to a 1 in 100-year event including an allowance for climate change. Any exceedance would be redirected towards existing pathways at a lower rate and volume than the existing overland flow pathway due to attenuation provided.	Negligible	Neutral
Drainage of additional hardstanding areas	<u>Direct Receptors</u> Increased localised flooding. Changes in surface water flood flow pathways resulting in overloading of drainage systems and surface watercourses and drainage ditches. <u>Indirect Receptors</u> Effects on flood-sensitive receptors near to overloaded systems and downstream.	Run Dike tributary (Broads IDB)	Water supply and quality	Medium	Infiltration basin and soakaways trenches attenuate highway drainage up to a 1 in 100-year event including 40% climate change allowance without water levels exceeding the ground level of the soakaway trenches or the capacity of the infiltration basin.	Negligible	Neutral
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	High		Negligible	Slight adverse
			Biodiversity	High		Negligible	Slight adverse
		Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
			Biodiversity	High		Negligible	Slight adverse

Operational Aspect	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
	Downstream consented discharges. Downstream aquatic environments.	Unnamed ordinary watercourses and ditches and ponds in the Bure (Horstead Mill to St Benet's Abbey) WFD water body catchment and the Bure Operational Catchment .	Dilution and removal of waste products	High		Negligible	Slight adverse
			Value to economy	Medium		Negligible	Neutral
			Conveyance of flow	Low		Negligible	Neutral
Infilling of Lingwood Pond	Removal of biodiversity habitat and ecology (potential great crested newts)	Unnamed ordinary watercourses and drainage ditches and ponds in the Witton Run WFD water body catchment	Biodiversity	High	Replacement of Lingwood Road pond. Refer to chapter 8 Biodiversity for detailed mitigation. Location to be confirmed at detailed design.	Negligible	Slight adverse
Below ground structures acting as a barrier to groundwater flow and contamination pathway between surface and aquifers.	<u>Direct receptors</u> Impede GW flow and/or cause GW mounding if structures are perpendicular to GW flow. Creation of contamination pathways <u>Indirect receptors</u> Reduction of GW flow to GW dependent abstractions	<u>Direct receptors</u> Broadland Rivers Chalk and Crag Secondary superficial aquifer <u>Indirect receptors</u> Licensed abstractions Unlicensed abstractions Yare Broads and Marshes SSSI Decoy Carr SSSI	Water supply and quality	High – Very High	Best practice methods for piling and subsurface works to minimise contamination pathways and generation of suspended solids Piling design to ensure no impedance of GW flow	Negligible	Slight adverse
			Soakaway	High		Negligible	Slight adverse
			Vulnerability	High		Negligible	Slight adverse
			Economic Value	Very High		Negligible	Slight adverse
			Conveyance of flow	Very High		Negligible	Slight adverse

Operational Aspect	Potential effects on direct and indirect receptors	Feature	Relevant attributes	Importance (value)	Mitigation	Magnitude of impact after mitigation	Significance of effect after mitigation
	Transport of contaminates from aquifer to GW dependent abstractions	Damgate Marshes SSSI Broadland Ramsar Mid Yare Valley NNR					
Routine road runoff and accidental spillages discharging to infiltration pond and trenches.	<u>Direct receptors</u> Discharge of contaminated routine road run off or spillage to groundwater <u>Indirect receptors</u> Transport of contaminants to licensed and unlicensed abstractions	<u>Direct receptors</u> Secondary superficial aquifers <u>Indirect receptors</u> Broadland Rivers Chalk and Crag Licensed abstractions Unlicensed abstractions Yare Broads and Marshes SSSI Decoy Carr SSSI Damgate Marshes SSSI Broadland Ramsar Mid Yare Valley NNR	Water supply and quality	Medium	Drainage designed to discharge to ground with the inclusion of pollution risk reduction factors (treatment)	Negligible	Neutral
			Soakaway	High		Negligible	Slight adverse
			Vulnerability	High		Negligible	Slight adverse
			Economic Value	Medium		Negligible	Neutral
			Conveyance of flow	High		Negligible	Slight adverse

Water Framework Directive Assessment

13.10.6. This section outlines the assessment of potential construction and related impacts on the ability of the relevant WFD water bodies to meet their current objectives.

13.10.7. The key objectives of the WFD, provided for in the area River Basin Management Plan (RBMP) (Environment Agency, 2018b), are as follows:

- To prevent deterioration of the status of surface waters and groundwater.
- To achieve objectives and standards for protected areas.
- To aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status.
- To reverse any significant and sustained upward trends in pollutant concentrations in groundwater.
- The cessation of discharges, emissions and losses of priority hazardous substances into surface waters.
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants.

13.10.8. The assessment outlined here details how the following WFD objectives have been considered as part of this assessment and are summarised in Table 13.9.

