The Sizewell C Project

6.4 Volume 3 Northern Park and Ride

Chapter 12 Groundwater and Surface Water

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Contents

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Plates

None Provided.

Figures

Appendices

None Provided.

12. Groundwater and Surface Water

12.1 Introduction

12.1.1 This chapter of **Volume 3** of the **Environmental Statement** (**ES**) presents an assessment of the potential effects on groundwater and surface water arising from the construction, operation and removal and reinstatement of the northern park and ride at Darsham (referred to throughout this volume as the 'proposed development'). This includes an assessment of potential impacts, the significance of effects, the requirements for mitigation and the residual effects.

12.1.2 Detailed descriptions of the northern park and ride site (referred to throughout this volume as the 'site'), the proposed development, and the different phases of development are provided in **Chapters 1** and **2** of this volume of the **ES**. A glossary of terms and list of abbreviations used in this chapter is provided in **Volume 1, Appendix 1A** of the **ES**.

12.1.3 The Government's Good Practice Guide for Environmental Impact Assessment (EIA)[1] (Ref. 12.1) outlines the potential environmental effects that should be considered for groundwater and surface water, for example the physical effects of the development and effects on groundwater. Further information on these topics and those which have been scoped into the assessment can be found in **section 12.3** of this chapter.

12.1.4 This assessment has been informed by data from the following assessments:

- **Appendix 11A** of this volume: northern park and ride site, Darsham: Phase 1 Desk Study Report, 2020;
- **Appendix 11B** of this volume: Conceptual site models;
- **Appendix 11C** of this volume: Impact assessment tables;
- **Northern Park and Ride Flood Risk Assessment** (**FRA**) (Doc Ref. 5.3); and
- **Water Framework Directive** (**WFD**) **Compliance Assessment** (Doc Ref. 8.14).

[1] This document has been withdrawn but still constitutes good advice and should be referred to in the absence of alternative guidance.

12.2 Legislation, policy and guidance

12.2.1 **Volume 1, Appendix 6O** of the **ES**, identifies and describes legislation, policy and guidance of relevance to the assessment of the potential groundwater and surface water impacts associated with the Sizewell C Project across all ES volumes.

12.2.2 This section provides an overview of the specific legislation, policy and guidance specific to the assessment of the proposed development.

a) International

12.2.3 International legislation or policy relevant to the groundwater and surface water assessment includes:

- Water Framework Directive 2000/60/EC (Ref.12.2).
- Groundwater Daughter Directive 2006/118/EC (Ref.12.3).
- The Discharge of Dangerous Substances into the Aquatic Environmental Directive 2006/11/EC (Ref.12.4).

12.2.4 The requirements of these, as relevant the groundwater and surface water assessment, are described in **Volume 1**, **Appendix 6O** of the **ES**.

b) National

i. Legislation

12.2.5 National legislation relevant to the groundwater and surface water assessment includes:

- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref.12.5).
- Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 (Ref.12.6).
- Environmental Permitting Regulations (England and Wales) 2016 (Ref.12.7).
- Water Resources Act 1991 (Ref.12.8).
- Water Act 2003 (Ref.12.9).

- Flood and Water Management Act 2010 (Ref.12.10).

12.2.6 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES.**

ii. Planning policies

12.2.7 The National Policy Statements (NPS) set out national policy for energy infrastructure. The overarching NPS for Energy (EN-1) (Ref. 12.11) and NPS for Nuclear Power Generation (EN-6) (Ref. 12.12) provide the primary policy framework within which the development will be considered. A summary of the relevant planning policy, together with consideration of how these have been taken into account, is provided in **Volume 1, Appendix 6O** of the **ES**.

12.2.8 Other national policies relevant to the groundwater and surface water assessment includes the National Planning Policy Framework (NPPF) (Ref. 12.13).

12.2.9 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

c) Regional

12.2.10 Regional policies relevant to the groundwater and surface water assessment includes:

- Environment Agency Anglian River Basin Management Plan (RBMP) (Ref.12.14).
- the East Suffolk Abstraction Licensing Strategy 2017 (Ref.12.15).
- Environment Agency East Suffolk Catchment Flood Management Plan 2009 (Ref.12.16).

12.2.11 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

d) Local

12.2.12 Local policies relevant to the groundwater and surface water assessment includes:

- Suffolk Flood Risk Management Strategy (Ref.12.17).
- Strategic Flood Risk Assessment (Ref.12.18).

- Suffolk Coastal District Council (SCDC) Local Plan Core Strategy and Development Management Policies (Ref.12.19).
- SCDC Final Draft Local Plan (Ref.12.20).

12.2.13 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

e) Guidance

12.2.14 Guidance relevant to the groundwater and surface water assessment includes:

- Planning Practice Guidance (Ref. 12.21).
- Government's 25 Year Environment Plan (Ref. 12.22).
- The Government's Good Practice Guide (Ref. 12.23) for EIAs.
- The Groundwater Protection Position Statements Guidance (Ref. 12.24).
- Control of water pollution from construction sites: A guide to good practice, Construction Industry Research and Information Association (CIRIA) (2001) (Ref. 12.25).
- Environment Agency's Pollution Prevention Guidelines: Working on construction sites (Ref. 12.26).
- The Design Manual for Roads and Bridges (DMRB) (2008) Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects (Ref. 12.27).
- DMRB (2009) Volume 11, Section 3, Environmental Assessment Techniques (Ref. 12.28).

12.2.15 The requirements of these, as relevant to the groundwater and surface water assessment, are described in **Volume 1, Appendix 6O** of the **ES**.

12.3 Methodology

a) Scope of the assessment

12.3.1 The generic EIA methodology is detailed in **Volume 1**, **Chapter 6** of the **ES**.

12.3.2 The full method of assessment for groundwater and surface water that has been applied for the Sizewell C Project is included in **Volume 1**, **Appendix 6O** of the **ES**.

12.3.3 This section provides specific details of the groundwater and surface water methodology applied to the assessment of the proposed development, and a summary of the general approach to provide appropriate context for the assessment that follows. The scope of this assessment considers the impacts of the construction, operation and removal and reinstatement phases of the proposed development.

12.3.4 The scope of this assessment has been established through a formal EIA scoping process undertaken with the Planning Inspectorate (PINS). A request for an EIA scoping opinion was initially issued to the PINS in 2014, with an updated request issued in 2019, see **Volume 1, Appendix 6A** of the **ES**.

12.3.5 Comments raised in the EIA scoping opinion received in 2014 and 2019 have been taken into account in the development of the assessment methodology. These are detailed in **Volume 1, Appendices 6A** to **6C** of the **ES.**

12.3.6 The Government's Good Practice Guide for EIA states that the following potential environmental effects should be considered for water environment:

- levels and effects of emissions to water from the development;
- abstractions of/effects on surface or groundwater resources;
- effects of development on drainage or run-off pattern in the area;
- changes to groundwater level, watercourses and flow of underground water;
- crossings of watercourses; and
- effects of pollutants on water quality.

12.3.7 Additionally, consideration should be given to flood risk as well as WFD compliance, and their interactions with other assessments such as geology and land quality, and terrestrial ecology and ornithology assessments.

12.3.8 Potential impacts from existing and new contamination sources on controlled waters have been considered as part of the geology and land quality assessment in **Chapter 11** of this volume, to determine and classify potential effects associated with ground contamination. Further assessment of effects from contamination to groundwater and surface water is reported in this chapter.

b) Consultation

12.3.9 The scope of the assessment has also been informed by ongoing project-wide consultation and engagement with statutory consultees throughout the design and assessment process as outlined in **Volume 1, Appendix 6O** of the **ES**.

c) Study area

12.3.10 The study area for the consideration of effects from contaminative sources on controlled waters is discussed in **Chapter 11** of this volume and includes the site and land immediately beyond it to a distance of 500 metres (m) from the site boundary. This is hereafter referred to as the inner study area.

12.3.11 The size of the inner study area takes into account the transport of potential contaminants of concern in the environment, and the connectivity of these contaminants via pathways of migration or exposure to the receptors and resources identified.

12.3.12 The general methodology adopted for the consideration of effects on groundwater and surface water levels and flows, and water dependent receptors and resources extends beyond this inner study area to a distance of 1 kilometre (km) from the site boundary. This is termed the outer study area.

