West Winch Housing Access Road

Environmental Statement – Chapter 11: Water Environment

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Glossary of Abbreviations and Defined Terms

The definition of key terms used in this report are provided below. These definitions have been developed by reference to the definitions used in EU and UK legislation and guidance relevant to the water environment as well as professional judgement based on knowledge and experience of similar schemes in the context of the Proposed Scheme.

Abbreviations

Abbreviation	Definition
BGS	British Geological Survey
CAMS	Catchment Abstraction Management Strategy
oCEMP	Outline Construction Environmental Mitigation Plan
DEFRA	Department for Environment, Food & Rural Affairs
DMRB	Design Manual for Roads and Bridges
EQS	Environmental Quality Standards
ES	Environmental Statement
FRA	Flood Risk Assessment
GWDTE	Groundwater Dependent Terrestrial Ecosystems
HEWRAT	Highways England Water Risk Assessment Tool
HGV	Heavy Good Vehicle
HMMM	Hexamethoxymethyl-melamine
LLFA	Lead Local Flood Authority
LiDAR	Light Detection and Ranging
NCC	Norfolk County Council
NPPF	National Planning Policy Framework

Abbreviation	Definition
OS	Ordnance Survey
PAH	Polycyclic Aromatic Hydrocarbon
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SPA	Special Protection Area
SPZ	Source Protection Zone
SUDS	Sustainable Drainage Systems
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compounds
WFD	Water Framework Directive
WFDa	Water Framework Directive Assessment

Glossary

Term	Definition
Culvert	Arched, enclosed or piped structure constructed to carry water under roads, railways and buildings.
Environmental Impact Assessment	A procedure that must be followed for certain types of projects before they can be given 'development consent'. The procedure is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects.
Environmental Statement	Produced as part of the Environmental Impact Assessment which must be followed for certain types of projects before they can be given 'development consent'. The procedure is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects.

Term	Definition
Flood Risk Assessment	As assessment that identifies and assesses the risk of flooding to and from a proposed development for all sources. It is a requirement under the national planning policy framework for all new developments that are in flood zone 2 or 3, are more than 1 hectare, land which has been identified by the Environment Agency as having critical drainage problems, land identified in a strategic flood risk assessment as being at increased flood risk in future or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.
Flood Zone	The classification of an area based on its risk of flooding from fluvial or tidal sources.
Groundwater	Water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.
Groundwater Dependent Terrestrial Ecosystems	Wetlands which critically depend on groundwater flows and / or chemistries.
Groundwater Vulnerability Zone	Show the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a single square kilometre.
Hydrology	The study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks. Hydrological inputs for the Proposed Scheme include the hydraulic modelling and conceptual modelling undertaken.

Term	Definition
Nitrate Vulnerability Zone	Areas designated as being at risk from agricultural nitrate pollution.
Principal Aquifer	Have the potential to provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.
Proposed Scheme	The proposed West Winch Housing Access Road scheme.
Q95 flow	The flow in cubic metres per second which was equalled or exceeded for 95% of the flow record. The Q95 flow is a commonly used low flow parameter particularly relevant in the assessment of river water quality consent conditions.
River Basin Management Plan	Set out specific environmental objectives for rivers within a defined area and set out the steps required to meet the objectives.
Site of Special Scientific Interest	Protected areas under legislation that are of particular interest due to the rare species of fauna or flora, or geological features that it contains.
Source Protection Zone	Zones which are designated for public drinking water supplies and show the risk associated with activities that have the potential to impact water quality.
Superficial Deposits	The youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 2.6 million years from the present.

Term	Definition
Surface Water Drainage Strategy	Demonstrates how surface water will be managed within a scheme so it does not increase flood risk elsewhere, how the scheme is compliant with the relevant legislation and manages risks to water quality.
Water Framework Directive	The Water Framework Directive (WFD) (2000/60/EC) is a significant piece of legislation for improving the water environment. The WFD legislation is transposed into UK law under The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (SI 407).
Water Framework Directive Assessment (WFDa)	WFDa is the abbreviation used for undertaking a WFD compliance assessment. A WFDa is undertaken to assess the potential impacts of development works on the quantity or quality elements of a waterbody, and whether the development works could lead to non-compliance with the objectives of the WFD.

1 Water Environment

1.1 Introduction

1.1.1 This chapter reports the outcome of the assessment of likely significant effects arising from the Proposed Scheme upon the Water Environment.

1.1.2 The remainder of this chapter describes the assessment methodology and the baseline conditions relevant to the assessment, which have been used to reach these conclusions, as well as a summary of the likely significant effects leading to the additional mitigation measures required to avoid, prevent, reduce or, if possible, offset any likely significant adverse effects, and the likely residual effects and any required monitoring after these measures have been employed. Opportunities for environmental enhancement, where such opportunities exist, are also discussed.

1.1.3 This chapter (and its associated figures and appendices) is intended to be read as part of the wider Environmental Statement (ES), with particular reference to **Chapter 8: Biodiversity**, **Chapter 12: Geology and Soils**, **Appendix 12.1 Geo-environmental Preliminary Risk Assessment Report**, **Appendix D of the Flood Risk Assessment: Ground Conditions Appraisal** and **Chapter 15: Climate Resilience and Greenhouse Gases**.

1.1.4 A number of appendices and figures have been produced to accompany this chapter including:

- Appendix 11.1: Flood Risk Assessment; and
- Appendix 11.2: Drainage Network Water Quality Assessment.

1.2 Legislative Framework, Policy and Guidance

Legislative Framework

1.2.1 The applicable legislative framework is summarised as follows:

- *The Water Environment (Water Framework Directive) (England and Wales) Regulations (the 'Water Framework Regulations') 2017* (**Ref. 11.1**);
- *The Groundwater (Water Framework Directive) (England) Direction 2016* (**Ref. 11.2**);
- *Flood and Water Management Act 2010* (**Ref. 11.3**);
- *The Environmental Permitting (England and Wales) 2016* (**Ref. 11.4**);
- *Land Drainage Act 1991* (**Ref. 11.5**);
- *Environmental Quality Standards Directive 2008/105/EC* (**Ref. 11.6**);
- *Priority Substances Directive 2013/39/EU* (**Ref. 11.7**);
- Part 2A of the *Environmental Protection Act 1990* (**Ref. 11.8**) as inserted by S.57 of *The Environment Act 1995* (**Ref. 11.9**);
- *The Contaminated Land (England) Regulations 2006* (**Ref. 11.10**);
- *Anti-Pollution Works Regulations 1999* (**Ref. 11.11**); and
- *The Water Supply (Water Quality) Regulations 2016* (**Ref. 11.12**).

Policy

1.2.2 The applicable policies to the Proposed Scheme are summarised below:

- *National Planning Policy Framework 2023* (**Ref. 11.13**); and
- *King's Lynn & West Norfolk Borough Council Local Development Framework – Core* Strategy 2011 (**Ref. 11.14**).

Guidance

1.2.3 The following guidance documents have been used during the preparation of this chapter:

- *National Planning Practice Guidance for Flood Risk and Coastal Change* (2022) (**Ref. 11.15**);

- *LA 113 Road Drainage and the Water Environment* (2020) (**Ref. 11.16**);
- *LA 104 Environmental Assessment* (2020) (**Ref. 11.17**);
- *Non-Statutory Technical Standards for Sustainable Drainage Systems* (2015) (**Ref. 11.18**);
- *Norfolk Local Flood Risk Management Strategy* (2015) (**Ref. 11.19**);
- *Investigation of Potentially Contaminated Sites Code of Practice* (2011) (**Ref. 11.20**);
- *Land Contamination: Risk Management* (2020) (**Ref. 11.21**);
- *Guidance on the legal definition of contaminated land* (2008) (**Ref. 11.22**);
- *Guiding Principles on Land Contamination* (2010) (**Ref. 11.23**);
- *Human Health Toxicological Assessment of Contaminants in Soil* (2008) (**Ref. 11.24**);
- *Updated Technical Background to the Contaminated Land Exposure Assessment Model* (2008) (**Ref. 11.25**);
- *C665: Assessing risks posed by hazardous ground gases to buildings* (2007) (**Ref. 11.26**);
- *Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health and Volatile Contaminates in Groundwater* (2017) (**Ref. 11.27**).
- *The Environment Agency's approach to groundwater protection* (2018) (**Ref. 11.28**);
- *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (2010) (**Ref. 11.29**);
- *Concrete in aggressive ground* (2005) (**Ref. 11.30**);

- *Guidance on the classification and assessment of waste* (2015) (**Ref. 11.31**); and
- *National Quality Mark Scheme for Land Contamination Management* (2020) (**Ref. 11.32**).

1.3 Consultation, Scope, Methodology and Significance Criteria

Consultation Undertaken to Date

1.3.1 Table 1-1 provides a summary of the consultation activities undertaken in support of the preparation of this assessment**.**

1.3.2 A detailed overview of the consultation undertaken is also provided within the standalone Flood Risk Assessment (**Appendix 11.1: Flood Risk Assessment**).

Table 1-1 Summary of consultation undertaken

Body / organisation	Individual / statutory body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
Anglian Water	Planning Liaison Officer	Email 7th Sept 2023	Anglian Water confirmed that they have no records of flooding within the vicinity of the Site that can be attributed to capacity limitations in the public sewerage system.

Body / organisation	Individual / statutory body / organisation	Meeting dates and other forms of consultation	Summary of outcome of discussions
Environment Agency	Customers & Engagement Officer East Anglia Area	Email 5th October 2023	The Environment Agency provided information regarding flood risk and surface water and groundwater abstractions and discharges.

Scope of the Assessment

1.3.3 The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Chapter 5: Approach to EIA**.

1.3.4 This section provides an update to the scope of the assessment and reiterates the evidence base for scoping out elements following further iterative assessment.

Elements scoped out of the assessment

1.3.5 The elements shown in **Table 1-2** are not considered to give rise to likely significant effects as a result of the Proposed Scheme and have therefore not been considered within this assessment as described in the EIA Scoping Report (**Appendix 1.1: EIA Scoping Report**).

Table 1-2 Elements scoped out of the assessment

Element scoped out	Justification
Alteration to hydromorphological regime	No main watercourses within close proximity to the Proposed Scheme with only field drains identified within this report.
Detailed Water Framework Directive Assessment (WFDa) assessment	Lack of main watercourses within close proximity to the Proposed Scheme with only field drains identified within this report.

Elements Scoped into the Assessment

Construction Phase

1.3.6 The following elements are considered to have the potential to give rise to likely significant effects during construction of the Proposed Scheme and have therefore been considered within this assessment:

- Increased sedimentation of surface water features and increased pollution risk of surface water and groundwater features;
- Changes to local water supplies and groundwater aquifers; and
- Increased flood risk associated with construction works, construction phasing and temporary works.

Operation Phase

1.3.7 The following elements are considered to have the potential to give rise to likely significant effects during operation of the Proposed Scheme and have therefore been considered within this assessment:

- Polluted surface water runoff to surface water and groundwater features from routine runoff and accidental spillages;
- Changes to catchment hydrology;

- Flood risk to the Proposed Scheme and increased flood risk to people, property and infrastructure elsewhere including increased rates and volumes of surface water runoff that could increase flood risk;
- Changes to groundwater levels / aquifer resources where the Proposed Scheme is constructed over an aquifer; and
- Potential impacts on groundwater abstractions (including private and public water supplies).

Extent of the Study Area

1.3.8 The Study Area is defined by the likely reach of potential effects as a result of the Proposed Scheme and is based on professional judgement using knowledge and experience of similar schemes and current knowledge of the area.

1.3.9 The assessment of direct effects encompasses surface water features up to 1km from the Site. This distance is considered appropriate and proportionate for the assessment of direct effects (i.e., associated with overland migration of pollutants directly to surface features, pollutants conveyed in drainage systems, and works within a river channel).

1.3.10 The assessment of indirect effects encompasses surface water features that have hydraulic connectivity with features within 1km from the Site. This includes watercourses and other water environment receptors that are located downstream, and that could be affected by pollutants conveyed by watercourses. The Study Area will depend on the likely magnitude of effect and sensitivity of downstream receptors, but a distance of approximately 5km is considered appropriate.

1.3.11 The Study Area encompasses groundwater features and groundwater abstractions up to 1km from the Site. This distance is appropriate and proportionate for the assessment of direct impacts from surface-borne pollutants migrating to groundwater features and groundwater flow and level changes.

1.3.12 **Figure 1.1: Water Environment Study Area** shows the study area and the surface water and groundwater receptors for the water environment. **Figure 1.1** does not show the Study Area for the assessment of flood risk which is described below.

1.3.13 The Study Area for the assessment of flood risk has been defined by the extent by which flood risk may be influenced and the extent of the relevant Flood Zones. This is driven by the need to consider the impact to people and property elsewhere, regardless of their location, although for a scheme such as this it is typical to consider risks up to 1km from the Site as there are unlikely to be any impacts beyond this distance. More details regarding the Study Area in relation to flood risk is detailed in **Appendix 11.1: Flood Risk Assessment**.