13.10.9. The baseline condition of the various WFD elements are provided in Section 13.4 and Table 13.3 and Table 13.4. The assessment was carried out with due regard to the Planning Inspectorate Water Framework Directive Guidance (Planning Inspectorate, 2017).

13.10.10. The south-eastern part of the study area does not contain any main rivers, however, there are ordinary watercourses and drainage ditches identified within the study area. This area is not included as part of a WFD water body catchment, although it is part of the Bure Operational Catchment.

13.10.11. The northern section, located in the Bure (Horstead Mill to St Benet's Abbey) WFD water body [GB105034050931], does not contain any main rivers within the study area. However, ordinary watercourses and drainage ditches have been identified within the study area. These watercourses and drainage ditches appear to be disconnected therefore effects on the WFD main water body are unlikely.

13.10.12. As the superficial aquifers are in hydraulic continuity with the Crag, and subsequently the Chalk, the WFD assessment incorporates secondary

superficial aquifers within the Broadland Rivers Chalk and Crag groundwater body and this therefore underlies the entire Scheme.

13.10.13. Table 13.9 indicates that the construction and operation of the Proposed Scheme will not cause deterioration in the status of receiving water bodies nor will it impact on the ability of the water bodies to achieve their objectives and standards under the Water Framework Directive.

Table 13.9 : Summary of WFD water body assessment

Water body name ID	WFD aspect		Impacts on status or ability to meet target	Reference
Witton Run [GB105034051310]	Ecological	Supporting elements (surface water)	Not a direct receptor. No construction related impact due to mitigation outlined in EMP. No operational impact.	See Table 13.7 and 13.8
		Biological		
		Hydromorphological supporting elements		
		Physico-chemical quality		
		Specific pollutants (including copper and zinc)		
	Chemical	Priority substances	Not a direct receptor. No construction related impact due to mitigation outlined in EMP. No operational impact.	See Table 13.7 and 13.8
		Other pollutants		
		Priority hazard substances		
Bure (Horstead Mill to St Benet's Abbey) WFD water body [GB105034050931]	Ecological	Supporting elements (surface water)	Not a direct receptor. No construction related impact due to mitigation outlined in EMP. No operational impact.	See Table 13.7 and 13.8
		Biological		
		Hydromorphological supporting elements		
		Physico-chemical quality		
		Specific pollutants (including copper and zinc)		
	Chemical	Priority substances	Not a direct receptor. No construction related impact due to mitigation outlined in EMP. No operational impact.	See Table 13.7 and 13.8
		Other pollutants		
		Priority hazard substances		
Bure Operational Catchment	Ecological	Supporting elements (surface water)	Not a direct receptor. No construction related impact due to mitigation outlined in EMP. No operational impact.	See Table 13.7 and 13.8
		Biological		
		Hydromorphological supporting elements		
		Physico-chemical quality		

Water body name ID	WFD aspect		Impacts on status or ability to meet target	Reference
		Specific pollutants (including copper and zinc)		
	Chemical	Priority substances	Not a direct receptor. No construction related impact due to mitigation outlined in EMP. No operational impact.	See Table 13.7 and 13.8
		Other pollutants		
		Priority hazard substances		
Broadland Rivers Chalk and Crag groundwater body	Quantitative	Quantitative saline intrusion	No construction related impact due to best practise mitigation measures outlined in EMP and piling risk assessment. Negligible operational impact due to mitigation included in Scheme design	See Table 13.7 and 13.8
		Quantitative water balance		
		Quantitative GWDTEs test		
		Quantitative dependent surface water body status		
	Chemical	Chemical drinking water protected area	No construction related impact due to best practise mitigation measures outlined in EMP and piling risk assessment. Negligible operational impact due to mitigation included in Scheme design	See Table 13.7 and 13.8
		General chemical test		
		Chemical GWDTEs test		
		Chemical dependent surface water body status		
		Chemical saline intrusion		

13.11. Monitoring

13.11.1. Inspections and audits along with general monitoring and reporting of effectiveness of control measures to be carried out throughout the construction programme shall be incorporated into the EMP (**TR010040/APP/7.7**). The mitigation strategies implemented will be reviewed regularly to best suit the practices currently being undertaken on site. The EMP may also include groundwater and surface water monitoring plans. As there are no anticipated discharges to surface water (drainage ditches and ordinary watercourses), it is anticipated that monitoring of these features will not be required.

13.12. Summary

13.12.1. The Proposed Scheme is not expected to give rise to significant residual effects during the construction or operational phases with the adoption of mitigation discussed in section 13.9. The Proposed Scheme will comply with local, regional and national policies.

13.12.2. The outcome of this assessment is based on the mitigation measures described in this chapter which shall be secured through the implementation of the EMP (**TR010040/APP/7.7**).

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