12.3.13 The size of the outer study area allows for any potential physical changes resulting from the proposed development that may propagate through the water environment, and beyond the inner study area to be assessed.

12.3.14 The site boundary and study areas are presented in **Figure 12.1** of this volume.

d) Assessment scenarios

12.3.15 The assessment of effects on the water environment includes the assessment of the construction, operational and the removal and reinstatement phases of the proposed development, rather than the assessment of specific years.

e) Assessment criteria

12.3.16 As described in **Volume 1**, **Chapter 6** of the **ES**, the EIA methodology considers whether impacts of the proposed development would have an effect on any receptors or resources. Assessments broadly consider the magnitude of impacts, and value/sensitivity of receptors/resources that could be affected in order to classify effects.

i. Assessment of physical impacts

12.3.17 Physical impacts include:

- changes or alterations to water levels and flow regimes of groundwater and surface water receptors and resources; and
- changes to water dependent groundwater and surface water receptors and resources .

12.3.18 The assessment criteria of physical impacts on groundwater and surface water receptors and resources are based on the methodology provided in **Volume 1, Appendix 6O** of the **ES** and summarised in the following sub-sections.

Sensitivity

12.3.19 The assessment of assigning the levels of sensitivity to receptors and resources is set out in **Table 12.1**.

Table 12.1: Assessment of the value or sensitivity of receptors and resources for groundwater and surface water.

Value or Sensitivity.	Description
High	An attribute with a high quality/rarity, international or national significance that has a low capacity to accommodate disturbance or change.

Value or Sensitivity.	Description
Medium	An attribute with high quality/rarity, national scale and some resilience to disturbance or change. An attribute with high quality/rarity, at a regional scale that has a low capacity to accommodate disturbance or change. An attribute with medium quality/rarity, national scale that has a low capacity to accommodate disturbance or change.
Low	An attribute with medium quality/rarity, national or regional scale and some resilience to disturbance or change. An attribute with low quality/rarity, national or regional scale and some resilience to disturbance or change.
Very Low.	An attribute with low quality/rarity, regional and local scale and resilience to disturbance or change.

Magnitude

12.3.20 The magnitude of a potential impact is estimated based on the likely level of change and is independent of the importance of the feature. The definitions of magnitude classifications are provided in **Table 12.2**.

Table 12.2: Assessment of magnitude of impact on groundwater and surface water.

Magnitude	Criteria
High	Large-scale permanent/irreversible, or long-term temporary, changes over the whole development area and potentially beyond (such as off-site) to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Medium	Medium-scale permanent/irreversible, or medium-term temporary, changes over the majority of the development area and potentially beyond, to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Low	Noticeable but small-scale change, permanent or temporary changes over a partial area, to key characteristics or features of the particular environmental aspect's character or distinctiveness.
Very Low.	Noticeable, but very small-scale change, or barely discernible changes for any length of time, over a small area, to key characteristics or features of the particular environmental aspect's character or distinctiveness.

12.3.21 Where the assessment of potential impact concludes that through careful design, and the application of appropriate mitigation, there will be no discernible change (no impact) to a receptor or resource, then a conclusion of no effect will be drawn.

12.3.22 Given the timescales of the Sizewell C Project, the nature of potential changes to the water environment from the proposed development and their reversibility, the definitions of temporary impacts are categorised as follows:

- short-term = less than six months;
- medium-term = between six months and six years; and
- long-term = more than six years.

Effect definition

12.3.23 The classification of the likely effect for groundwater and surface water was determined using the matrix presented in **Table 12.3**.

Table 12.3: Classification of effects.

		Value/Sensitivity of Receptor.			
		Very Low.	Low	Medium	High
Magnitude	Very Low.	Negligible	Negligible	Minor	Minor
	Low	Negligible	Minor	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major
	High	Minor	Moderate	Major	Major

12.3.24 An effect can be ‘adverse’ or ‘beneficial’ depending on the nature of impact on the quality and integrity on the receptor or resource. For example, an adverse effect would be where there would be a loss or damage to the quality or integrity of an attribute, whereas a beneficial effect would arise from the creation of a new or an improvement to an attribute.

12.3.25 Following the classification of an effect as presented in **Table 12.3**, a clear statement is made as to whether the effect is 'significant' or 'not significant'. As a general rule, major and moderate effects are considered to be significant, and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where appropriate.

ii. Assessment of contamination to controlled waters

12.3.26 The assessment of potential impacts from existing and new contamination sources on controlled waters has been considered as part of the geology and land quality assessment in the production of the Preliminary Conceptual Site Model (PCSM) to determine and classify potential effects.

12.3.27 Further details on the methodology applied is provided in **Volume 1, Appendix 6N** of the **ES**, and summarised in **Chapter 11** of this volume.

iii. Water Framework Directive compliance

12.3.28 WFD impacts are assessed differently to the approach conventionally used within the EIA process, and require an assessment of whether a project (or an element of a project) is compliant or non-compliant with the environmental objectives outlined in Article 4 of the WFD.

12.3.29 The significance of effects on WFD status relates only to compliance or non-compliance. Non-compliance will only occur because of permanent impacts that cannot be mitigated, irrespective of the degree of vulnerability to change of the receptor. The assessment in this context will be restricted to either compliance or non-compliance.

12.3.30 The **WFD Compliance Assessment** (Doc Ref. 8.14) has been provided as a separate document as part of this application for development consent. The main conclusions with relevance to the activities considered as part of the EIA are summarised in this chapter.

iv. Flood risk assessment

12.3.31 The **Northern Park and Ride at Darsham FRA** (Doc Ref. 5.3) has been provided as a separate document as part of this application for development consent. The main conclusions from the FRA with relevance to the potential flood sources affecting the site, and the impacts that the proposed development would have on altering the flood risk levels relating to the surrounding surface water receptors are summarised in this chapter.

f) Assessment methodology

12.3.32 **Volume 1**, **Chapter 6** sets out the broad approach to impact assessment employed within the overall **ES**. This section details the approach to the assessment of impacts specifically relating to groundwater and surface water.

i. General approach

12.3.33 The approach to the groundwater and surface water assessment comprises:

- establishing the baseline conditions for the study area with respect to geology, hydrology, hydrogeology, and water dependent resources and receptors;

- identification of potential impacts on identified water dependent resources and receptors from the construction, operation and removal and reinstatement phases of the proposed development;
- assessment of the significance of likely effects from the proposed development including the consideration of primary and tertiary mitigation measures; and
- identification of any residual effects and secondary mitigation where required.

12.3.34 The assessment also considers the findings of the **WFD compliance assessment** (Doc Ref. 8.14) and **Northern Park and Ride FRA** (Doc Ref. 5.3).

ii. Existing Baseline

12.3.35 Existing baseline conditions are defined based on available published and site-specific information.

12.3.36 The baseline assessment has relied on existing data, previous desk study and historical records. The following sources have been reviewed:

- publicly available information from the British Geological Survey (BGS) online mapping resource (Ref. 12.29);
- publicly available information from the Environment Agency (Ref. 12.30 and Ref. 12.31);
- publicly available information from the Defra's Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref. 12.32); and
- **Appendix 11A** of this volume: Northern Park and Ride Desk Study report which includes the Landmark Envirocheck Report for the site and study area, and details of the site walkover.

12.3.37 It is noted that the Envirocheck report was obtained in 2012. Updated information has therefore been obtained from publicly available sources of information. Information obtained during the site walkover undertaken in 2019 was also used to determine whether there had been any substantial changes between 2012 and present day. No substantial changes have been identified.

iii. Future baseline

12.3.38 The future baseline is typically established upon extrapolating the current baseline using technical knowledge of changes (for example changes in rainfall), and future climate forecasts to predict the environmental conditions at a future point in time. This assessment considers future baseline conditions solely in the context of known future developments and predictable changes in the quality of receptors (for example forecast improvements in the status of WFD water bodies).

iv. Assessment

12.3.39 Potential changes to the water environment in terms of water levels, flow and quality are considered qualitatively against baseline conditions. Should a significant effect be identified at the end of the qualitative assessment, a more detailed quantitative appraisal of potential impacts on water levels and flow has been undertaken to determine the magnitude and extent of potential changes.

g) Assumptions and limitations

12.3.40 The following assumptions have been made in this assessment:

- Excavation works carried out as part of the proposed development will mostly involve soil stripping, and the construction of Sustainable Drainage System (SuDS) features and would likely be shallow and therefore it is assumed that they will not intercept the water table.
- Surface water discharge will be managed so it does not exceed the predetermined Greenfield run-off rates in accordance with the **Outline Drainage Strategy** provided in **Volume 2, Appendix 2A** of the **ES.**
- Environmental Quality Standards prescribed for downstream designated WFD water bodies have been adopted for upstream, non-designated watercourses for the purposes of this assessment, in order to consider the worst case scenario.
- The treated foul sewage would be discharged to ground.