Method of Baseline Data Collation

Desk Study

1.3.14 The following sources of information have been reviewed as part of the desk study:

- Environment Agency's online Flood Map for Planning (**Ref. 11.33**);
- Environment Agency's online Long Term Flood Risk map (**Ref. 11.34**);
- Environment Agency's online Catchment Data Explorer (**Ref. 11.35**);
- *Anglian River Basin Management Plan* (2015) (**Ref. 11.36**);
- *King's Lynn and West Norfolk Strategic Flood Risk Assessment* (2018) (**Ref. 11.37**);
- Contemporary Ordnance Survey (OS) Mapping (**Ref. 11.38**);
- Environment Agency LiDAR Digital Terrain Model (**Ref. 11.39**);
- British Geological Survey Geology Viewer (**Ref. 11.40**);
- British Geological Survey Geoindex (**Ref. 11.41**);

- Licensed surface and groundwater abstractions, provided by the Environment Agency (**Ref. 11.42**); and
- Designated areas data, available on Magic Map (**Ref. 11.43**).

Site Visit and Surveys

1.3.15 A site visit was undertaken in May 2019 as part of the 2023 Geo-environmental Preliminary Risk Assessment (**Appendix 12.1: Geo-environmental Preliminary Risk Assessment**).

1.3.16 A geotechnical site investigation was undertaken by WSP in areas of the Proposed scheme. A total of 11 groundwater monitoring visits were completed at the site within the window sample exploratory holes between August and December 2020. Groundwater samples were collected from the window sample locations on two occasions (August and November 2020).

Assessment Methodology

1.3.17 The assessment has been undertaken in accordance with the DMRB (LA 113) (**Ref. 11.16**) using the assessment criteria provided below. The assessment of effects has been carried out by establishing the sensitivity of the receptor, magnitude of the potential impact and consequently determining the significance of the effect.

1.3.18 **Table 1-3** below details the criteria for defining the sensitivity of each receptor (based on Table 3.70 in LA 113 (**Ref. 11.16**)) and **Table 1-4** below details the criteria for determining the magnitude of an impact (based on Table 3.71 in LA 113 (**Ref. 11.16**)). Typical examples are provided as informed by the guidance in DRMB (LA 113) (**Ref. 11.16**).

Table 1-3 Criteria for determining the sensitivity of the receptor

Sensitivity of Receptor	Definition of Sensitivity	Receptor	Typical Examples
Very High	Nationally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a River Basin Management Plan (RBMP) and with Q_{95} > 1.0m^3/s. Site protected / designated under EC or UK habitat legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Ramsar site, salmonid water), or species protected by EC Legislation as described in *LA 108* (2020) (**Ref. 11.44**).
Very High	Nationally significant attribute of high importance	Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK Legislation protected site. Groundwater locally supports a GWDTE. Source Protection Zone (SPZ) 1.
Very High	Nationally significant attribute of high importance	Flood Risk	Essential infrastructure or highly vulnerable development as defined in the *National Planning Practice Guidance for Flood Risk and Coastal Change* (2022) (**Ref. 11.15**).
High	Locally significant attribute of high importance	Surface water	Watercourse having a WFD classification shown in a RBMP and with Q95 < 1.0m3/s. Species protected under UK Legislation as described in *LA 108* (2020) (**Ref. 11.44**).
High	Locally significant attribute of high importance	Groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE. SPZ 2.
High	Locally significant attribute of high importance	Flood Risk	More vulnerable development as defined in the *National Planning Practice Guidance for Flood Risk and Coastal Change* (2022) (**Ref. 11.15**).
Medium	Moderate quality and rarity	Surface water	Watercourse not having a WFD classification shown in a RBMP and with Q_{95} > 0.001m^3/s.
Medium	Moderate quality and rarity	Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ 3.
Medium	Moderate quality and rarity	Flood Risk	Less vulnerable development as defined in the *National Planning Practice Guidance for Flood Risk and Coastal Change* (2022) (**Ref. 11.15**).

Sensitivity of Receptor	Definition of Sensitivity	Receptor	Typical Examples
Low	Lower quality	Surface water	Watercourse not having a WFD classification shown in a RBMP and with Q_{95} < 0.001m^3/s.
Low	Lower quality	Groundwater	Unproductive strata.
Low	Lower quality	Flood Risk	Water compatible development as defined in the *National Planning Practice Guidance for Flood Risk and Coastal Change* (2022) (**Ref. 11.15**).

Table 1-4 Criteria for determining the magnitude of an impact

Impact Magnitude	Criteria	Receptor	Typical Examples
Major adverse	Results in loss of attribute and / or quality and integrity of the attribute.	Surface water	Failure of both acute-soluble and chronic-sediment related pollutants when using the Highways England Water Risk Assessment Tool (HEWRAT) and compliance failure with Environmental Quality Standards (EQS) values. Calculated risk of pollution from a spillage ≥2% annually (spillage assessment). Loss or adverse 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.
Major adverse	Results in loss of attribute and / or quality and integrity of the attribute.	Groundwater	Loss of, or adverse change to, an aquifer. Loss of regionally important public 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.
Major adverse	Results in loss of attribute and / or quality and integrity of the attribute.	Flood risk	Increase in peak flood level (>100mm).

Impact Magnitude	Criteria	Receptor	Typical Examples
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 when using the 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/agricultural supplies. Contribution to reduction in water body WFD classification.
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute.	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 150-250. 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.
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Flood risk	Increase in peak flood level (>50mm).
Minor Adverse	Results in some measurable change in attributes, quality or vulnerability.	Surface water	Failure of either acute soluble or chronic sediment related pollutants when using the HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Minor effects on water supplies.
Minor Adverse	Results in some measurable change in attributes, quality or vulnerability.	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% annually. Minor effects on an aquifer, GWDTEs, abstractions and structures.

Impact Magnitude	Criteria	Receptor	Typical Examples
Minor Adverse	Results in some measurable change in attributes, quality or vulnerability.	Flood risk	Increase in peak flood level (>10mm).
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	Surface water	No risk identified by the HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	Groundwater	No measurable impact upon an aquifer and/or groundwater receptors and risk of pollution from spillages <0.5%.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	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).
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	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.
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	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.

Impact Magnitude	Criteria	Receptor	Typical Examples
Moderate beneficial	Results in moderate improvement of attribute quality.	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.
Moderate beneficial	Results in moderate improvement of attribute quality.	Flood risk	Creation of flood storage and decrease in peak flood level (>50mm).
Major beneficial	Results in major improvement of attribute quality.	Surface water	Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.
Major beneficial	Results in major improvement of attribute quality.	Groundwater	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.
Major beneficial	Results in major improvement of attribute quality.	Flood risk	Creation of flood storage and decrease in peak flood level (>100mm).
No change	No change.	Surface water Groundwater Flood risk	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Significance Criteria

1.3.19 The significance level attributed to each effect has been assessed based on the sensitivity of the affected receptor(s) and the magnitude of change arising from the Proposed Scheme, as outlined in **Chapter 5: Approach to EIA** and shown in **Table 1-5** below. The matrix is based on Table 3.4N in LA 104 (**Ref. 11.17**).

Table 1-5 Matrix for classifying effects

Significance Matrix	**No Change in Magnitude**	**Negligible Change in Magnitude**	**Minor Change in Magnitude**	**Moderate Change in Magnitude**	**Major Change in Magnitude**
Very High Sensitivity	Neutral	Slight	**Moderate or Large**	**Large or Very Large**	**Very Large**
High Sensitivity	Neutral	Slight	Slight or **Moderate**	**Moderate or Large**	**Large or Very Large**
Medium Sensitivity	Neutral	Neutral or Slight	Slight	**Moderate**	**Moderate or Large**
Low Sensitivity	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or **Moderate**
Negligible Sensitivity	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

1.3.20 The sensitivity of the affected receptor is assessed on a scale of very high, high, medium, low and negligible, and the magnitude of change is assessed on a scale of major adverse, moderate adverse, minor adverse, negligible, no changes, minor beneficial, moderate beneficial and major beneficial as set out in **Chapter 5: Approach to EIA**.

Effect Significance

1.3.21 The following terms have been used to define the significance of the effects identified and apply to both beneficial and adverse effects as set out in **Chapter 5: Approach to EIA**:

- **Very Large effect**: where the Proposed Scheme could be expected to have a very substantial improvement or deterioration on receptors;
- **Large effect**: where the Proposed Scheme could be expected to have a substantial improvement or deterioration on receptors;
- **Moderate effect**: where the Proposed Scheme could be expected to have a noticeable improvement or deterioration on receptors;
- **Slight effect**: where the Proposed Scheme could be expected to result in a perceptible improvement or deterioration on receptors; and
- **Neutral**: where no discernible improvement or deterioration is expected as a result of the Proposed Scheme on receptors, including instances where no change is confirmed.

1.3.22 As set out in **Chapter 5: Approach to EIA**, effects that are classified as **moderate or above** are considered to be **significant**. Effects classified as **below moderate** are considered to be **not significant**.

Assessment Methodology

1.3.23 This chapter is supported by two standalone documents as follows:

- **Appendix 11.1: Flood Risk Assessment**; and
- **Appendix 11.2: Drainage Network Water Quality Assessment.**

1.3.24 The methodologies undertaken for the appendices are detailed in the standalone reports.

1.4 Baseline Conditions

Surface Water Features

Unnamed field drains

1.4.1 There are nine unnamed field drains that flow through the Site. The unnamed field drains primarily drain the adjacent fields. The field drains are not monitored against the WFD but are in hydraulic connectivity with either the Middleton Stop drain to the north or the River Nar to the west and south of the Site. The Q95 river flow (low flow parameter) is expected to be <0.001m³/s for the majority of the field drains.

The County Drain

1.4.2 The County Drain (also known as Puny Drain) flows in a primarily northern direction to the west of the Site and confluences with the River Nar approximately 1.3km to the north-west of the Site. The Q95 river flow (low flow parameter) is expected to be <0.001m³/s. The County Drain is classified as an ordinary watercourse and is under the jurisdiction of Norfolk County Council (NCC) as Lead Local Flood Authority (LLFA) for the area.

1.4.3 The County Drain is monitored against the objectives of the WFD. The Country Drain Water Body (GB105033047770) is not designated as being artificial or heavily modified. In accordance with WFD terminology, the Country Drain Water Body is currently performing at 'Poor' status (2022), comprising 'Poor' ecological status. The chemical status does not require assessment, although was previously assessed as 'Fail' in 2019. The reasons for not achieving 'Good' status are stated as sewage discharge.

Middleton Stop Drain

1.4.4 The Middleton Stop Drain flows in a primarily west direction to the north of the Site and confluences with the River Nar approximately 1.6km to the north-west of the Site. The Q95 river flow (low flow parameter) is expected to be <0.001m³/s. The Middleton Stop Drain is classified as an ordinary watercourse and is under the jurisdiction of NCC as LLFA for the area.

1.4.5 The Middleton Stop Drain is monitored against the objectives of the WFD. The Middleton Stop Drain Water Body (GB105033047670) is designated as heavily modified. In accordance with WFD terminology, the Middleton Stop Drain Water Body is currently performing at 'Moderate' status (2022), comprising 'Moderate' ecological status. The chemical status does not require assessment, although was previously assessed as 'Fail' in 2019. The reasons for not achieving 'Good' status are stated as land drainage within agriculture and rural land management.

River Nar

1.4.6 The River Nar flows in a primarily northern direction to the west of the Site and confluences with the River Great Ouse approximately 2.2km to the north-west of the Site. The River Nar is classified as a main river and is under the jurisdiction of the Environment Agency.

1.4.7 The River Nar is monitored against the objectives of the WFD. The River Nar downstream of Abbey Farm Water Body (GB105033047792) is designated as heavily modified. In accordance with WFD terminology, the River Nar downstream of Abbey Farm Water Body is currently performing at 'Moderate' status (2022), comprising 'Moderate' ecological status. The chemical status does not require assessment, although was previously assessed as 'Fail' in 2019. The reasons for not achieving 'Good' status are stated as physical modification.

1.4.8 The River Nar is also designated as a SSSI due to the transition from chalk to fenland river. The extent which is designated is upstream of where the Middleton Drain and the Country Drain discharges into the River Nar, and therefore is not hydraulically connected to the Proposed Scheme. The Setchey SSSI is located adjacent to the River Nar approximately 1.8km to the south of the Site. The Setchey SSSI is located upstream from where the Proposed Scheme is hydraulically connected to the River Nar and so is not hydraulically connected to the Proposed Scheme.

Surface Water Abstractions

1.4.9 Environment Agency surface water abstraction data indicates that there are five licensed surface water abstractions located within the Study Area. These are shown in **Figure 1.2: Water Environment Key Sensitive Receptors**. All of the licenced surface water abstractions are for agricultural purposes.

Existing Surface Water Drainage

1.4.10 There are no public surface water sewers within the Proposed Scheme boundary.

1.4.11 The nearest surface water sewer to the site is located approximately 200m north of Rectory Lane where it discharges into a land drain approximately 100m east of the Site. The size of this sewer is currently unknown. No other surface water sewers are known to be located near the Site.

Groundwater Features

Geology

1.4.12 The main characteristics of the geology (superficial and bedrock) that underlies the Proposed Scheme is described in **Chapter 12: Geology and Soils** and is briefly summarised below.

1.4.13 The British Geological Survey (BGS) Map Sheet 145 with part of 129 Solid and Drift – King's Lynn and the Wash (**Ref. 11.45**); and Sheet 159 Solid and Drift – Wisbech (**Ref 11.46**) have been viewed. The underlying geology is presented in **Table 1-6** and **Table 1-7** below together with Environment Agency aquifer designations for the relevant geological units.

Table 1-6 Underlying geology for superficial deposits

Strata	**Environment Agency Aquifer designation**	**Thickness (m) (Note 1)**	**Location**
Topsoil	Not applicable	0.30 – 0.65	Across the Proposed Scheme **(Note 1)**

Strata	Environment Agency Aquifer designation	Thickness (m) (Note 1)	Location
Alluvium	Secondary (A)	1.00	Encountered in one location (TP217) in the north. Not noted on BGS mapping for the Proposed Scheme.
Raised Beach Deposits	Secondary (A)	Not applicable	Not encountered during the ground investigation. BGS mapping indicates this is located in the north of the Proposed Scheme.
Tottenhill Gravel Member	Secondary (A)	0.40 – 1.85	Central and Southern section's (Note 1) BGS mapping indicates this is within the southern area of the Proposed Scheme.
Head	Secondary Undifferentiated	1.50	Encountered in one location (WS106) located in the south-west of the Proposed Scheme. BGS mapping indicates this is potentially located west area of the Hardwick Interchange.

Note 1 - Information taken from Preliminary Risk Assessment (**Appendix 12.1: Preliminary Risk Assessment**).

Table 1-7 Underlying geology for bedrock formations

Strata	Environment Agency Aquifer designation	Thickness (m) (Note 1)	Location
Lowestoft Formation	Secondary Undifferentiated	0.40 – 4.80	Central and Southern section's (Note 1). BGS mapping indicates this is also potentially located in the northern area of the Proposed Scheme.
Sandringham Sand Formation - Leziate Member	Principal Aquifer	Not applicable	Not encountered during the ground investigation. BGS mapping indicates this is located in the northern and central sections of the scheme.
Sandringham Sand Formation - Mintlyn Member	Principal Aquifer	0.50 – 4.60 (Not proven in the central section)	Northern, central and southern sections.
Sandringham Sand Formation - Roxham and Runcton Member	Principal Aquifer	0.20 – 2.60	Northern, central and southern sections.

Strata	Environment Agency Aquifer designation	Thickness (m) (Note 1)	Location
Kimmeridge Clay Formation	Unproductive Strata	0.40 – 3.55 (not proven)	Northern, and Southern sections. Potential to be encountered in the central sections.

Note 1 - Information taken from Preliminary Risk Assessment (**Appendix 12.1: Preliminary Risk Assessment**)

Hydrogeology

1.4.14 A review of DEFRA's Magic Map (**Ref. 11.43**) application indicates that the sandstone bedrocks to the east are classified as Principal Aquifers. These are defined as layers of rock or drift deposits that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage and transmission. They may support water supply and/or river base flow on a strategic scale.

1.4.15 The superficial Raised Beach deposits, Tottenhill Gravel Member and Lowestoft Formation (clay and gravel) are Secondary A aquifers, which are comprised of permeable layers that can support local water supplies and may form an important source of base flow to rivers.

1.4.16 The superficial deposits Head and Lowestoft Formation (Diamicton) are classified as Secondary (undifferentiated) aquifers, meaning they are largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them.

1.4.17 There are no SPZs located within the Study Area.

1.4.18 The groundwater vulnerability classifications underlying the site, range from unproductive to high. Low vulnerability areas are areas in which groundwater

is afforded the greatest protection from pollution, while high areas are areas in which pollution can easily be transmitted to groundwater.

1.4.19 The site is located within a Nitrate Vulnerable Zone.

Private Groundwater Abstractions

1.4.20 Groundwater abstraction data provided by the Environment Agency indicates that there are no groundwater abstraction licences within 1km of the Site.

Groundwater Dependant Terrestrial Ecosystems (GWDTEs)

1.4.21 There are no GWDTE location within or within 1km of the Site.

Groundwater Body – Water Framework Directive Status

1.4.22 Review of the Environment Agency's Data Catchment Explorer (**Ref. 11.35**) identifies the groundwater waterbody as the 'North West Norfolk Sandringham Sands Water Body'. The groundwater water body underlies the entire Site. A summary of the WFD classification data is provided in **Table 1-8.**

Table 1-8 Groundwater Water Body WFD Classification

Attributes	**Description**
Waterbody ID	GB40501G400400
Waterbody Name	North West Norfolk Sandringham Sands Water Body
Overall Status	Good
Overall Status Objective	Good 2015
Overall Quantitative Status	Good

Attributes	Description
Overall Quantitative Status Objective	Good 2015
Overall Chemical Status	Good
Overall Chemical Status Objective	Good 2015
Reason for not achieving Good status	Not applicable
Waterbody Measures	Not applicable

Flood Risk

1.4.23 A detailed description of the baseline flood risk for all sources of flooding is included in the accompanying **Appendix 11.1 Flood Risk Assessment**. A summary of the fluvial, surface water and groundwater flood risks are presented below.

Fluvial Flooding

1.4.24 A review of the Environment Agency's Flood Map for Planning (**Ref. 11.33**) indicates that the vast majority of the Site is located within Flood Zone 1. Flood Zone 1 is classed as having a Low Probability of flooding and is assessed as land having a 1 in 1,000 annual probability of river flooding. There is a small area located towards the east of Hardwick roundabout

adjacent to the A47 that is located within Flood Zone 2 and Flood Zone 3. Flood Zone 3 is classed as having a High Probability of flooding and is assessed as land having a 1 in 100 or greater annual probability of river flooding. Flood Zone 2 is classed as having a Medium Probability of flooding and is assessed as land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding. The fluvial flood risk is associated with the River Great Ouse.

Surface Water Flood Risk

1.4.25 Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. In rural locations such as the site of the Proposed Scheme, it typically occurs when the underlying soils are saturated, with overland flows following topography and flowing downhill.

1.4.26 Surface water flooding has been assessed by review of the Environment Agency's Flood Risk from Surface Water maps (**Ref. 11.34**). Review of these maps indicates that there are small pockets of high, medium and low flood risk from surface water along the Proposed Scheme. High risk means that each year this area has a chance of flooding of greater than 1 in 30. Medium risk means that each year this area has a chance of flooding of between 1 in 100 and 1 in 30. Low risk means that each year this area has a chance of flooding of between 1 in 1000 and 1 in 100. The areas of risk are associated with areas of low topography or the unnamed land drains throughout the Site. More information regarding surface water flood risk is discussed in **Appendix 11.1 Flood Risk Assessment**.

Flood Risk from Artificial Sources

1.4.27 The Environment Agency's Flood Risk from Reservoirs mapping (**Ref. 11.34**) indicates that the Proposed Scheme is not at risk of flooding reservoirs.

Groundwater Flood Risk

1.4.28 Groundwater flooding occurs when the groundwater levels rise to within close proximity of ground level, either causing flood risk to underground structures

or emerging and flowing across the ground's surface. Groundwater flooding is generally a result of extended periods of heavy rainfall associated with porous underlying geology, such as chalk, limestone and gravels.

1.4.29 The water level recorded in the BGS Borehole data (**Ref. 11.41**) is variable across the site with ground water levels recorded between 1.52 -8.23m BGL.

1.4.30 The Borough Council of King's Lynn and West Norfolk Strategic Flood Risk Assessment (2018) (**Ref.11.47**) gives an indication of the risk of groundwater flooding in the flood risk maps in Appendix F. The maps indicate the lowest level of risk in the north and east of the Site (<25%) and a higher level of risk in the south (25%<50%). More information regarding groundwater flood risk is available in the standalone FRA (**Appendix 11.1: Flood Risk Assessment**).

Future Baseline

1.4.31 The most likely change in the baseline conditions in the future would be associated with an increase in peak river flows and peak rainfall intensity associated with the potential effects of climate change. The Environment Agency provide guidance on a range of potential climate change allowances dependant on the relevant river basin district and climate change probability. The Proposed Scheme is located within the North West Norfolk Management Catchment. In this region it is predicted that by the 2080s peak river flows could increase by 23% (central allowance), 33% (higher central allowance) and 57% (upper end allowance). This may increase the frequency of flood risk to identified receptors and increase the extent of Flood Zones 2 and 3, resulting in a greater area of the Proposed Scheme at risk of fluvial flooding. The potential effects of climate change have been assessed in **Appendix 11.1: Flood Risk Assessment.**

1.4.32 The peak rainfall intensity may also increase as a result of climate change, which could potentially increase the risk of surface water flooding to the Proposed Scheme. The Environment Agency provides guidance on the central and upper end allowances for all of England. The Proposed Scheme is located within the North West Norfolk Management Catchment. In this region

it is predicted that the total potential change anticipated up to the 2070s is 20% (central allowance) and 35% (upper end allowance). The potential effects of climate change have been assessed in **Appendix 11.1: Flood Risk Assessment** and considered in the design of the proposed surface water drainage system discussed in the Surface Water Drainage Strategy**.**

1.4.33 It is expected that there would be no significant changes between current and future baseline for groundwater resources. The drainage of the Principal Aquifer would remain unchanged and so the peak groundwater levels would also be expected to remain unchanged.

1.5 Design and Embedded Best Practice Mitigation Measures

1.5.1 This section lists the various mitigation measures that will be incorporated within the Proposed Scheme to address the relevant potential effects during the construction and operation phases.

Construction Phase

1.5.2 The following forms of embedded mitigation have been considered within the construction phase assessment:

- The Outline Construction Environmental Mitigation Plan (oCEMP) details mitigation measures that would manage environmental impacts during construction. The oCEMP sets out how construction activities would be undertaken in accordance with appropriate good practice guidance, such as CIRIA's control of water pollution from construction sites (C532) (**Ref.11.46**). The oCEMP would also include the requirements for any licences and permits required for the construction of the Proposed Scheme. Specific mitigation measures included within the oCEMP that are relevant and haven been included within the assessment of likely effects are specified in the tables below; and
- Areas for temporary use during construction which include the construction compounds are generally located away from the unnamed land drains and are located away from the named watercourses. The

areas for temporary use during construction are described in **Chapter 3: Description of the Proposed Scheme**.

Operation Phase

1.5.3 The following forms of embedded mitigation have been considered within the operation phase assessment:

- Implementation of a new surface water drainage system prepared in accordance with latest standards and guidance;
- The surface water drainage system includes attenuation ponds to provide a buffering and filtration mechanism, such that particulates and contaminants within the surface water discharge are removed prior to entering underlying groundwater; and
- Existing drainage ditches and channels flows will be maintained by the installation of culverts under the new road.

1.6 Sensitive Receptors

1.6.1 The following sensitive receptors have been assessed as shown in **Table 1-9**. Key sensitive receptors are shown on **Figure 1.2: Water Environment Key Sensitive Receptors**.

Table 1-9 Sensitive Receptors

Receptor	Sensitivity	Justification
Unnamed field drains	Low	The unnamed field drains provide a drainage function. Not monitored against the WFD but in hydraulic connectivity with the River Nar. Q95 river flow expected to be < 0.001m³/s.
The Country Drain	High	Ordinary watercourse under the jurisdiction of NCC as LLFA. Current WFD classification is Poor.

Receptor	Sensitivity	Justification
Middleton Stop Drain	High	Ordinary watercourse under the jurisdiction of NCC as LLFA. Current WFD classification is Moderate.
River Nar	Very High	A main river under the jurisdiction of the Environment Agency. Current WFD classification is Moderate. SSSI.
Surface water abstractions	Medium	There are five licensed surface water abstractions located within the Study Area for agricultural purposes.
Principal bedrock aquifer – Sandringham Sands (Leziate, Mintlyn, Roxham and Runcton)	High	Principal Aquifer.
Bedrock Secondary Aquifer – Lowestoft Formation	Medium	Secondary (Undifferentiated) Aquifer.

Receptor	Sensitivity	Justification
Superficial deposits – Alluvium, Raised Beach Deposits, Tottenhill Gravel, Head (Secondary aquifers)	Medium	Secondary (Undifferentiated) Aquifer. Secondary (A) Aquifer
Third Party Flood Risk	Low to High	Flood risk to third party land as a result of the Proposed Scheme.
Proposed Scheme	Very High	In accordance with NPPF the Proposed Scheme is considered to be Essential Infrastructure and therefore allocated a sensitivity of Very High.