12.3.41 The following limitations have been identified:

- Ground investigation has not been carried out at the site at the time of writing, but will be undertaken prior to the commencement of construction. Therefore, no observed information about the ground

conditions at the site or encountered groundwater levels were available for the production of this assessment. Publicly available information from the BGS such as historical borehole logs has been used to inform the assessment.

- No groundwater quality data is available for the site, however given the site setting and historical land use there is a low risk of poor quality groundwater. Potential sources of contamination have been considered in **Chapter 11** of this volume and this has informed the assessment.

12.4 Baseline environment

12.4.1 This section presents a description of the baseline environmental characteristics within the site of the proposed development and in the surrounding area.

12.4.2 Further detail can be found in northern park and ride site, Darsham: Phase 1 Desk Study Report provided in **Appendix 11A** of this volume.

a) Current baseline

i. Site walkover

12.4.3 A site walkover was undertaken during March 2019 to gain further information on the site setting and study area, to consider the context of the site, and to support the desk study mapping and aerial photographs. The site is currently open fields and farmed agricultural land, with Darsham service station 30m to the south-east and Darsham railway station located adjacent to the southern site boundary. A pond was identified within the site, adjacent to the boundary with Moate Hall. No groundwater emergences were identified. Further details on observations made during the site walkover including photographs can be found in the desk study provided in **Appendix 11A** of this volume.

ii. Topography

12.4.4 Light Detection and Ranging data show that the highest ground levels, above 32m Above Ordnance Datum (AOD), are located in the north-east corner of the site. Ground levels are lower in the south and west of the site, with the lowest ground levels slightly below 22m AOD at the south-west edge.

iii. Geology

12.4.5 Online BGS mapping shows that the superficial geology underlying the majority of the site is the Lowestoft Formation, specifically diamicton (boulder clay). The Lowestoft Formation is formed of a sheet of chalky till, together

with outwash sands and gravels, silts, and clays. A thin strip of land along the western site boundary is underlain by Head (windblown) deposits, comprising clay, silt, sand and gravel deposits. Although not shown on the online BGS mapping, Made Ground is expected to be present along the East Suffolk line which is adjacent to the south-west and north-west sections of the site.

12.4.6 Online BGS mapping shows that the bedrock geology beneath the site comprises the Crag Group. The Crag Group is made up of shallow water marine and estuarine sands, gravels, silts and clays. Beneath the Crag Group is the London Clay Formation and the Chalk Group.

12.4.7 There are no BGS borehole scans or trial pits within the inner study area. Within the outer study area, the closest borehole scan (ref. TM37SE18) is located at National Grid Reference (NGR) 639750E 270780N which is approximately 750m to the north-west of the site boundary. This borehole shows a thickness of Lowestoft Formation (diamicton) of approximately 20m, underlain by approximately 30m of Crag Group.

12.4.8 Further detail on the geology of the site is presented in **Chapter 11** of this volume.

iv. Hydrogeology

12.4.9 The Environment Agency classifies the Head Deposits and the diamicton of the Lowestoft Formation as Secondary Aquifers (undifferentiated)[2]. The Crag Group bedrock underlying the site is classified as a Principal Aquifer[3].

12.4.10 The study area does not lie within or adjacent to a groundwater Source Protection Zone (SPZ)[4] The study area is not within a groundwater drinking water safeguard zone.

12.4.11 Current groundwater levels at the site are not known. Contours shown on BGS hydrogeological mapping (Ref. 12.33) suggest that groundwater levels within the Crag Group may be around 7m AOD (approximately 20m below ground level (bgl)) at the site. These contours are based on data from 1976, and are only indicative of current levels, however the hydrogeological regime

[2] A Secondary (Undifferentiated) Aquifer is designated in cases where it has not been possible to attribute either category Secondary A or Secondary B to a rock type.
[3] Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
[4] Groundwater Source Protection Zones are areas defined around groundwater sources used for public drinking water supply. The SPZ shows the risk of contamination from activities that might cause pollution in the area. The closer the activity, the greater the risk

is not considered likely to have changed substantially in the intervening years.

12.4.12 The Lowestoft Formation (diamicton) at the site is expected to be of relatively low permeability, and therefore have a limited hydraulic connection to the underlying Crag groundwater. It is likely that there are perched water tables in permeable lenses within the Lowestoft Formation (diamicton).

12.4.13 The site is located on the Waveney and East Suffolk Chalk and Crag groundwater body (groundwater body ID GB40501G400600). The Environment Agency catchment data explorer 2016 classification shows that this groundwater body as being of Poor quantitative and Poor chemical status, with an objective to be of Good quantitative and Good chemical status by 2027. The Poor chemical status is attributed to impacts from agriculture as evidenced by elevated nitrate concentrations in groundwater. The site falls within a groundwater Nitrate Vulnerable Zone.

v. Surface water features

12.4.14 The site is located within the River Yox catchment. The Environment Agency's Catchment Data Explorer (Ref. 12.34) defines the reach in the vicinity of the site as the Minsmere Old River water body (water body ID GB105035046270)) as presented in **Figure 12.1** of this volume. The catchment of the Minsmere Old River water body is drained by four principal rivers, namely the River Yox, Minsmere River, Minsmere New Cut River and the Minsmere Old River. Only the River Yox falls within the study area. The River Yox is located approximately 920m to the south of the site. The A12 road separates the site from this watercourse. According to the Environment Agency 2016 classification the Minsmere Old River water body has an overall classification of Moderate ecological potential and for the purpose of this assessment, these standards have been applied to the River Yox.

12.4.15 An unnamed watercourse originates in the east of Martins Farm, approximately 275m to the north-west of the site. The watercourse crosses the East Suffolk line to the south of Willow Marsh Lane crossing, and flows southwards along the western boundary of the site. The channel crosses back beneath the East Suffolk line to the south of Little Nursery Wood, and flows to the west of Darsham railway station and ultimately joins the Minsmere River approximately 1.2km south-east of the site. This watercourse receives surface water drainage from the site.

12.4.16 A series of ponds are also located within and in close proximity to the site. The only pond within the site, is located in the woodland immediately to the west of Moate Hall, was confirmed in the site walkover and reported in the northern park and ride Phase 1 Desk Study Report, 2019 provided in

Appendix 11A of this volume. Several other pond features are shown on available online mapping in the grounds of Moate Hall (approximately 40m from the site boundary), Darsham Cottage (approximately 60m from the site boundary), and White House Farm to the north (approximately 630m from the site boundary), and a larger pond adjacent to the unnamed road to Darsham Old Hall to the south of the A12 which is approximately 340m from the site boundary.

vi. Water quality

12.4.17 The 2016 physico-chemical and chemical data presented on the Environment Agency's Catchment Data Explorer for the Minsmere Old River water body have been reviewed to characterise the Minsmere Old River catchment. The chemical status of the river is Good.

12.4.18 Physico-chemical data indicate that the Minsmere Old River near the site boundary is at Good or High status for ammonia, biochemical oxygen demand, dissolved oxygen, pH, phosphate and temperature, and are not adversely affected by pollutants such as copper, triclosan and zinc. The water body is at Good physico-chemical status.

12.4.19 However, there is evidence of poor water quality (high turbidity) throughout the unnamed tributary of the Minsmere Old River adjoining the site, in particular, between the points where the channel crosses underneath the East Suffolk line. This may be a result of run-off from the East Suffolk line, road, agricultural land, and/or residential properties.