1.7 Assessment of Potential Effects, Mitigation and Residual Effects

Construction Phase

Table 1-10 Assessment of potential effects on the unnamed field drains during construction activities

Description	Potential effects on the unnamed field drains during construction activities
Sensitive receptor	Unnamed field drains

Description	Potential effects on the unnamed field drains during construction activities
Potential effects	Sedimentation Temporary increased sedimentation within the unnamed field drains could be caused by surface water runoff containing elevated levels of suspended particles that may result from land clearance, excavation, dewatering of excavations, wheel washings, areas of bare earth, construction materials such as aggregate and stockpiles of topsoil substances associated with temporary works. There are two new culverts proposed across unnamed field drains and an existing culvert beneath the A47 will be replaced. More details regarding the culverts are available in **Appendix 11.1: Flood Risk Assessment**. The proposed culverts will require works to be undertaken within the watercourse channels. There are also seven proposed outfalls into unnamed field ditches which will require some in channel works. To construct the culverts in the dry will therefore either require the diversion of the existing watercourses during construction or offline construction with the eventual diversion of the watercourse onto a new alignment. This will be consulted on with the LLFA during the development of the ordinary watercourse consent application. Runoff with high sediment loads may potentially have direct adverse impacts on the unnamed field drains through smothering natural vegetation of the field drains and bed substrates which may require additional maintenance in order to maintain the capacity of the field drains. The magnitude of the impact is likely to be greater when working in areas above and adjacent to the unnamed field drains, and in periods of heavy rainfall. Sediment is likely to settle quickly due to the relatively flat channel gradients and small catchments. The source of risk of increased sedimentation in construction runoff would reduce shortly after completion of the works when exposed areas of earth are resurfaced, reseeded or replanted, although sediment may not be flushed through the drains in the same way that would be expected for a watercourse and therefore the impact may be of greater duration. The mitigation measures detailed in the oCEMP and further consultation with the LLFA during the development of the ordinary watercourse consent application would reduce the risk of increased sedimentation and potential effects to the unnamed field drains. This process is separate to the planning process. Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. Pollution risks Increased pollution risks from spillage of fuels or other harmful substances associated with temporary works may migrate to the unnamed field drains. Hydrocarbons form a film on the surface of the field drain or smother vegetation. If materials and activities are not stored and carried out in designated areas, runoff and washdown may enter the unnamed field drains, adversely affecting the quality of the field drains. A common source of pollution is from leaks and spillages of hydrocarbons from mechanical plant or storage vessels. Concrete and cement products can also pose a significant risk to the water environment and are highly alkaline and corrosive. For the most part, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the watercourse, that a significant risk of acute toxicity would arise in the receiving field drain. Areas for temporary use during construction which include the construction compounds are generally located away from the unnamed land drains and are located away from the named watercourses. Overall Assessment The sensitivity of the unnamed field drains is **Low** and the magnitude of impact prior to mitigation is **Minor Adverse** associated with the release of sediment and potential pollution risk. Therefore, there is likely to be a direct, temporary, short to long term **Slight** effect (not significant) on the unnamed field drains prior to the implementation of additional mitigation measures.
Additional mitigation	Further consultation with the LLFA during the development of the ordinary watercourse consent application would reduce the risk of increased sedimentation and potential effects to the unnamed field drains.

Description	Potential effects on the unnamed field drains during construction activities
Residual effects and monitoring	The sensitivity of the unnamed field drains is **Low**, and the magnitude of effect, following mitigation, is **Minor Adverse**. Therefore, there is likely to be a direct, temporary, short to long term **Slight** residual effect (not significant) on the unnamed field drains following the implementation of additional mitigation measures.

Table 1-11 Assessment of potential effects on the Country Drain during construction activities

Description	Potential effects on the Country Drain during construction activities
Sensitive receptor	The Country Drain
Potential effects	Sedimentation and Pollution risks There are no works within or in close proximity to the watercourse. The nearest works are approximately 1.1km to the east of the Country Drain. Due to the distance between the Country Drain and the proposed construction activities and the measures outlined in the oCEMP, it is considered unlikely that sedimentation or pollution risks will directly impact the Country Drain. There is an indirect risk that sedimentation and pollution could impact the Country Drain via the surface water drainage system. A number of the receiving watercourses from the proposed outfalls eventually drain into the Country Drain. Measures to reduce the impacts associated with sedimentation and pollution risks are including within the oCEMP to reduce the impacts. Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. The sensitivity of the Country Drain is considered to be **High**, and the magnitude of impact, prior to additional mitigation is **Negligible**. Therefore, there is likely to be an indirect, temporary, short to long-term negligible to **Slight** effect (not significant) on the Country Drain prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable.
Residual effects and monitoring	The sensitivity of the Country Drain is considered to be **High**, and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be an indirect, temporary, short term **Slight** residual effects (not significant) on the Country Drain following the implementation of additional mitigation measures.

Table 1-12 Assessment of potential effects on Middleton Stop Drain during construction activities

Description	Potential effects on the Middleton Stop Drain during construction activities
Sensitive receptor	Middleton Stop Drain
Potential effects	Sedimentation and Pollution risks There are no works within or in close proximity to the watercourse. The nearest works are approximately 1km to the south-west of the Middleton Stop Drain. Due to the distance between Middleton Stop Drain and the proposed construction activities and the measures outlined in the oCEMP, it is considered unlikely that sedimentation or pollution risks will directly impact the Middleton Stop Drain. There is an indirect risk that sedimentation and pollution could impact the Middleton Stop Drain via the surface water drainage system. A number of the receiving watercourses from the proposed outfalls eventually drain into the Middleton Stop Drain. Measures to reduce the impacts associated with sedimentation and pollution risks are including within the oCEMP to reduce the impacts. Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. The sensitivity of the Middleton Stop Drain is considered to be **High**, and the magnitude of impact, prior to additional mitigation is **Negligible**. Therefore, there is likely to be an indirect, temporary, short to long-term negligible to **Slight** effect (not significant) on the Middleton Stop Drain prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable.
Residual effects and monitoring	The sensitivity of the Middleton Stop Drain is considered to be **High**, and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be an indirect, temporary, short term **Slight** residual effects (not significant) on the Middleton Stop Drain following the implementation of additional mitigation measures.

Table 1-13 Assessment of potential effects on the River Nar during construction activities

Description	Potential effects on the River Nar during construction activities
Sensitive receptor	River Nar

Description	Potential effects on the River Nar during construction activities
Potential effects	Sedimentation and Pollution risks There are no works within or in close proximity to the watercourse. The nearest works are approximately 1km to the east of the River Nar. Due to the distance between the River Nar and the proposed construction activities and the measures outlined in the oCEMP, it is considered unlikely that sedimentation or pollution risks will directly impact the River Nar. There is an indirect risk that sedimentation and pollution could impact the River Nar via the surface water drainage system. A number of the receiving watercourses from the proposed outfalls eventually drain into the River Nar. Measures to reduce the impacts associated with sedimentation and pollution risks are including within the oCEMP to reduce the impacts. Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. The sensitivity of the River Nar is **Very High** and the magnitude of impact, prior to mitigation, is **Negligible**. Therefore, there is likely to be an indirect, temporary, short to long-term **Slight** effect (not significant) on the River Nar prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of the River Nar is **Very High** and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be an indirect, temporary, short to long-term **Slight** residual effects (not significant) on the River Nar following the implementation of additional mitigation measures.

Table 1-14 Assessment of potential effects on surface water abstractions during construction activities

Description	**Potential effects on surface water abstractions during construction activities**
Sensitive receptor	Surface water abstractions
Potential effects	The five surface water abstractions are located outside of the Proposed Scheme boundary and therefore no works are within or in close proximity to the watercourses from which the abstractions are licensed for. Measures regarding pollution management during the construction of the Proposed Scheme will be detailed in the oCEMP. Due to the distance between the surface water abstractions and the proposed construction activities and with the measures outlined in the oCEMP, it is considered unlikely that pollution risks will directly impact the surface water abstractions. The sensitivity of the surface water abstractions is **Medium** and the magnitude of impact, prior to additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short to long term **Neutral** effect (not significant) on surface water abstractions prior to the implementation of mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of surface water abstractions is **Medium** and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short to long term **Neutral** residual effects (not significant) on surface water abstractions following the implementation of additional mitigation measures.

Table 1-15 Assessment of potential effects on Principal bedrock aquifer (Sandringham Sands) during construction activities

Description	**Potential effects on the Principal bedrock aquifer (Sandringham Sands) during construction activities**
Sensitive receptor	Principal bedrock aquifer – Sandringham Sands (Leziate, Mintlyn, Roxham and Runcton)

Description	Potential effects on the Principal bedrock aquifer (Sandringham Sands) during construction activities
Potential effects	Changes to groundwater quality Large earthwork plant will be required during the construction of the Proposed Scheme. Plant is expected to include excavators, dump trucks, haulage wagons, as well as commuting vehicles for drivers. There may be leaks of lubricating oils, fuels (petrol and diesel) from these vehicles, refuelling of the plant will also be required. This may result in small spillages such as drips from the refuelling nozzle or directly from vehicles, but potentially also large-scale spillages with major loss to the ground. This has the potential to impact the water environment including groundwater bodies spreading down hydraulic gradient. The oCEMP will specify that refuelling needs to be undertaken in a designated bunded location, such that any spills or drips are contained. Fuel needs to be stored in a suitable bunded container, sufficient to contain the hydrocarbons in the case of a loss of primary containment. The use of drip trays under plant when not in use would also be beneficial. The oCEMP will also specify the accessibility of oil spill kits on site. If a spill does occur, the oCEMP will include emergency procedures in order to contain the spill such as excavation of the immediate locality of soils where the spill has occurred, to minimise onward transmission into the ground. Excavated contaminated soils should then be contained in such a manner that they would not impact the environment, prior to remedial actions being undertaken. This would comprise tertiary mitigation and would be the responsibility of the Principal Contractor on site. The sensitivity of the principal bedrock aquifer is **High** and the magnitude of impact, prior to mitigation is **Minor Adverse**. Therefore, there is likely to be a direct, temporary, long term **Moderate** effect (significant) on the principal bedrock aquifer prior to the implementation of additional mitigation measures. Changes to water quality on off-site groundwater due to earthworks Construction of a development platform upon which to build the road will require earthworks. Such earthworks are expected to include as a minimum the removal of topsoil and subsoil, and then slight cutting into the underlying geology to a required level which will vary across the site. Preliminary design of the degree of cutting indicates the road will be at grade so there is expected to be minimal excavation. Such earthworks will require large plant earth moving equipment such as excavators, dumper trucks, and haulage wagons to take the excess soils away (potentially for re-use). Plant movements and earthworks are likely to result in vibrations which can result in turbidity in groundwater aquifers. The sensitivity of the principal bedrock aquifer is **High** and the magnitude of impact, prior to mitigation is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on the principal bedrock aquifer prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of the principal bedrock aquifer is **High**, and the magnitude of impact, following additional mitigation, is **Minor Adverse**. Therefore, there is likely to be a direct, temporary, short term **Slight** residual effects (not significant) on the principal bedrock aquifer following the implementation of additional mitigation.

Table 1-16 Assessment of potential effects on Bedrock Secondary Aquifer (Lowestoft Formation) during construction activities

Description	Potential effects on bedrock secondary aquifer during construction activities
Sensitive receptor	Bedrock Secondary Aquifer – Lowestoft Formation
Potential effects	Changes to groundwater quality Large earthwork plant will be required during the construction of the Proposed Scheme. Plant is expected to include excavators, dump trucks, haulage wagons, as well as commuting vehicles for drivers. There may be leaks of lubricating oils, fuels (petrol and diesel) from these vehicles, refuelling of the plant will also be required. This may result in small spillages such as drips from the refuelling nozzle or directly from vehicles, but potentially also large-scale spillages with major loss to the ground. This has the potential to impact the water environment including groundwater bodies spreading down hydraulic gradient. The oCEMP will specify that refuelling needs to be undertaken in a designated bunded location, such that any spills or drips are contained. Fuel needs to be stored in a suitable bunded container, sufficient to contain the hydrocarbons in the case of a loss of primary containment. The use of drip trays under plant when not in use would also be beneficial. The oCEMP will also specify the accessibility of oil spill kits on site. If a spill does occur, the oCEMP will include emergency procedures in order to contain the spill such as excavation of the immediate locality of soils where the spill has occurred, to minimise onward transmission into the ground. Excavated contaminated soils should then be contained in such a manner that they would not impact the environment, prior to remedial actions being undertaken. This would comprise tertiary mitigation and would be the responsibility of the Principal Contractor on site. The sensitivity of the bedrock secondary aquifer is **Medium** and the magnitude of impact, prior to mitigation is **Minor Adverse**. Therefore, there is likely to be a direct, temporary, long term **Slight** effect (significant) on the bedrock secondary aquifer prior to the implementation of additional mitigation measures. Changes to water quality on off-site groundwater due to earthworks Construction of a development platform upon which to build the road will require earthworks. Such earthworks are expected to include as a minimum the removal of topsoil and subsoil, and then slight cutting into the underlying geology to a required level which will vary across the site. Preliminary design of the degree of cutting indicates the road will be at grade so there is expected to be minimal excavation. Such earthworks will require large plant earth moving equipment such as excavators, dumper trucks, and haulage wagons to take the excess soils away (potentially for re-use). Plant movements and earthworks are likely to result in vibrations which can result in turbidity in groundwater aquifers. The sensitivity of the bedrock secondary aquifer is **Medium** and the magnitude of impact, prior to mitigation is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on the bedrock secondary aquifer prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of the bedrock secondary aquifer is **Medium**, and the magnitude of impact, following additional mitigation, is **Minor Adverse**. Therefore, there is likely to be a direct, temporary, short term **Slight** residual effects (not significant) on the principal bedrock aquifer following the implementation of additional mitigation.

Table 1-17 Assessment of potential effects on superficial deposits (secondary aquifers) during construction activities

Description	Potential effects on superficial deposits during construction activities
Sensitive receptor	Superficial deposits – Alluvium, Raised Beach Deposits, Tottenhill Gravel, Head (Secondary A Aquifers)
Potential effects	Changes to groundwater quality Large earthwork plant will be required during the construction of the Proposed Scheme. Plant is expected to include excavators, dump trucks, haulage wagons, as well as commuting vehicles for drivers. There may be leaks of lubricating oils, fuels (petrol and diesel) from these vehicles, refuelling of the plant will also be required. This may result in small spillages such as drips from the refuelling nozzle or directly from vehicles, but potentially also large-scale spillages with major loss to the ground. This has the potential to impact the water environment including groundwater bodies spreading down hydraulic gradient. The oCEMP will specify that refuelling needs to be undertaken in a designated bunded location, such that any spills or drips are contained. Fuel needs to be stored in a suitable bunded container, sufficient to contain the hydrocarbons in the case of a loss of primary containment. The use of drip trays under plant when not in use would also be beneficial. The oCEMP will also specify the accessibility of oil spill kits on site. If a spill does occur, the oCEMP will include emergency procedures in order to contain the spill such as excavation of the immediate locality of soils where the spill has occurred, to minimise onward transmission into the ground. Excavated contaminated soils should then be contained in such a manner that they would not impact the environment, prior to remedial actions being undertaken. This would comprise tertiary mitigation and would be the responsibility of the Principal Contractor on site. The sensitivity of the superficial deposits is **Medium** and the magnitude of impact, prior to mitigation is **Minor Adverse**. Therefore, there is likely to be a direct, temporary, long term **Slight** effect (significant) on the superficial deposits prior to the implementation of additional mitigation measures. Changes to water quality on off-site groundwater due to earthworks Construction of a development platform upon which to build the road will require earthworks. Such earthworks are expected to include as a minimum the removal of topsoil and subsoil, and then slight cutting into the underlying geology to a required level which will vary across the site. Preliminary design of the degree of cutting indicates the road will be at grade so there is expected to be minimal excavation. Such earthworks will require large plant earth moving equipment such as excavators, dumper trucks, and haulage wagons to take the excess soils away (potentially for re-use). Plant movements and earthworks are likely to result in vibrations which can result in turbidity in groundwater aquifers. The sensitivity of the superficial deposits is **Medium** and the magnitude of impact, prior to mitigation is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on the superficial deposits prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of the superficial deposits is **Medium**, and the magnitude of impact, following additional mitigation, is **Minor Adverse**. Therefore, there is likely to be a direct, temporary, short term **Slight** residual effects (not significant) on the superficial deposits following the implementation of additional mitigation.

Table 1-18 Assessment of potential effects on third party flood risk during construction activities

Description	Potential effects on third party flood risk during construction activities
Sensitive receptor	Third party flood risk
Potential effects	**Appendix 11.1: Flood Risk Assessment** concludes that the Proposed Scheme and embedded mitigation will not increase flood risk to third parties. Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. The sensitivity of third party flood risk is **Low to High** and the magnitude of impact, prior to additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on third party flood risk prior to the implementation of mitigation measures.
Additional mitigation	Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.
Residual effects and monitoring	The sensitivity of third party flood risk is **Low to High** and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on third party flood risk prior to the implementation of additional mitigation measures.

Table 1-19 Assessment of potential effects on flood risk to the Proposed Scheme during construction activities

Description	Potential effects on flood risk to the Proposed Scheme during construction activities
Sensitive receptor	Flood risk to the Proposed Scheme
Potential effects	**Appendix 11.1: Flood Risk Assessment** concludes that the Proposed Scheme is not at risk of flooding and is compliant with the criteria set out in the NPPF (**Ref. 11.13**). Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. The sensitivity of flood risk to the Proposed Scheme is **Very High** and the magnitude of impact, prior to additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on flood risk to the Proposed Scheme prior to the implementation of mitigation measures.
Additional mitigation	Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.
Residual effects and monitoring	The sensitivity of flood risk to the Proposed Scheme is **Very High** and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on flood risk to the Proposed Scheme following the implementation of additional mitigation measures.

Operation Phase

Table 1-20 Assessment of potential effects on the unnamed field drains during operation

Description	**Potential effects on the unnamed field drains during operation**
Sensitive receptor	Unnamed field drains
Potential effects	Pollution Risks The Surface Water Drainage Strategy included in **Appendix 11.1: Flood Risk Assessment**, includes seven outfalls which discharge to the unnamed field drains. **Appendix 11.1: Drainage Network Quality Assessment** assess using the HEWRAT assessment tool to assess the risks to water quality during operation of the Proposed Scheme. Prior to the inclusion of mitigation measures, the outfall passed the assessment of acute impacts of soluble pollutants (zinc and copper) and long term impacts to the receiving water environment against the EQS threshold values set out under the WFD. This indicates that the proposed mitigation measures go beyond the minimum standards required to pass the HEWRAT assessment for these parameters. **Appendix 12.1: Drainage Network Quality Assessment** also concluded that the Proposed Scheme passed the spillage risk assessment. Culverts Flows will be maintained through the existing unnamed field ditches by the installation of culverts under the new road. The proposed culverts have been sized by assessing the upstream catchment area of the ditch at the point of the road crossing and from this the greenfield run-rate calculated using the ReFH2 methodology. More information regarding the culverts is available in **Appendix 11.1: Flood Risk Assessment**. Changes in catchment hydrology The Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment** provides information about the existing drainage catchments within the vicinity of the Proposed Scheme and how these have been considered in the design of the drainage strategy. Existing catchments will be maintained as far as practicable to limit changes to catchment hydrology. The sensitivity of the unnamed field drains is **Low** and the magnitude of impact, prior to additional mitigation, is **Minor Adverse**. Therefore, there is likely to be a direct, permanent, long-term **Slight** effect (not significant) on the unnamed field drains prior to the implementation of additional mitigation measures.
Additional mitigation	Additional mitigation measures in relation to the unnamed field drains in relation to flood risk is available in **Appendix 11.1: Flood Risk Assessment**.
Residual effects and monitoring	The sensitivity of the unnamed field drains is **Low**, and the magnitude of impact, following additional mitigation, is **Minor Adverse**. Therefore, there is likely to be a direct, permanent, long-term **Slight** residual effect (not significant) on the unnamed field drains following the implementation of additional mitigation measures.

Table 1-21 Assessment of potential effects on the Country Drain during operation

Description	Potential effects on the Country Drain during operation
Sensitive receptor	The Country Drain
Potential effects	Pollution risks There is an indirect risk that pollution could impact the Country Drain via the surface water drainage system. A number of the receiving watercourses from the proposed outfalls eventually drain into the Country Drain. Measures to reduce the impacts associated with pollution risks are including within the Surface Water Drainage Strategy to reduce the impacts. **Appendix 11.1: Drainage Network Quality Assessment** uses the HEWRAT assessment tool to assess the risks to water quality during operation of the Proposed Scheme. Prior to the inclusion of mitigation measures, the outfalls passed the assessment of acute impacts of soluble pollutants (zinc and copper) and long term impacts to the receiving water environment against the EQS threshold values set out under the WFD. This indicates that the proposed mitigation measures go beyond the minimum standards required to pass the HEWRAT assessment for these parameters. **Appendix 11.1: Drainage Network Quality Assessment** also concluded that the Proposed Scheme passed the spillage risk assessment. The sensitivity of the Country Drain is considered to be **High**, and the magnitude of impact, prior to additional mitigation is **Negligible**. Therefore, there is likely to be indirect, permanent, long-term **Slight** effect (not significant) on the Country Drain prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of the Country Drain is **High**, and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be indirect, permanent, long-term **Slight** residual effects on the Country Drain (not significant) following the implementation of additional mitigation measures.

Table 1-22 Assessment of potential effects on the Middleton Stop Drain during operation

Description	Potential effects on the Middleton Stop Drain during operation
Sensitive receptor	Middleton Stop Drain
Potential effects	Pollution risks There is an indirect risk that pollution could impact the Country Drain via the surface water drainage system. A number of the receiving watercourses from the proposed outfalls eventually drain into the Country Drain. Measures to reduce the impacts associated with pollution risks are including within the Surface Water Drainage Strategy to reduce the impacts. **Appendix 11.1: Drainage Network Quality Assessment** uses the HEWRAT assessment tool to assess the risks to water quality during operation of the Proposed Scheme. Prior to the inclusion of mitigation measures, the outfalls passed the assessment of acute impacts of soluble pollutants (zinc and copper) and long term impacts to the receiving water environment against the EQS threshold values set out under the WFD. This indicates that the proposed mitigation measures go beyond the minimum standards required to pass the HEWRAT assessment for these parameters. **Appendix 11.1: Drainage Network Quality Assessment** also concluded that the Proposed Scheme passed the spillage risk assessment. The sensitivity of the Middleton Stop Drain is **High** and the magnitude of impact, prior to mitigation, is **Negligible**. Therefore, there is likely to be an indirect, permanent, long term **Slight** effect (not significant) on the Middleton Stop Drain prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of the Middleton Stop Drain is **High** and the magnitude of impact, prior to mitigation, is **Negligible**. Therefore, there is likely to be an indirect, permanent, long term **Slight** residual effect (not significant) on the Middleton Stop Drain following the implementation of additional mitigation measures.

Table 1-23 Assessment of potential effects on the River Nar during operation

Description	Potential effects on the River Nar during operation
Sensitive receptor	River Nar
Potential effects	Pollution risks There is an indirect risk that pollution could impact the River Nar via the surface water drainage system. A number of the receiving watercourses from the proposed outfalls eventually drain into the River Nar. Measures to reduce the impacts associated with pollution risks are including within the Surface Water Drainage Strategy to reduce the impacts. **Appendix 11.1: Drainage Network Quality Assessment** uses the HEWRAT assessment tool to assess the risks to water quality during operation of the Proposed Scheme. Prior to the inclusion of mitigation measures, the outfalls passed the assessment of acute impacts of soluble pollutants (zinc and copper) and long term impacts to the receiving water environment against the EQS threshold values set out under the WFD. This indicates that the proposed mitigation measures go beyond the minimum standards required to pass the HEWRAT assessment for these parameters. **Appendix 11.1: Drainage Network Quality Assessment** also concluded that the Proposed Scheme passed the spillage risk assessment. The sensitivity of the River Nar is **Very High** and the magnitude of impact, prior to mitigation, is **Negligible**. Therefore, there is likely to be an indirect, permanent, long term **Slight** effect (not significant) on the River Nar prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable

Description	Potential effects on the River Nar during operation
Residual effects and monitoring	The sensitivity of the River Nar is **Very High** and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be an indirect, permanent, long term **Slight** residual effect (not significant) on the River Nar following the implementation of additional mitigation measures.

Table 1-24 Assessment of potential effects on the surface water abstractions during operation

Description	Potential effects on surface water abstractions during operation
Sensitive receptor	Surface water abstractions
Potential effects	The five surface water abstractions are located outside of the Proposed Scheme boundary and therefore no works are within or in close proximity to the watercourses from which the abstractions are licensed for. Due to the distance between the surface water abstractions and the Proposed Scheme and with the measures outlined in the Surface Water Drainage Strategy included in **Appendix 11.1: Flood Risk Assessment**, it is considered unlikely that pollution risks will directly impact the surface water abstractions. Therefore, there is likely to be a direct, temporary, short to long term **Neutral** effect (not significant) on surface water abstractions prior to the implementation of mitigation measures. The sensitivity of the surface water abstractions is **Medium** and the magnitude of impact, prior to additional mitigation, is **Negligible**. Therefore, there is likely to be an indirect, permanent, long term **Neutral** effect (not significant) on the surface water abstractions prior to the implementation of additional mitigation measures.
Additional mitigation	Not applicable
Residual effects and monitoring	The sensitivity of the surface water abstractions is **Medium** and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be an indirect, permanent, long term **Neutral** effect (not significant) on the surface water abstractions following the implementation of additional mitigation measures

Table 1-25 Assessment of potential effects on the Principal bedrock aquifer (Sandringham Sands) during operation

Description	Potential effects on the Principal Bedrock Aquifer (Sandringham Sands) during scheme operation
Sensitive receptor	Principal Bedrock Aquifer (Sandringham Sands)