12.4.20 No groundwater quality data is available for the site.

vii. Groundwater and surface water interaction

12.4.21 Given the local geology and assumed depth to groundwater it is not considered that there is a substantial connection between groundwater and the surface water features identified. There may be local interaction between discrete water bodies in the Lowestoft Formation (diamicton) aquifer and surface water.

viii. Water abstractions

Groundwater

12.4.22 One licensed groundwater abstraction is located within the outer study area. This is detailed in **Table 12.4** and shown on **Figure 12.1** of this volume.

Table 12.4: Licensed groundwater abstractions within the outer study area.

Licence Number	Location Including National Grid Reference (NGR)	Source	Purpose	Maximum Annual Abstraction (m^3)
7/35/03/*G/0076.	641200 269300 (805m south-east of site).	Groundwater	General farming and domestic.	3,600

12.4.23 There is the potential for unknown Private Water Supplies (PWS) to be in use within the outer study area. Should any PWS exist, they would likely be associated with the farm buildings and residential properties in the study area.

Surface water

12.4.24 One licensed surface water abstraction is located within the outer study area. This is detailed in **Table 12.5** and shown on **Figure 12.1** of this volume.

Table 12.5: Licensed surface water abstractions within the outer study area.

Licence Number	Location Including National Grid Reference (NGR)	Source	Purpose	Maximum Annual Abstraction (m^3)
7/35/03/*S/0050.	640340 268760 (960m south of site).	Surface water (River Yox).	General Agriculture: Spray Irrigation – Direct. Seasonal – abstraction only 01 May to 30 Sept.	Not provided in Envirocheck.

v. Fluvial geomorphology

12.4.25 The surface watercourses in the area are typical of lowland, low energy drainage systems. Many of the channels are entirely artificial, and the natural channels have been extensively modified (probably to facilitate drainage and use of the surrounding marshland as grazing marsh).

12.4.26 Geomorphology and hydromorphology are key factors contributing to whether a water body can achieve or maintain Good Ecological Status.

12.4.27 Sediment deposition and, when flows have sufficient energy, transport are likely to be the dominant fluvial processes which operate in the Minsmere Old

River. The behaviour of the fluvial system is largely dominated by artificial modifications, principally the operation of the Minsmere Sluice, which is operated by the Environment Agency. Minsmere Sluice prevents free drainage during high tide or increased water levels. The management of the floodplain drainage systems by the East Suffolk Internal Drainage Board, Suffolk Wildlife Trust and the Royal Society for the Protection of Birds is also likely to affect the geomorphology of the drainage system.

12.4.28 The unnamed tributary of the Minsmere Old River channel located at the bottom of a slope at the western boundary of the site appears to have been modified (straightened for land drainage purposes). The Minsmere Old River water body is designated as a Heavily Modified Water Body. The hydrological regime is of sufficient quality to support Good status.

vi. Flood risk

12.4.29 The East Suffolk Council Strategic FRA did not identify any historic flooding as having occurred within the site. However, the maps do identify two cases of highways drainage flooding that has occurred immediately south of the site, near Darsham railway station.

12.4.30 The Environment Agency's Flood Map for Planning indicates that the site is located in Flood Zone 1, and has a low risk of flooding from rivers or the sea without defences, as shown on **Figure 12.1** of this volume. The Environment Agency's long-term flood risk mapping shows that the majority of the site is also at very low risk of flooding from surface water. However, there a potential surface water flow route is indicated along the western site boundary. This flow route runs from north to south and connects to the unnamed watercourse located immediately west of Darsham railway station, before discharging to the Minsmere River to the south.

12.4.31 An area of high surface water flood risk is located at the northern end of the site. It is suggested that the lower topography adjacent to the A12 to the west leads to pooling of surface water during peak flow events.

12.4.32 Smaller isolated areas of low to high surface water flood risk are also located within the site. Analysis of topographic data shows these are a mixture of topographically low points, ridges and furrows associated with existing agricultural land drainage and management.

12.4.33 Further information on flood risk at the site is provided in the **Northern Park and Ride at Darsham FRA** (Doc Ref. 5.3), which has been submitted as part of this application for development consent.

vii. Historic and environmentally sensitive sites

12.4.34 A review of the MAGIC website has confirmed that there are no internationally or nationally designated ecological sites within the outer study area as shown on **Figure 7.1** of this volume.

12.4.35 The lower reaches of the Minsmere Old River system has been designated for its nature conservation value. The southern parts of the surface water drainage network comprise the nationally and internationally designated Minsmere to Walberswick Heaths and Marshes Special Area of Conservation, Special Protected Area, Ramsar site and Site of Special Scientific Interest approximately 3.2km to the east of the site.

12.4.36 Further consideration of designated historic and ecological sites, both statutory and non-statutory is given in terrestrial ecology and ornithology and terrestrial historic environmental chapters provided in **Chapters 7** and **9** respectively of this volume.

viii. Existing buildings

12.4.37 Changes in groundwater level have the potential to affect building foundations. There are no existing buildings present on-site, however, there are several farms and associated buildings within the outer study area, including White House Farm located east adjacent to the site and Brakes Lane Farm located north-east adjacent to the site. Darsham railway station is located south adjacent to the site, as well as residential properties of Darsham Village approximately 600m to the east.

12.4.38 Further consideration of existing buildings within the study area is given in **Chapter 9** of this volume.

ix. Potential for existing contamination

12.4.39 The following potential existing contamination sources are discussed in **Chapter 11** of this volume:

- historical site usage;
- waste management sites;
- service stations;
- industrial and other potentially contaminative land uses; and
- potential for Unexploded Ordnance.

12.4.40 The potential sources of contamination at the proposed development are presented in the PCSM in **Chapter 11** of this volume.

x. Summary of key receptors

12.4.41 The key receptors for potential effects are summarised in **Table 12.6.**

Table 12.6: Key receptors within the study area.

Receptor	Receptor Sensitivity to Physical Effects.	Receptor Sensitivity to Contaminative Effects.
Crag groundwater (Principal Aquifer).	Medium	Medium
Head Deposits groundwater (Secondary Aquifer (Undifferentiated)).	Very low.	Medium
Lowestoft Formation groundwater (Secondary Aquifer (Undifferentiated)).	Very low.	Medium
Groundwater abstraction 7/35/03/*G/0076.	Medium	Medium
Potential PWS.	Medium	Medium
Existing buildings.	Medium	Low
Surface Water abstraction.	Medium	Low
River Yox (Main River).	Medium	Low
Tributary of River Yox (ordinary watercourse).	Very low.	Low
Existing pond within the site.	Very low.	Low

b) Future baseline

12.4.42 Committed developments have been considered as future receptors in the assessment of ground and surface water impacts during the construction, operation and removal and reinstatement phases of the proposed development. Three relevant committed developments have been identified within the study area, and are summarised in **Table 12.7.**

Table 12.7: Committed developments.

Planning Application Ref.	Site Address.	Description of Development.	Date of Approval.	Status	Distance from Site (m).
DC/14/0420/OUT.	Land Between Station Garage and Railway Cottage Main Road Darsham Suffolk.	Erection of 82-bedroom hotel, car parking and associated works.	02/05/2014 Reserved matters application approved 23 June 2017 (DC/17/1769/ARM).	Construction not commenced.	29
DC/13/2933/OUT	Land to the rear of 1 and 2 Chapel Cottages adjoining the street Darsham Suffolk.	Erection of new village hall, creation of village green, erection of 20 houses including 6 affordable homes, access and private roads.	18/06/2015	Construction has not started (2019 google maps), trail trenching has started.	592
DC/18/1394/FUL	Beaubelle, Part Side Garden Westleton Road Yoxford IP17 3LD	Construction of 2 new two storey private residential dwellings with upgraded vehicular access, parking & turning area.	26/08/2016	Construction not commenced	681

12.4.43 The construction timeline for this committed development is unconfirmed. However, planning permissions generally require construction to commence within three years of the grant of planning permission or reserved matters approval before the planning permission lapses. As such, and for the purposes of this assessment, it has been assumed that the development will have been constructed prior to 2022. This committed development has therefore been considered as future receptor as part of the baseline for the groundwater and surface water assessments.

12.4.44 There is not anticipated to be any change to aquifer classification as a result of any stage of the development.

12.4.45 As the length of the construction, operational and removal and reinstatement phases of the proposed development will cover a period of 9-12 years, changes to the WFD status of the Minsmere Old River Water Body could be

realised, relating to the default 'good status' been achieved by 2027 and beyond. Although WFD status is only relevant to the **WFD Compliance Assessment** (Doc Ref. 8.14). By-products, such as improved water quality, geomorphology or biology as a result of WFD implementation should be considered within the evolution of the future baseline.