Description	Potential effects on the Principal Bedrock Aquifer (Sandringham Sands) during scheme operation
Potential effects	Potential increase in physical contamination (i.e. sedimentation) and chemical contamination of groundwater aquifers. Daily use of the Proposed Scheme as a public road is likely to generate diffuse contamination. Brake dust has been found to be a key part of water contamination, typically associated with locations where HGVs apply their brakes such as approaching roundabouts. In addition to the Hardwick Interchange at the northern end of the scheme, there is the proposed A47 roundabout, the proposed Hopkins roundabout, the proposed Metacre roundabout, the proposed Zurich roundabout, and at the southern end there is the proposed A10 roundabout. Traffic data for the operation of the Proposed Scheme indicates that the average predicted volume of HGVs is approximately 6%, as a result the number of roundabouts does indicate there is potential for the notable generation of brake dust. Research undertaken by Middlesex University with the British Geological Survey and the Environment Agency on London roads, indicated that roads cause the highest contribution to London's river pollution (**Ref. 11.47**) and poor water quality (**Ref. 11.48**). Residue from oil spills and tyre wear, also contribute to the levels of contaminants found in run-off from roads that have the potential to impact the water environment. Toxic metals from engine wear and hydrocarbons including PAHs from vehicle exhausts, as well as SVOCs, phthalates and microplastics are part of the reported over 300 pollutants which can be present in road run-off. In winter, road run-off can also include salt which is used as de-icer. Hexamethoxymethyl-melamine (HMMM), 6PPD-quinone and 1,3-diphenylguanidine are compounds which are used in the manufacture of tyres and can be present in road run-off. Tian et al. (**Ref. 11.49**) recently reported that 6PPD-quinone is toxic to salmon at concentrations < 1 µg/L. Izzo et al. (**Ref. 11.50**) illustrated the seasonal differences in chloride levels in streams managed with storm water retention ponds compared to those without such ponds thus indicating that such ponds can make a significant difference. The proposed surface water drainage strategy includes seven lined attenuation ponds which will collect road run-off from the proposed scheme. The proposed ponds are reported to discharge into local watercourses. The recommendation of the Middlesex University research was that wetlands are beneficial in filtering out pollutants. Therefore, the filtration capabilities of the ponds should be reviewed to enhance the degree of retention of pollutants that occurs. If the ponds were not lined, shallow organic rich soils could be beneficial in filtering out pollutants before discharge to groundwater (or surface water such as the Pierpoint and Puny drains). If there is no liner to the attenuation ponds, it is recommended that the ponds are lined with organic rich soils such as topsoil or peat that could enhance filtration of attenuated water as it drains into the underlying groundwater. Alternatively, if a liner is to be used, there should be some form of filtration such as filter drains, SUDS systems, and reed beds that facilitate multiple stages of filtration. The location of the attenuation ponds would also be beneficial to be placed over the unproductive Kimmeridge clay, and not over the Principal Aquifers. At present (as per drawing 70100518-WSP-WW-C-000XX P0.3 – Scheme Overview Plan-) the ponds are located as follows: • Northern most attenuation pond – over Kimmeridge Clay • 2nd and 3rd – Roxham and Runcton Member sand (Principal Aquifer) • 4th and 5th attenuation ponds – over Mintlyn sands (Principal Aquifer) • 6th attenuation pond – Roxham and Runcton Member sand (Principal Aquifer)/ Boundary with Kimmeridge Clay • 7th attenuation ponds (southern most) – over Kimmeridge clay. The depth below ground of the Mintlyn Beds was recorded (**Appendix D of Appendix 11.1: Flood Risk Assessment - Ground Conditions Appraisal**) to be between 0.35 and 1.60m bgl in the northern section of the site, 0.4 to 2.0m bgl in the central area, and 0.8 – 2.0m bgl in the southern areas of the scheme, so this Principal aquifer is close to the surface with little cover to protect it. The Mintlyn beds are between 0.50 and 4.60m thick (**Appendix D of Appendix 11.1: Flood Risk Assessment -** Ground Conditions Appraisal). The Mintlyn beds were recorded to have a permeability ranging between 3.5E-06 and 9.2E-06. The sensitivity of Principal Bedrock Aquifer is **High** and the magnitude of effect, prior to additional mitigation, is **Moderate Adverse.** Therefore, there is likely to be a direct, cumulative, long-term **Moderate** effect (significant) on the Principal Bedrock Aquifer prior to the implementation of additional mitigation. Major spillage of contamination resulting in impact to surface water and groundwater There is the potential for a large-scale spillage of contamination on the road, such as a road traffic accident where vehicle fuel tanks are ruptured, or if a tanker / bowser overturns with a loss of its contents. Potentially there could be a fire, which would result in the Fire Brigade washing away the contamination, which then enters into the drainage system where it could impact groundwater via drainage and surface water supplies. In balance, the probability of such as event occurring is considered to be very low. Attenuation ponds would assist in capturing a significant volume of any large scale spill, but it is assumed that the scale of the spill would be in excess of what the attenuation ponds could handle. Some of the attenuation ponds are located directly over Principal Aquifers, and discharge to surface water bodies that are assumed to be hydraulically linked to the groundwater in the underlying aquifers. Atkins Geo-Environmental Assessment Report (2017) (**Ref. 11.53**) recorded groundwater levels to be between 1.10m and 7.5m bgl. The sensitivity of the Principal Bedrock Aquifer is considered to be **High**. As a result of the implementation of the proposed surface water drainage strategy and other measures above, the magnitude of effect prior to additional mitigation is likely to be **Major Adverse** on the Principal Bedrock Aquifer. Therefore, there is likely to be an indirect, permanent, long-term, **Major** effect (significant).

Description	Potential effects on the Principal Bedrock Aquifer (Sandringham Sands) during scheme operation
Additional mitigation	Some form of filtration should be present in the design of the drainage system / attenuation ponds to filter out the physical and chemical contaminants. A single form of filtration may not be sufficient as breakthrough may occur over time. Some of the attenuation ponds are located over the Kimmeridge Clay (unproductive non-aquifer), whilst some are located over the sandstone Principal Aquifers. It would be beneficial if all the attenuation ponds were located over Kimmeridge Clay if they were unlined. Relocation of the central attenuation ponds would comprise primary mitigation and would be led by the Principal Designer. The filtration capacities of the drainage system / attenuation ponds would comprise secondary mitigation and would be led by the specialist designer. If a major spill took place, hydrocarbon retention equipment could be used such as booms across the drainage channels. The contamination could then be relatively contained and removed from the environment. The size of the attenuation ponds could be reviewed in relation to their capacity to retain the contents of a tanker (5,000 to 10,000 gallons). Some of the attenuation ponds are located over the Kimmeridge Clay (unproductive non-aquifer), whilst some are located over the sandstone Principal Aquifers. It would be beneficial if all the attenuation ponds were located over Kimmeridge Clay if they were unlined. Relocation of the central attenuation ponds would comprise primary mitigation and would be led by the Principal Designer. Capturing hydrocarbon spills after a major spillage event may comprise tertiary mitigation and may be undertaken by the Environment Agency.
Residual effects and monitoring	The sensitivity of the Principal Bedrock Aquifer is **High**, and the magnitude of effect, following additional mitigation measures, is **Minor Adverse**. Therefore, there is likely to be a direct, cumulative, long term **Slight** residual effect on the Principal Bedrock Aquifer (not significant) following the implementation of additional mitigation.

Table 1-26 Assessment of potential effects on the Bedrock Secondary Aquifer (Lowestoft Formation) during operation

Description	Potential effects on Bedrock Secondary Aquifer (Lowestoft Formation) during operation
Sensitive receptor	Bedrock Secondary Aquifer (Lowestoft Formation)

Description	Potential effects on Bedrock Secondary Aquifer (Lowestoft Formation) during operation
Potential effects	Potential increase in physical contamination (i.e. sedimentation) and chemical contamination of groundwater aquifers. Daily use of the Proposed Scheme as a public road is likely to generate diffuse contamination. Brake dust has been found to be a key part of water contamination, typically associated with locations where HGVs apply their brakes such as approaching roundabouts. In addition to the Hardwick Interchange at the northern end of the scheme, there is the proposed A47 roundabout, the proposed Hopkins roundabout, the proposed Metacre roundabout, the proposed Zurich roundabout, and at the southern end there is the proposed A10 roundabout. Traffic data for the operation of the Proposed Scheme indicates that the average predicted volume of HGVs is approximately 6%, as a result the number of roundabouts does indicate there is potential for the notable generation of brake dust. Research undertaken by Middlesex University with the British Geological Survey and the Environment Agency on London roads, indicated that roads cause the highest contribution to London's river pollution (**Ref. 11.47**) and poor water quality (**Ref. 11.48**). Residue from oil spills and tyre wear, also contribute to the levels of contaminants found in run-off from roads that have the potential to impact the water environment. Toxic metals from engine wear and hydrocarbons including PAHs from vehicle exhausts, as well as SVOCs, phthalates and microplastics are part of the reported over 300 pollutants which can be present in road run-off. In winter, road run-off can also include salt which is used as de-icer. Hexamethoxymethyl-melamine (HMMM), 6PPD-quinone and 1,3-diphenylguanidine are compounds which are used in the manufacture of tyres and can be present in road run-off. Tian et al. (**Ref. 11.49**) recently reported that 6PPD-quinone is toxic to salmon at concentrations < 1 µg/L. Izzo et al. (**Ref. 11.50**) illustrated the seasonal differences in chloride levels in streams managed with storm water retention ponds compared to those without such ponds thus indicating that such ponds can make a significant difference. The proposed surface water drainage strategy includes seven lined attenuation ponds which will collect road run-off from the proposed scheme. The proposed ponds are reported to discharge into local watercourses. The recommendation of the Middlesex University research was that wetlands are beneficial in filtering out pollutants. Therefore, the filtration capabilities of the ponds should be reviewed to enhance the degree of retention of pollutants that occurs. If the ponds were not lined, shallow organic rich soils could be beneficial in filtering out pollutants before discharge to groundwater (or surface water such as the Pierpoint and Puny drains). If there is no liner to the attenuation ponds, it is recommended that the ponds are lined with organic rich soils such as topsoil or peat that could enhance filtration of attenuated water as it drains into the underlying groundwater. Alternatively, if a liner is to be used, there should be some form of filtration such as filter drains, SUDS systems, and reed beds that facilitate multiple stages of filtration. The location of the attenuation ponds would also be beneficial to be placed over the unproductive Kimmeridge clay, and not over the Principal Aquifers. At present (as per drawing 70100518-WSP-WW-C-000XX P0.3 – Scheme Overview Plan) the ponds are located as follows: • Northern most attenuation pond – over Kimmeridge Clay • 2nd and 3rd – Roxham and Runcton Member sand (Principal Aquifer) • 4th and 5th attenuation ponds – over Mintlyn sands (Principal Aquifer) • 6th attenuation pond – Roxham and Runcton Member sand (Principal Aquifer)/ Boundary with Kimmeridge Clay • 7th attenuation ponds (southern most) – over Kimmeridge clay. The depth below ground of the Mintlyn Beds was recorded (**Appendix D of Appendix 11.1: Flood Risk Assessment - Ground Conditions Appraisal**) to be between 0.35 and 1.60m bgl in the northern section of the site, 0.4 to 2.0m bgl in the central area, and 0.8 – 2.0m bgl in the southern areas of the scheme, so this Principal aquifer is close to the surface with little cover to protect it. The Mintlyn beds are between 0.50 and 4.60m thick (**Appendix D of Appendix 11.1: Flood Risk Assessment - Ground Conditions Appraisal**). The Mintlyn beds were recorded to have a permeability ranging between 3.5E-06 and 9.2E-06. The sensitivity of Bedrock Secondary Aquifer is **Medium** and the magnitude of effect, prior to additional mitigation, is **Moderate Adverse.** Therefore, there is likely to be a direct, cumulative, long-term **Moderate** effect (significant) on the Bedrock Secondary Aquifer prior to the implementation of additional mitigation. Major spillage of contamination resulting in impact to surface water and groundwater There is the potential for a large-scale spillage of contamination on the road, such as a road traffic accident where vehicle fuel tanks are ruptured, or if a tanker / bowser overturns with a loss of its contents. Potentially there could be a fire, which would result in the Fire Brigade washing away the contamination, which then enters into the drainage system where it could impact groundwater via drainage and surface water supplies. In balance, the probability of such as event occurring is considered to be very low. Attenuation ponds would assist in capturing a significant volume of any large scale spill, but it is assumed that the scale of the spill would be in excess of what the attenuation ponds could handle. Some of the attenuation ponds are located directly over Principal Aquifers, and discharge to surface water bodies that are assumed to be hydraulically linked to the groundwater in the underlying aquifers. Atkins Geo-environmental Assessment Report (2017) (**Ref. 11.53**) recorded groundwater levels to be between 1.10m and 7.5m bgl. The sensitivity of the Bedrock Secondary Aquifer is considered to be **Medium**. As a result of the implementation of the proposed surface water drainage strategy and other measures above, the magnitude of effect prior to additional mitigation is likely to be **Minor Adverse** on the Bedrock Secondary Aquifer. Therefore, there is likely to be an indirect, permanent, long-term, **Slight** effect (not significant) prior to the implementation of additional mitigation measures.