12.4.46 The future baseline of the Minsmere Old River Water Body from a WFD perspective does not envisage any change to the status of the water body as a result of the proposed development. Factors confirming that the existing ecological qualities of the Minsmere Old River will be maintained as the future baseline include:

- the Minsmere Old River already supports Good hydromorphological elements, thus this quality cannot be improved;
- biological quality elements will remain Poor due to the unfavourable balance of costs and benefits to improve the status of fish within the system. This is due to physical modifications such as hard barriers and land drainage for agriculture and rural land management; and
- due to the Poor biological status that is not anticipated to improve, the ecological status will remain as Moderate throughout the construction, operation, and removal and reinstatement phases of the proposed development.

12.5 Environmental design and mitigation

12.5.1 As detailed in **Volume 1**, **Chapter 6** of the **ES**, a number of primary mitigation measures have been identified through the iterative EIA process, and have been incorporated into the design and construction planning of the proposed development. Tertiary mitigation measures are legal requirements or are standard practices that will be implemented as part of the proposed development.

12.5.2 The assessment of likely significant effects of the proposed development assumes that primary and tertiary mitigation measures are in place. For groundwater and surface water, these measures are identified later, with a summary provided on how the measures contribute to the mitigation and management of potentially significant environmental effects.

a) Primary mitigation

12.5.3 Primary mitigation is often referred to as 'embedded mitigation' and includes modifications to the location or design to mitigate impacts; these measures become an inherent part of the proposed development.

i. Construction phase

12.5.4 The existing pond on the site would be retained within the site layout.

12.5.5 The maintenance of the 20m buffer zone between Little Nursery Wood and the operational park and ride facility will serve to minimise disturbance to the existing watercourse along the western site boundary.

ii. Operational phase

12.5.6 The proposed drainage system would incorporate SuDS measures as set out in the **Outline Drainage Strategy** provided in **Volume 2, Appendix 2A** of the **ES.** This includes provision for permeable surfaces, swale and infiltration pond features within the site. Through these measures, it is envisaged there would be no overall change in run-off characteristics of the site.

12.5.7 Bypass separators would be incorporated into the drainage design, where considered necessary, to protect both the underlying groundwater and surface water receptors, and to maintain the efficacy of the SuDS measures.

12.5.8 It is proposed to introduce a sewage treatment package plant and to drain the effluent to ground through SuDS infiltration devices. Low flow rates are likely to impact on the functionality of a package treatment plant, and a low flow package treatment plant shall be specified. There would also be a small cess pit serving the more isolated security booth, on the access road at the entrance to the site, with field drain infiltration. Tankering to works is an alternative option should the flow be insufficient for the low-flow package treatment plant.

iii. Removal and reinstatement

12.5.9 The removal of the proposed development would include the removal of any related drainage and SuDS measures within the site. Any control measures used to protect groundwater and surface water during the construction phase would also be applied during the removal and reinstatement phase.

b) Tertiary mitigation

12.5.10 Tertiary mitigation will be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral practices.

12.5.11 The drainage/flood prevention strategies will consider the ground conditions of the site, including the permeability of the strata and the level of on-site contamination.

12.5.12 Tertiary mitigation measures to be incorporated into the proposed development during enabling works, construction, operation and the removal and reinstatement phases, as set out in the **Code of Construction Practice** (**CoCP**) (Doc Ref. 8.11) include:

- Foul drainage arising on site during construction to be tankered off site until the operational arrangements are in place.
- Temporary SuDS to be implemented early in the construction phase. Construction phase water management zones to intercept surface run-off, sediment and contaminants from the construction compound and laydown areas, and incorporate sustainable drainage measures such as swales, filter drains, infiltration ponds and soakaways to promote infiltration.
- Construction drainage would be contained within the site, with infiltration to ground. A low bund to be constructed to achieve this with an external toe drain to intercept off-site run-off that may otherwise be impeded by the presence of the proposed bund. Only if full infiltration is not possible, would these systems discharge into the surface drainage network at greenfield run-off rates to minimise the potential for impact.
- Hardstanding to be constructed within the construction compounds where required to mitigate potential spills and leaks. Water falling onto impermeable surfaces to pass through a bypass separator.
- Active management and maintenance of the drainage infrastructure is required to ensure the continued efficacy of the surface water drainage system.
- Implementation of working methods during construction to ensure there would be no surface water run-off from the works, or any stockpiles, into adjacent surface watercourses/leaching into underlying groundwater in accordance with best practice.
- Implementation of appropriate pollution incident control, such as the use of plant drip trays and spill kits. Spill kits would be available on-site at all times. Sand bags or stop logs would also be available for deployment on the outlets from the site drainage system in case of emergency spillages.

- Implementation of appropriate and safe storage of fuel, oils and equipment during construction. For example, all fuels, oils, lubricants and other chemicals would be stored in an impermeable bund with at least 110% of the stored capacity. All refuelling would take place in a dedicated impermeable area, using a bunded bowser. Biodegradable oils would be used, where possible.

- The wheels of all vehicles would be free of contamination before arriving at site. All vehicles would be inspected prior to leaving site and should contaminative substances be identified suitable measures (e.g. wheel washing) would be implemented.

- Concrete and cement mixing and washing areas would be situated at least 10m away from surface water receptors. These would incorporate settlement and recirculation systems to allow water to be re-used. All washing out of equipment would be undertaken in a contained area, and all water would be collected for off-site disposal.

- Stockpiles would be located a minimum of 10m from the nearest watercourse.

12.5.13 Additional tertiary mitigation that would be anticipated and referenced in the **CoCP** (Doc Ref. 8.11) includes:

- Excavation and handling of materials and stockpiling, and construction waste, would be managed by good working practice in accordance with the materials management measures, soil management measures and waste management measures set out in the **CoCP** (Doc Ref. 8.11).

12.6 Assessment

a) Introduction

12.6.1 This section presents the findings of the groundwater and surface water assessment for the construction, operation, and removal and reinstatement stages of the proposed development.

12.6.2 This section identifies any likely significant effects that are predicted to occur and **section 12.7** of this chapter then highlights any secondary mitigation and monitoring measures that are proposed to minimise any adverse significant effects (if required).

b) Construction

i. Groundwater level and flow regime

12.6.3 The removal of on-site vegetation, and the compaction of soils due to construction vehicles and materials storage may locally reduce the rate at which rainfall makes its way into the groundwater for a short duration, however, the overall volume of water discharging to ground is unlikely to change. The impact to groundwater from these activities would be very low, resulting in a negligible effect for the very low value superficial deposits, and a minor adverse effect for the medium value Crag deposits. These effects would be **not significant**.

12.6.4 The groundwater levels at the site have not been established, however, available BGS hydrogeological mapping suggest that Crag groundwater level at the site is around 20m bgl. Given the nature of the proposed works, excavation is anticipated to be shallow, and therefore it has been assumed that groundwater in the underlying aquifers would not be encountered during construction. It is therefore anticipated that groundwater control measures would not be required, and that there would be **no effect** on the underlying aquifers with respect to dewatering activities.

12.6.5 The groundwater abstraction is assumed to be within the Crag Group, which is expected to experience no discernible change resulting from the proposed development. The abstraction is also located more than 800m from the site, and is unlikely to be affected by any local changes to the hydrogeological environment. It is therefore concluded that there would be **no effect** on the abstraction with respect to groundwater level and flow.

12.6.6 There are no known PWS in the outer study area. As no groundwater control measures are anticipated, it is concluded that there would be **no effect** on PWS in the outer study area with respect to groundwater level and flow.

12.6.7 Due to no groundwater control measures being anticipated at the site during construction, it is concluded that there would be **no effect** on the medium value existing buildings in terms of subsidence risk.

ii. Contamination of groundwater

12.6.8 As presented in **Chapter 11** of this volume and its appendices, the construction phase would potentially introduce new sources of contamination to the site through spills or leaks of contaminants used during construction. Construction works, such as excavation and stockpiling, can pose a risk to groundwater receptors through leaching and run-off of contaminants. Intrusive activities and removal of low permeability material can pose a risk to groundwater by creating new contaminant pathways or mobilising existing

contamination through exposure of contaminated soil or remobilisation of contaminants through soil disturbance. The potential contaminant linkages assessed in **Chapter 11** of this volume which have been carried forward into this assessment are:

- the potential for mobilising contaminants by excavation and stockpiling of material, increasing the risk to controlled water receptors through leaching and run-off. Earthworks could provide opportunities for run-off to contain suspended solids if not carried out in line with required management procedure;
- the potential for introducing new sources of contamination i.e. from spillages and leaks; and
- the potential for creation of new pathways to groundwater during groundworks, through opening up ground temporarily and construction activities, such as earthworks, installation of drainage and other below-ground services and foundations.

12.6.9 As presented in **Chapter 11** of this volume and its appendices, there is the potential for existing contamination on the site as well as the introduction of new contaminants and preferential pathways through construction activities. The implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter and in **Chapter 11** of this volume, including implementation of pollution incident control and safe storage of fuel, oils and equipment, would reduce this risk.

12.6.10 The Crag groundwater would be protected from any spills or leaks where it is overlain by the low permeability superficial deposits of the Lowestoft Formation (diamicton) and Head deposits.

12.6.11 If a spill or leak does occur, given the relatively low volumes of potentially contaminative material and the primary and tertiary mitigation measures employed, the scale of any spill or leak is likely to be small.

12.6.12 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial, and bedrock aquifers from the leaching/migration of contaminants through the soil is slightly increased during the construction phase and the effect is classified as minor adverse. The effects would be **not significant**.

12.6.13 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the migration of contaminants through preferential pathways created by the construction

activities is increased during the construction phase, and the effect is classified as minor adverse. The effects would be **not significant**.

12.6.14 There are no known PWS in the inner study area, however there is the potential for as yet unidentified PWS to be within the outer study area. With the implementation of the primary and tertiary mitigation measures identified, the impact to potential PWS with respect to water quality beyond the site itself would be the same as for the groundwater from which they would abstract and therefore classified as minor adverse. The effect would be **not significant**.

12.6.15 It is considered that there is no pathway for contaminative sources from the construction activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline environment **section 12.4** of this chapter which are situated outside of the inner study area are therefore not assessed for the effects from contaminative sources during the construction phase.

iii. Alteration of the surface water flow regime

12.6.16 Any changes to the flow regime have the potential to increase existing pressures and adversely affect the hydromorphology and biology of the unnamed tributary, a very low sensitivity receptor.

12.6.17 With regards to the impact of changes to the flow regime on the River Yox, this has the potential to adversely affect the hydromorphology and biology of the river. The sensitivity of the receptor is considered medium.

12.6.18 Where construction increases the extent of bare and compacted ground for a prolonged period, there is the potential for an increase in surface run-off and increase in flood peaks in the nearest receptor. The proposed development will create new areas of bare ground for prolonged periods during the construction phase.

12.6.19 Construction phase water management is embedded in the design, with on-site surface water run-off being infiltrated or discharged at Greenfield run-off rates until the operational phase SuDS infrastructure is operational to avoid off-site contamination. This will result in a very low magnitude effect. This effect would be classified as minor adverse for the River Yox and negligible for the unnamed tributary, which are considered to be **not significant**. Once the SuDS infrastructure is operational, there will be **no effect**.

iv. Contamination of surface waters

12.6.20 It is considered that there is a pathway for contaminative sources from the construction activities to impact surface water receptors beyond the inner

study area of 500m. Therefore, surface water receptors identified in the baseline environment **section 12.4** of this chapter which are situated in the outer study area (River Yox and abstraction) are therefore assessed for the effects from contaminative sources during the construction phase.

12.6.21 Contamination of surface waters arising from construction activities through the disturbance/mobilisation of existing sources of contamination, or the introduction of new sources/contaminants have the potential to adversely affect the biology and water quality of the River Yox, the unnamed tributary, the existing pond, and the surface water abstraction, increasing existing pressures on these watercourses.

12.6.22 Where excavations and the introduction of contaminants to a site take place, there is the potential for an increase in the risk of contaminating the nearest receptor. The proposed development will involve excavations and the introduction of contaminants during the construction phase.

12.6.23 The site would be isolated from the wider environment until the operational phase SuDS measures are operational. Implementation of appropriate pollution incident control in accordance with the **CoCP** (Doc Ref. 8.11) will further minimise the impacts of site construction activities on the surface drainage network.

12.6.24 As detailed in **Appendices 11B** and **11C** of this volume, the risk on the River Yox and the unnamed tributary from both lateral migration of existing contamination, and discharge of contaminates from construction activities are considered to remain the same as the baseline risk. The effects from both impacts on these surface water receptors are classified as negligible, and considered to be **not significant**. The risk on the existing pond is considered to increase compared to the baseline risk during construction. The effects from both impacts on these surface water receptors are classified as minor adverse and considered to be **not significant**.

12.6.25 Contamination of surface waters arising from construction activities also have the potential to affect the existing surface water abstraction (Trustans Farm, Darsham) from the River Yox. Based on the protection afforded by the design, **no effect** is predicted for the surface water abstraction.

v. Flood risk

12.6.26 The proposed development would include sustainable drainage for the life time of the development to manage any additional surface water run-off from it. A combination of infiltration and controlled discharge methods are proposed for the discharge of surface water run-off. Controlled discharge would be at the greenfield run-off rate to the unnamed watercourse. As the majority of the site is located in Flood Zone 1, construction activities will not

lead to a loss in functional floodplain storage or displacement of sea or river flood water. **No significant** effect is predicted.

12.6.27 Further information on flood risk at the site is provided in the **Northern Park and Ride at Darsham FRA** (Doc Ref. 5.3) which has been submitted as part of this application for development consent.

vi. WFD compliance

12.6.28 The site is located within the Minsmere Old River WFD water body catchment and on the Waveney and East Suffolk Chalk and Crag groundwater body.

12.6.29 The WFD assessment demonstrates that proposed construction activities would not have direct or indirect effects on the Minsmere Old River and Waveney and East Suffolk Chalk and Crag water bodies that would be sufficient to cause deterioration in the status of the water body or Protected Areas located within the water bodies.

12.6.30 As the proposed construction activities will not lead to a change in the overall status of the water bodies; the proposed construction activities are deemed compliant with the WFD.

12.6.31 Further information on WFD compliance is provided in the **WFD Compliance Assessment** (Doc Ref. 8.14) which has been submitted as part of this application for development consent.

vii. Inter-relationship effects

12.6.32 This section provides a description of the identified inter-relationship effects that are anticipated to occur on groundwater and surface water receptors between the individual environmental effects arising from construction of the proposed development.

12.6.33 There are anticipated to be inter-relationship effects between groundwater and surface water (i.e. groundwater providing baseflow to surface watercourses); geology and land quality provided in **Chapter 11** of this volume (i.e. naturally elevated concentration of contaminants in certain geologies); and terrestrial ecology and ornithology (i.e. groundwater dependent ecosystems). This is in relation to potential receptors which could be impacted during the construction of the proposed development.

12.6.34 The assessment of groundwater and surface water flows and levels is considered in this chapter, and there are no further combined effects beyond those stated in the preceding section.

12.6.35 The assessment of contamination to groundwater and surface water is considered inherently within the geology and land quality assessment provided in **Chapter 11** of this volume, and no further combined effects are anticipated.

12.6.36 The assessment of terrestrial ecology is considered in **Chapter 7** of this volume.

c) Operation

i. Groundwater level and flow regime

12.6.37 It has been assumed that groundwater in the underlying aquifers would not be encountered during the operation phase, and therefore groundwater dewatering control measures would not be required during the operation of the proposed development. Therefore, there is no potential impact to groundwater levels, and therefore **no effect** on existing buildings, from the proposed development with respect to subsidence risk.

12.6.38 The parking areas would predominantly be covered with permeable surfaces, and any water falling onto impermeable surfaces would be channelled into the SuDS infrastructure. This would allow infiltration to ground and would mean that although the spatial distribution of infiltration would be changed by the proposed development, the total volume of infiltration entering the ground would not be substantially changed. The proposed development would therefore not significantly alter recharge volumes to the superficial aquifer. The impact to the very low value superficial aquifers would be of medium-term, low magnitude, and the effect classified as negligible. The effect would be **not significant**.