Description	Potential effects on Bedrock Secondary Aquifer (Lowestoft Formation) during operation
Additional mitigation	Some form of filtration should be present in the design of the drainage system / attenuation ponds to filter out the physical and chemical contaminants. A single form of filtration may not be sufficient as breakthrough may occur over time. Some of the attenuation ponds are located over the Kimmeridge Clay (unproductive non-aquifer), whilst some are located over the sandstone Principal Aquifers. It would be beneficial if all the attenuation ponds were located over Kimmeridge Clay if they were unlined. Relocation of the central attenuation ponds would comprise primary mitigation and would be led by the Principal Designer. The filtration capacities of the drainage system / attenuation ponds would comprise secondary mitigation and would be led by the specialist designer. If a major spill took place, hydrocarbon retention equipment could be used such as booms across the drainage channels. The contamination could then be relatively contained and removed from the environment. The size of the attenuation ponds could be reviewed in relation to their capacity to retain the contents of a tanker (5,000 to 10,000 gallons). Some of the attenuation ponds are located over the Kimmeridge Clay (unproductive non-aquifer), whilst some are located over the sandstone Principal Aquifers. It would be beneficial if all the attenuation ponds were located over Kimmeridge Clay if they were unlined. Relocation of the central attenuation ponds would comprise primary mitigation and would be led by the Principal Designer. Capturing hydrocarbon spills after a major spillage event may comprise tertiary mitigation and may be undertaken by the Environment Agency.
Residual effects and monitoring	The sensitivity of the Bedrock Secondary Aquifer is **Medium**, and the magnitude of effect, following additional mitigation measures, is **Minor Adverse**. Therefore, there is likely to be a direct, cumulative, long term **Slight** residual effect on the Bedrock Secondary Aquifer (not significant) following the implementation of additional mitigation measures.

Table 1-27 Assessment of potential effects on the superficial deposits during operation

Description	Potential effects on superficial deposits during operation
Sensitive receptor	Superficial deposits – Alluvium, Raised Beach Deposits, Tottenhill Gravel, Head (Secondary A Aquifers)

Description	Potential effects on superficial deposits during operation
Potential effects	Potential increase in physical contamination (i.e. sedimentation) and chemical contamination of groundwater aquifers. Daily use of the Proposed Scheme as a public road is likely to generate diffuse contamination. Brake dust has been found to be a key part of water contamination, typically associated with locations where HGVs apply their brakes such as approaching roundabouts. In addition to the Hardwick Interchange at the northern end of the scheme, there is the proposed A47 roundabout, the proposed Hopkins roundabout, the proposed Metacre roundabout, the proposed Zurich roundabout, and at the southern end there is the proposed A10 roundabout. Traffic data for the operation of the Proposed Scheme indicates that the average predicted volume of HGVs is approximately 6%, as a result the number of roundabouts does indicate there is potential for the notable generation of brake dust. Research undertaken by Middlesex University with the British Geological Survey and the Environment Agency on London roads, indicated that roads cause the highest contribution to London's river pollution (**Ref. 11.47**) and poor water quality (**Ref. 11.48**). Residue from oil spills and tyre wear, also contribute to the levels of contaminants found in run-off from roads that have the potential to impact the water environment. Toxic metals from engine wear and hydrocarbons including PAHs from vehicle exhausts, as well as SVOCs, phthalates and microplastics are part of the reported over 300 pollutants which can be present in road run-off. In winter, road run-off can also include salt which is used as de-icer. Hexamethoxymethyl-melamine (HMMM), 6PPD-quinone and 1,3-diphenylguanidine are compounds which are used in the manufacture of tyres and can be present in road run-off. Tian et al. (**Ref. 11.49**) recently reported that 6PPD-quinone is toxic to salmon at concentrations < 1 µg/L. Izzo et al. (**Ref. 11.50**) illustrated the seasonal differences in chloride levels in streams managed with storm water retention ponds compared to those without such ponds thus indicating that such ponds can make a significant difference. The proposed surface water drainage strategy includes seven lined attenuation ponds which will collect road run-off from the proposed scheme. The proposed ponds are reported to discharge into local watercourses. The recommendation of the Middlesex University research was that wetlands are beneficial in filtering out pollutants. Therefore, the filtration capabilities of the ponds should be reviewed to enhance the degree of retention of pollutants that occurs. If the ponds were not lined, shallow organic rich soils could be beneficial in filtering out pollutants before discharge to groundwater (or surface water such as the Pierpoint and Puny drains). If there is no liner to the attenuation ponds, it is recommended that the ponds are lined with organic rich soils such as topsoil or peat that could enhance filtration of attenuated water as it drains into the underlying groundwater. Alternatively, if a liner is to be used, there should be some form of filtration such as filter drains, SUDS systems, and reed beds that facilitate multiple stages of filtration. The location of the attenuation ponds would also be beneficial to be placed over the unproductive Kimmeridge clay, and not over the Principal Aquifers. At present (as per drawing 70100518-WSP-WW-C-000XX P0.3 – Scheme Overview Plan) the ponds are located as follows: • Northern most attenuation pond – over Kimmeridge Clay • 2nd and 3rd – Roxham and Runcton Member sand (Principal Aquifer) • 4th and 5th attenuation ponds – over Mintlyn sands (Principal Aquifer) • 6th attenuation pond – Roxham and Runcton Member sand (Principal Aquifer)/ Boundary with Kimmeridge Clay • 7th attenuation ponds (southern most) – over Kimmeridge clay The depth below ground of the Mintlyn Beds was recorded (WSP Ground Conditions Appraisal 2021) to be between 0.35 and 1.60m bgl in the northern section of the site, 0.4 to 2.0m bgl in the central area, and 0.8 – 2.0m bgl in the southern areas of the scheme, so this Principal aquifer is close to the surface with little cover to protect it. The Mintlyn beds are between 0.50 and 4.60m thick (**Appendix D of Appendix 11.1: Flood Risk Assessment - Ground Conditions Appraisal**). The Mintlyn beds were recorded to have a permeability ranging between 3.5E-06 and 9.2E-06. The sensitivity of Bedrock Secondary Aquifer is **Medium** and the magnitude of effect, prior to additional mitigation, is **Moderate Adverse.** Therefore, there is likely to be a direct, cumulative, long-term **Moderate** effect (significant) on the Bedrock Secondary Aquifer prior to the implementation of additional mitigation. Major spillage of contamination resulting in impact to surface water and groundwater There is the potential for a large-scale spillage of contamination on the road, such as a road traffic accident where vehicle fuel tanks are ruptured, or if a tanker / bowser overturns with a loss of its contents. Potentially there could be a fire, which would result in the Fire Brigade washing away the contamination, which then enters into the drainage system where it could impact groundwater via drainage and surface water supplies. In balance, the probability of such as event occurring is considered to be very low. Attenuation ponds would assist in capturing a significant volume of any large scale spill, but it is assumed that the scale of the spill would be in excess of what the attenuation ponds could handle. Some of the attenuation ponds are located directly over Principal Aquifers, and discharge to surface water bodies that are assumed to be hydraulically linked to the groundwater in the underlying aquifers. Atkins Geo-environmental assessment (2017) (**Ref. 11.53**) recorded groundwater levels to be between 1.10m and 7.5m bgl. The sensitivity of the superficial deposits is considered to be **Medium**. As a result of the implementation of the proposed surface water drainage strategy and other measures above, the magnitude of effect prior to additional mitigation is likely to be **Minor Adverse** on the superficial deposits. Therefore, there is likely to be an indirect, permanent, long-term, **Slight** effect (not significant) prior to the implementation of additional mitigation measures.

Description	Potential effects on superficial deposits during operation
Additional mitigation	Some form of filtration should be present in the design of the drainage system / attenuation ponds to filter out the physical and chemical contaminants. A single form of filtration may not be sufficient as breakthrough may occur over time. Some of the attenuation ponds are located over the Kimmeridge Clay (unproductive non-aquifer), whilst some are located over the sandstone Principal Aquifers. It would be beneficial if all the attenuation ponds were located over Kimmeridge Clay if they were unlined. Relocation of the central attenuation ponds would comprise primary mitigation and would be led by the Principal Designer. The filtration capacities of the drainage system / attenuation ponds would comprise secondary mitigation and would be led by the specialist designer. If a major spill took place, hydrocarbon retention equipment could be used such as booms across the drainage channels. The contamination could then be relatively contained and removed from the environment. The size of the attenuation ponds could be reviewed in relation to their capacity to retain the contents of a tanker (5,000 to 10,000 gallons). Some of the attenuation ponds are located over the Kimmeridge Clay (unproductive non-aquifer), whilst some are located over the sandstone Principal Aquifers. It would be beneficial if all the attenuation ponds were located over Kimmeridge Clay if they were unlined. Relocation of the central attenuation ponds would comprise primary mitigation and would be led by the Principal Designer. Capturing hydrocarbon spills after a major spillage event may comprise tertiary mitigation and may be undertaken by the Environment Agency.
Residual effects and monitoring	The sensitivity of the superficial deposits is **Medium**, and the magnitude of effect, following additional mitigation measures, is **Minor Adverse**. Therefore, there is likely to be a direct, cumulative, long term **Slight** residual effect on the superficial deposits (not significant) following the implementation of additional mitigation measures.

Table 1-28 Assessment of potential effects on third party flood risk during operation

Description	Potential effects on third party flood risk during operation
Sensitive receptor	Third Party Flood Risk
Potential effects	**Appendix 11.1: Flood Risk Assessment** concludes that the Proposed Scheme and embedded mitigation will not increase flood risk to third parties. Surface Water Flood Risk The Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment** details the surface water drainage strategy for the Proposed Scheme. The surface water drainage strategy has been designed using a 40% climate change allowance and will attenuate flows up to the 1 in 100 annual probability event with climate change. The Proposed Scheme is therefore not predicted to increase flood risk elsewhere associated with an increase in scheme-generated surface water runoff. Changes in catchment hydrology The Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment** provides information about the existing drainage catchments within the vicinity of the Proposed Scheme and how these have been considered in the design of the drainage strategy. Existing catchments will be maintained as far as practicable to limit changes to catchment hydrology. The sensitivity of third party flood risk is **Low** to **High** and the magnitude of impact, prior to additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on third party flood risk prior to the implementation of additional mitigation measures.
Additional mitigation	Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.
Residual effects and monitoring	The sensitivity of third party flood risk is **Low** to **High** and the magnitude of impact, following additional mitigation measures, is **Negligible**. Therefore, there is likely to be a direct, temporary, and short term **Slight** effect (not significant) on third party flood risk following the implementation of additional mitigation measures.

Table 1-29 Assessment of potential effects on flood risk to the Proposed Scheme during operation

Description	Potential effects on flood risk to the Proposed Scheme during operation
Sensitive receptor	Flood risk to the Proposed Scheme
Potential effects	**Appendix 11.1: Flood Risk Assessment** concludes that the Proposed Scheme is not at risk of flooding and is compliant with the criteria set out in the NPPF (**Ref. 11.13**). The sensitivity of flood risk to the Proposed Scheme is **Very High** and the magnitude of impact, prior to additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on flood risk to the Proposed Scheme prior to the implementation of mitigation measures.
Additional mitigation	Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.
Residual effects and monitoring	The sensitivity of flood risk to the Proposed Scheme is **Very High** and the magnitude of impact, following additional mitigation, is **Negligible**. Therefore, there is likely to be a direct, temporary, short term **Slight** effect (not significant) on flood risk to the Proposed Scheme following to the implementation of mitigation measures.

Assessment against Future Baseline

1.7.1 The potential effects of climate change have been assessed in **Appendix 11.1 Flood Risk Assessment** and considered in the design of the proposed surface water drainage system discussed in the Surface Water Drainage Strategy.

Cumulative Effects

1.7.2 Cumulative effects for the Water Environment have been assessed in **Table 1-30** below.

Table 1-30 Committed Developments with the potential for cumulative effects

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
23/00269/F	Proposed product display area and factory retail outlet.	2km north west	It is unlikely that significant cumulative effects on the water environment receptors would occur due to the distance to the Proposed Scheme and no hydraulic connectivity to the Proposed Scheme.

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
20/01957/FM	Construction of 78 affordable dwellings and associated access, infrastructure and landscaping.	3km north	It is unlikely that significant cumulative effects on the water environment receptors would occur due to the distance to the Proposed Scheme and no hydraulic connectivity to the Proposed Scheme.

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
17/01151/OM	Outline Major Application: Sustainable mixed-use urban extension comprising: up to 450 dwellings, a mixed use local centre comprising Class A uses (including retail facilities and public house) and Class D1 (such as creche/day centre/community centre) and B1 uses (such as offices), open space and landscaping, wildlife area, children's play areas, sustainable urban drainage infrastructure, access and link road and associated infrastructure.	3.9km north	It is unlikely that significant cumulative effects on the water environment receptors would occur due to the distance to the Proposed Scheme and no hydraulic connectivity to the Proposed Scheme.

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
23/00195/F	Retrospective: Warehouse extension associated with the existing building to the Southern side of the site.	Adjacent to the south boundary.	It is unlikely that significant cumulative effects on the water environment receptors would occur due to the minor nature of the development. It is assumed that appropriate mitigation has been included within the development to ensure no impacts on nearby surface water features.

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
21/01873/FM	Construction of 226 new homes and associated green space, landscaping and ancillary infrastructure.	1.4km north	It is unlikely that significant cumulative effects on the water environment receptors would occur due to the distance to the Proposed Scheme and no hydraulic connectivity to the Proposed Scheme.
14/01690/OM	Construction of up to 81 dwellings with access road.	3.3km north	It is unlikely that significant cumulative effects on the water environment receptors would occur due to the distance to the Proposed Scheme and no hydraulic connectivity to the Proposed Scheme.