12.6.39 The Crag underlies the low permeability superficial deposits across the site, which naturally act to limit vertical recharge of Crag groundwater. The changes to the distribution of recharge over the site area are, therefore, unlikely to change the flow regime of the Crag groundwater. The impact on the medium value Crag aquifer would be very low, and the effect on the flow regime of the Crag aquifer is classified as minor adverse. The effect would be **not significant**.

12.6.40 The groundwater abstraction is assumed to be within the Crag Group, which is expected to experience no discernible change resulting from the proposed development . The abstraction is also located more than 800m from the site and is unlikely to be affected by any local changes to the hydrogeological environment. It is, therefore, concluded that there will be **no effect** on the groundwater abstraction with respect to groundwater level and flow.

12.6.41 There are no known PWS in the outer study area, and the superficial and bedrock aquifers are anticipated to experience very low from the proposed development . The impact on any medium value PWS would be very low, and the effect is classified as minor adverse. The effect would be **not significant**.

ii. Contamination of groundwater

12.6.42 As presented in **Chapter 11** of this volume and its appendices, the operation of the proposed development could introduce new sources of contamination to the site, and create additional potential pathways for the migration of potential contamination. The implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter and in **Chapter 11** of this volume, would reduce this risk.

12.6.43 During operation, the main risks from contamination are fuel spills or leaks within the car parks. It is not anticipated that substantial spills or leaks will occur from vehicles used for commuting purposes. The presence of bypass separators within the drainage design would prevent the supply of sediment, and other contamination to the drainage network. The provision of swales and infiltration ponds for areas of impermeable surface cover would protect the underlying groundwater from hydrocarbon contamination.

12.6.44 As presented in **Chapter 11** of this volume and its appendices, when considering contamination sources, and the existing contamination on the site, compared to the existing baseline, the level of risk to receptors is slightly reduced.

12.6.45 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the leaching/migration of contaminants through the soil is slightly decreased during the operation phase and the effect is classified as minor beneficial. The effects would be **not significant**.

12.6.46 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the migration of contaminants through preferential pathways created by the operational activities is slightly decreased during the operation phase and the effect is classified as minor beneficial. The effects would be **not significant**.

12.6.47 There are no known PWS in the inner study area. With the implementation of the primary and tertiary mitigation measures identified, the impact on any PWS with respect to water quality would be the same as for the groundwater from which they would abstract, and therefore the effect is classified as minor beneficial. The effect would be **not significant**.

12.6.48 It is considered that there is no pathway for contaminative sources from the operational activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline environment **section 12.4** of this chapter which are situated outside of the inner study area are therefore not assessed for the effects from contaminative sources during the operation phase.

iii. Alteration of the surface water flow regime

12.6.49 Any changes to the flow regime have the potential to increase existing pressures and adversely affect the hydromorphology and biology of the unnamed tributary, a very low sensitivity receptor.

12.6.50 With regards to the impact of changes to the flow regime on the River Yox, this impact has the potential to adversely affect the hydromorphology and biology of the river. The sensitivity of the receptor is considered medium.

12.6.51 An increase in the extent of hardened surfaces will lower the infiltration rate and could increase surface run-off in receiving watercourses without suitable mitigation. As detailed in **section 12.5** of this chapter the proposed development will have areas of impermeable surfaces, an operational SuDS system is embedded in the design, with on-site surface water run-off being infiltrated or discharged at Greenfield run-off rates. **No effect** is predicted for the unnamed tributary or the River Yox.

iv. Contamination of surface waters

12.6.52 It is considered that there is a pathway for contaminative sources from the operational activities to impact surface water receptors beyond the inner study area of 500m. Surface water receptors identified in the baseline environment **section 12.4** of this chapter which are situated in the outer study area (River Yox and abstraction) are therefore assessed for the effects from contaminative sources during the operation phase.

12.6.53 Contamination of surface waters arising from the operation of the proposed development through the disturbance/mobilisation of existing sources of contamination, or the introduction of new sources/contaminants have the potential to adversely affect the biology and water quality of the River Yox, the unnamed tributary, the existing pond, and the surface water abstraction, increasing existing pressures on these watercourses.

12.6.54 Water draining from the car parking areas will pass through bypass separators before discharging to the swales. Implementation of appropriate pollution incident control will further reduce the risk of chemical spills, or leaks run-off, and prevent water contamination of the surface drainage network and existing pond.

12.6.55 As detailed in **Appendices 11B** and **11C** of this volume, on the basis of the implementation of primary and tertiary mitigation measures detailed in **section 12.5** of this chapter, the risk on the River Yox, the unnamed tributary, and the existing pond are considered to remain the same as the baseline risk. The effects from lateral migration and discharge of contaminants on these surface water receptors are classified as negligible and considered to be **not significant**.

12.6.56 Contamination of surface waters arising from operational activities also have the potential to affect the existing surface water abstraction (Trustans Farm, Darsham) from the River Yox. Based the protection afforded by the design of the proposed development, **no effect** is predicted for the surface water abstraction.

v. Discharge of foul sewage

12.6.57 Foul sewage from the operation of the proposed development would be treated by a package plant. The treated effluent would drain to ground through infiltration devices.

12.6.58 It is assumed that the treated foul sewage would be discharged to ground so as to not cause a measurable change in the integrity of the underlying aquifers, and that the discharge would be localised and of medium-term duration.

12.6.59 It is therefore considered that there will be **no effect** to groundwater and surface water from the discharge of foul sewage during the operation of the proposed development.

vi. Flood risk

12.6.60 The site is located in Flood Zone 1, meaning that there will be no loss in functional floodplain storage or displacement of sea or river flood water as a result of the proposed development. The proposed development will not, therefore, increase flood risk to surrounding areas.

12.6.61 With the exception of the section encompassing the A12, the existing site is currently greenfield, with no impermeable surfaces and small localised areas of surface water flood risk. Therefore, the proposed development would substantially increase the impermeable area on the site. Without infiltration, this increase in impermeable area would increase the surface water run-off and the associated flood risk both on and off-site.

12.6.62 The increase in impermeable area associated with the proposed development would require sustainable management of surface water run-off through the infiltration, and controlled discharge of flows to the

surrounding environment, most likely infiltration to ground. These mitigation measures would be designed to ensure that there are no adverse effects from the existing surface water flood risk identified on part of the site. Following the implementation of this mitigation, the proposed development is considered to be appropriate in terms of flood risk vulnerability under the NPPF and passes the Sequential Test guidance. The high risk areas of the site have been avoided in terms of vulnerable uses or integrated into the drainage system. The surface water flood risk is managed as part of the **Outline Drainage Strategy** provided in **Volume 2, Appendix 2A** of the **ES** and therefore **no effect** is predicted even though there might be localised changes in flood risk.

12.6.63 Further information on flood risk at the site is provided in the **Northern Park and Ride at Darsham FRA** (Doc Ref. 5.3) which has been submitted as part of this application for development consent.

vii. WFD compliance

12.6.64 The site is located within the Minsmere Old River WFD water body catchment and on the Waveney and East Suffolk Chalk and Crag groundwater body.

12.6.65 The WFD assessment demonstrates that proposed operational activities would not have direct or indirect effects on the Minsmere Old River and Waveney and East Suffolk Chalk and Crag water bodies that would be sufficient to cause deterioration in the status of the water body or Protected Areas located within the water bodies.

12.6.66 Furthermore, the proposed operational activities would not counteract or otherwise affect the delivery of the mitigation or improvement measures that have been identified in the RBMP for these water bodies.

12.6.67 As the proposed operational activities will not lead to a change in the overall status of the water bodies; the proposed operational activities are deemed compliant with the WFD.

12.6.68 Further information on WFD compliance is provided in the **WFD Compliance Assessment** (Doc Ref. 8.14) which has been submitted as part of this application for development consent.

viii. Inter-relationship effects

12.6.69 This section provides a description of the identified inter-relationship effects that are anticipated to occur on groundwater and surface water receptors between the individual environmental effects arising from operation of the proposed development.