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
14/01114/OM	Outline Application: mixed use development comprising business / industrial / storage and distribution floorspace (Class B1 / B2 / B8), DIY superstore and garden centre (Class A1), limited assortment of discount supermarket (Class A1), Drive-Thru Restaurant (Class A3 / A5), Family Public House (Class A4), Hotel (Class C1), Car Showroom (Sui Generis) and associated access, car parking, road infrastructure, servicing and associated works.	800m north	It is unlikely that significant cumulative effects on the water environment receptors would occur due to no hydraulic connectivity to the Proposed Scheme. It is assumed that appropriate mitigation has been included within the development to ensure no impacts on the surface water features.

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
16/02231/OM	Residential development of the land to provide up to 600 dwellings, incorporating affordable housing, together with a local centre for uses A1, A2, A3 and/or A5 (600m2) with the total quantum of A1 net sales area not to exceed 279m2 in the alternative, D2 community floorspace (up to 500m2), open space, formal sport pitches, a car park to serve Reffley Wood and associated development to include substations, drainage features, roads, cycle and pedestrian paths and other such works.	5.3km north east	It is unlikely that significant cumulative effects on the water environment receptors would occur due to distance to the Proposed Scheme and no hydraulic connectivity to the Proposed Scheme.

Reference Number	Description	Approximate distance from the Proposed Scheme	Cumulative impacts and effects likely
17/01106/OM	Residential development for up to 125 dwellings together with associated works.	4.8 km north	It is unlikely that significant cumulative effects on the water environment receptors would occur due to the distance to the Proposed Scheme and no hydraulic connectivity to the Proposed Scheme.

West Winch Growth Area

1.7.3 It is envisaged that the West Winch Growth Area will deliver up to 4,000 homes, with 2500 being delivered by 2036. The Growth Area will be brought forward by individual developer planning applications and at present, two applications were identified through the Borough Council of King's Lynn and West Norfolk planning portal. It is unlikely that significant cumulative effects on the water environment receptors would occur. It is assumed that appropriate mitigation will be included within the developments to ensure that impacts to surface water and groundwater features are minimised as appropriate. Some increase in sediment and pollution loading during construction would be likely if physical works are undertaken within or adjacent to surface water features at the same time as the construction of the Proposed Scheme, but it is not expected to be significant.

1.8 Opportunities for Environmental Enhancement

1.8.1 There are no opportunities for environmental enhancement as part of the Proposed Scheme regarding the water environment.

1.9 Difficulties and Uncertainties

1.9.1 This assessment has relied upon the accuracy and level of detail of the data sources utilised as part of the desktop assessment. Whilst reasonable checks have been made on data sources and the accuracy of the data, WSP UK Ltd accepts no liability in relation to the report should any data, information or condition be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to WSP UK Ltd.

1.10 Summary

1.10.1 **Table 1-31** provides a summary of the findings of the assessment.

Table 1.31 – Summary of Water Environment Effects

Key to table: P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term

Receptor	Potential Effects	Significance of Effects Prior to Mitigation/Enhancement	Additional Mitigation	Residual Effects	Monitoring
Construction Phase Unnamed Field Drains	Sedimentation Pollution risks Works within the watercourses	**Slight Adverse** (not significant) D / T / ST - LT	Further consultation with the LLFA during the development of the ordinary watercourse consent application would reduce the risk of increased sedimentation and potential effects to the unnamed field drains.	**Slight Adverse** residual effect (not significant)	Any monitoring requirements during construction will be set out in the oCEMP.
Construction Phase The Country Drain	Sedimentation Pollution risks	**Neutral** (not significant) I / T / ST - LT	Not applicable	**Slight** (not significant) I / T / ST - LT	Any monitoring requirements during construction will be set out in the oCEMP.
Construction Phase Middleton Stop Drain	Sedimentation Pollution risks	**Neutral** (not significant) I / T / ST - LT	Not applicable	**Slight** (not significant) I / T / ST - LT	Any monitoring requirements during construction will be set out in the oCEMP.
Construction Phase River Nar	Sedimentation Pollution risks	**Neutral** (not significant) I / T / ST - LT	Not applicable	**Slight** (not significant) I / T / ST - LT	Any monitoring requirements during construction will be set out in the oCEMP.
Construction Phase Surface Water Abstractions	Pollution risks	**Neutral** (not significant) I / T / ST - LT	Not applicable	**Neutral** (not significant) I / T / ST – LT	Any monitoring requirements during construction will be set out in the oCEMP.
Construction Phase Principal bedrock aquifer (Sandringham Sands)	Changes to groundwater quality Changes to water quality on off-site groundwater	**Moderate Adverse** (significant) D / T / ST	Not applicable	**Slight Adverse** (not significant) D / T / ST	Any monitoring requirements during construction will be set out in the oCEMP.

Receptor	Potential Effects	Significance of Effects Prior to Mitigation/Enhancement	Additional Mitigation	Residual Effects	Monitoring
Construction Phase Bedrock Secondary Aquifer – Lowestoft Formation	Changes to groundwater quality Changes to water quality on off-site groundwater	**Slight Adverse** (not significant) D / T / ST	Not applicable	**Slight Adverse** (not significant) D / T / ST	Any monitoring requirements during construction will be set out in the oCEMP.
Construction Phase Superficial deposits	Changes to groundwater quality Changes to water quality on off-site groundwater	**Slight Adverse** (not significant) D / T / ST	Not applicable	**Slight Adverse** (not significant) D / T / ST	Any monitoring requirements during construction will be set out in the oCEMP.
Construction Phase Third party flood risk	Fluvial Flood Risk Surface Water Flood Risk	**Neutral** (not significant) D / T / ST	Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.	**Slight** (not significant) D / T / ST	Not applicable
Construction Phase Flood risk to the Proposed Scheme	Fluvial Flood Risk Surface Water Flood Risk	**Neutral** (not significant) D / T / ST	Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.	**Slight** (not significant) D / T / ST	Not applicable
Operation Phase Unnamed Field Drains	Pollution risks Installation of culverts Changes in catchment hydrology	**Slight Adverse** (not significant) D / P / LT	Additional mitigation measures in relation to the unnamed field drains in relation to the proposed culverts is available in **Appendix 11.1: Flood Risk Assessment**.	**Slight Adverse** (not significant) D / P / LT	Not applicable
Operation Phase The Country Drain	Pollution risks	**Neutral** (not significant) I / P / LT	Not applicable	**Slight Adverse** (not significant) I / P / LT	Not applicable
Operation Phase Middleton Stop Drain	Pollution risks	**Neutral** (not significant) I / P / LT	Not applicable	**Slight Adverse** (not significant) I / P / LT	Not applicable
Operation Phase River Nar	Pollution risks	**Neutral** (not significant) I / P / LT	Not applicable	**Slight Adverse** (not significant) I / P / LT	Not applicable

Receptor	Potential Effects	Significance of Effects Prior to Mitigation/Enhancement	Additional Mitigation	Residual Effects	Monitoring
Operation Phase Surface Water Abstractions	Pollution risks	**Neutral** (not significant) I / P / LT	Not applicable	**Neutral** (not significant) I / P / LT	Not applicable
Operation Phase Principal bedrock aquifer (Sandringham Sands)	Potential increase in physical contamination and chemical contamination of groundwater aquifers Major spillage of contamination	**Moderate Adverse** (significant) D / P / LT	Filtration within the surface water drainage system to filter out the physical and chemical contaminants. Also, ensuring that spillages can be contained prior to discharging to the receiving watercourses.	**Slight Adverse** (not significant) D / P / LT	Not applicable
Operation Phase Bedrock Secondary Aquifer – Lowestoft Formation	Potential increase in physical contamination and chemical contamination of groundwater aquifers Major spillage of contamination	**Slight Adverse** (not significant) D / P / LT	Filtration within the surface water drainage system to filter out the physical and chemical contaminants. Also, ensuring that spillages can be contained prior to discharging to the receiving watercourses.	**Slight Adverse** (not significant) D / P / LT	Not applicable
Operation Phase Superficial deposits	Potential increase in physical contamination and chemical contamination of groundwater aquifers Major spillage of contamination	**Slight Adverse** (not significant) D / P / LT	Filtration within the surface water drainage system to filter out the physical and chemical contaminants. Also, ensuring that spillages can be contained prior to discharging to the receiving watercourses.	**Slight Adverse** (not significant) D / P / LT	Not applicable
Operation Phase Third party flood risk	Surface Water Flood Risk Changes in catchment hydrology	**Neutral** (not significant) D / T / ST	Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.	**Slight Adverse** (not significant) D / T / ST	Not applicable

Receptor	Potential Effects	Significance of Effects Prior to Mitigation/Enhancement	Additional Mitigation	Residual Effects	Monitoring
Operation Phase Flood risk to the Proposed Scheme	Surface Water Flood Risk	**Neutral** (not significant) D / T / ST	Measures regarding surface water management during the construction of the Proposed Scheme are detailed in the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment**. Additional mitigation measures in relation to flood risk are found in **Appendix 11.1: Flood Risk Assessment**.	**Slight Adverse** (not significant) D / T / ST	Not applicable

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Figures

Figure 1-1 Water Environment Study Area

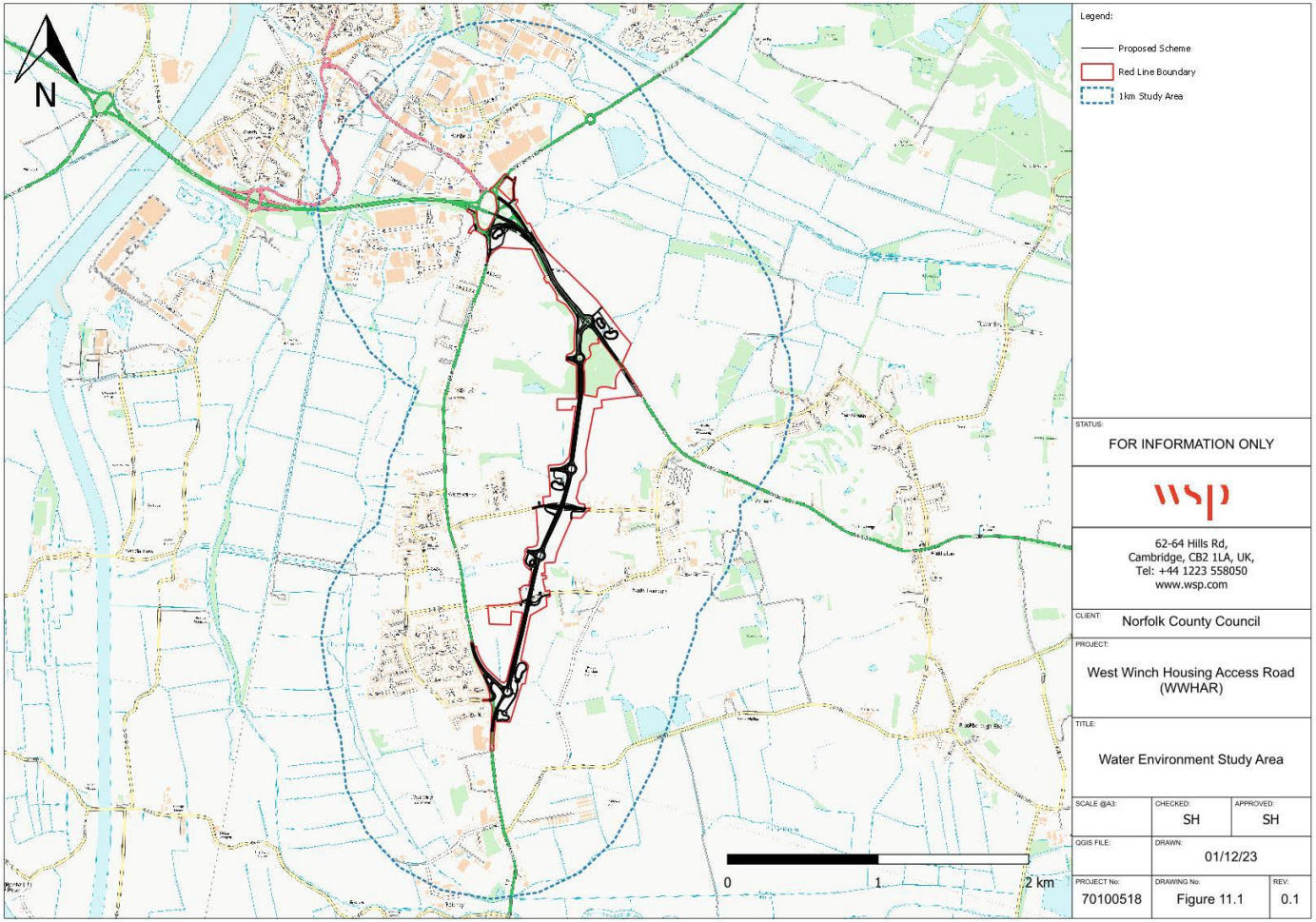

Figure 1-2 Water Environment Key Sensitive Receptors