12.6.70 There are anticipated to be inter-relationship effects between groundwater and surface water (i.e. groundwater providing baseflow to surface watercourses); geology and land quality (i.e. naturally elevated concentration of contaminants in certain geologies); and terrestrial ecology and ornithology (i.e. groundwater dependent ecosystems). This is in relation to potential receptors which could be impacted during the operation of the proposed development.

12.6.71 The assessment of groundwater and surface water flows and levels is considered in this chapter and there are no further combined effects beyond those stated in the preceding section.

12.6.72 The assessment of contamination on groundwater and surface water is considered inherently within the geology and land quality assessment provided in **Chapter 11** of this volume, and no further combined effects are anticipated.

12.6.73 The assessment of terrestrial ecology is considered in **Chapter 7** of this volume.

d) Removal and reinstatement

i. Groundwater level and flow regime

12.6.74 The proposed development would be removed, and the site reinstated to existing conditions as far as reasonably practical. The removal of hardstanding and compaction of soils may locally reduce the rate at which rainfall makes its way into the groundwater for a short duration, however, the overall volume of water discharging to ground is unlikely to change. The impact to groundwater from these activities would be localised and very low, resulting in a negligible effect for the very low value superficial aquifers and a minor adverse effect for the medium value Crag aquifer. These effects would be **not significant**.

12.6.75 It has been assumed that groundwater in the underlying aquifers would not be encountered during the removal and reinstatement phase, and therefore groundwater dewatering control measures would not be required during the operation of the proposed development. Therefore, there is no potential impact to groundwater levels, and **no effect** on existing buildings, from the proposed development with respect to subsidence risk.

ii. Contamination of groundwater

12.6.76 As presented in **Chapter 11** of this volume and its appendices, the removal and reinstatement of the proposed development could introduce new sources of contamination to the site, and create additional potential pathways for the

migration of potential contamination. Intrusive activities and removal of SuDS infrastructure and low permeability material can pose a risk to groundwater by creating new contaminant pathways, or mobilising existing contamination through exposure of contaminated soil, or remobilisation of contaminants through soil disturbance. The implementation of the primary and tertiary mitigation measures identified in **section 12.5** of this chapter and in **Chapter 11** of this volume, would reduce this risk.

12.6.77 The Crag groundwater would be protected from any spills or leaks where it is overlain by the low permeability superficial deposits of the Lowestoft Formation (diamicton) and Head deposits.

12.6.78 If a spill or leak does occur, given the relatively low volumes of potentially contaminative material and the primary and tertiary mitigation measures employed, the scale of any spill or leak is likely to be small.

12.6.79 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the leaching/migration of contaminants through the soil is slightly increased during the removal and reinstatement phase, and the effect is classified as minor adverse. The effects would be **not significant**.

12.6.80 Compared to the existing baseline, the level of risk to groundwater in the underlying superficial and bedrock aquifers from the migration of contaminants through preferential pathways created by the construction activities is increased during the removal and reinstatement phase, and the effect is classified as minor adverse. The effects would be **not significant**.

12.6.81 There are no known PWS in the inner study area, however there is the potential for as yet unidentified PWS to be within the outer study area. With the implementation of the primary and tertiary mitigation measures identified, the impact to potential PWS with respect to water quality beyond the site itself would be the same as for the groundwater from which they would abstract, and therefore classified as minor adverse. The effect would be **not significant**.

12.6.82 It is considered that there is no pathway for contaminative sources from the removal and reinstatement activities to impact groundwater receptors beyond the inner study area of 500m. Groundwater receptors identified in the baseline environment **section 12.4** of this chapter which are situated outside of the inner study area are, therefore, not assessed for the effects from contaminative sources during the removal and reinstatement phase.

iii. Alteration of the surface water flow regime

12.6.83 Any changes to the flow regime have the potential to increase existing pressures and adversely affect the hydromorphology and biology of the unnamed tributary, a very low sensitivity receptor.

12.6.84 With regards to the impact of changes to the flow regime on the River Yox, this has the potential to adversely affect the hydromorphology and biology of the river. The sensitivity of the receptor is considered medium.

12.6.85 Where removal and reinstatement activities increase the extent of bare and compacted ground for a prolonged period, there is the potential for an increase in surface run-off and increase in flood peaks in the nearest receptor. The proposed development would create new areas of bare ground for prolonged periods during the removal and reinstatement phase.

12.6.86 Removal and reinstatement phase water management is embedded in the design, with on-site surface water run-off being infiltrated or discharged at Greenfield run-off rates. This will result in a very low magnitude effect. This effect is as negligible for the unnamed tributary, and minor adverse for the River Yox. This effect would be **not significant** for the unnamed tributary or the River Yox.

iv. Contamination of surface waters

12.6.87 There is a pathway for contaminative sources from the removal and reinstatement activities to impact surface water receptors beyond the inner study area of 500m. Surface water receptors identified in the baseline environment **section 12.4** of this chapter which are situated in the outer study area (River Yox and abstraction) are therefore assessed for the effects from contaminative sources during the removal and reinstatement phase.

12.6.88 Contamination of surface waters arising from removal and reinstatement activities through the disturbance/mobilisation of existing sources of contamination, or the introduction of new sources/contaminants have the potential to adversely affect the biology, and water quality of the River Yox, unnamed tributary, the existing pond and the surface water abstraction, increasing existing pressures on these watercourses.

12.6.89 Where excavations and the introduction of contaminants to a site take place, there is the potential for an increase in the risk of contaminating the nearest receptor. The proposed development will involve excavations and the introduction of contaminants during the removal and reinstatement phase.

12.6.90 The site would be isolated from the wider environment until the demolition works have ceased. Implementation of appropriate pollution incident control

in accordance with the **CoCP** (Doc Ref. 8.11) would further minimise the impacts of site construction activities on the surface drainage network.

12.6.91 As detailed in **Appendices 11B** and **11C** of this volume, the risk on the River Yox, and the unnamed tributary from both lateral migration of existing contamination, and discharge of contaminates from removal and reinstatement activities is considered to remain the same as the baseline risk. The effects from both impacts on these surface water receptors are classified as negligible, and considered to be **not significant**. The risk on the existing pond is considered to increase compared to the baseline risk. The effects from both impacts on the existing pond are classified as minor adverse and considered to be **not significant**.

12.6.92 Contamination of surface waters arising from removal and reinstatement activities also have the potential to affect the existing surface water abstraction (Trustans Farm, Darsham) from the River Yox. Based on the protection afforded by the design, **no effect** is predicted for the surface water abstraction.

v. Flood risk

12.6.93 As the site is located in Flood Zone 1, removal and reinstatement activities will not lead to a loss in functional floodplain storage or displacement of sea or river flood water.

12.6.94 Once the operation of the proposed development has ceased, the site would be returned to its original agricultural use. This would include the removal of any related drainage and SuDS measures, which would have no adverse impact on flood risk to the site or the surface water flood risk, as such **no effect** is predicted.

12.6.95 Further information on flood risk at the site is provided in the **Northern Park and Ride at Darsham FRA** (Doc Ref. 5.3) which has been submitted as part of this application for development consent.

vi. WFD compliance

12.6.96 The site is located in within the Minsmere Old River WFD water body catchment and on the Waveney and East Suffolk Chalk and Crag groundwater body.

12.6.97 The WFD assessment demonstrates that proposed removal and reinstatement activities would not have direct or indirect effects on the Minsmere Old River and Waveney and East Suffolk Chalk and Crag water bodies that would be sufficient to cause deterioration in the status of the water body or Protected Areas located within the water bodies.

12.6.98 As the proposed removal and reinstatement activities will not lead to a change in the overall status of the water bodies; the proposed removal and reinstatement activities are deemed compliant with the WFD.

12.6.99 Further information on WFD compliance is provided in the **WFD Compliance Assessment** (Doc Ref. 8.14) which has been submitted as part of this application for development consent.

vii. Inter-relationship effects

12.6.100 This section provides a description of the identified inter-relationship effects that are anticipated to occur on groundwater surface water receptors, between the individual environmental effects arising from the removal and site restoration phase of the proposed development.

12.6.101 There are anticipated to be inter-relationship effects between groundwater and surface water (i.e. groundwater providing baseflow to surface watercourses); geology and land quality (i.e. naturally elevated concentration of contaminants in certain geologies); and terrestrial ecology and ornithology (i.e. groundwater dependent ecosystems). This is in relation to potential receptors which could be impacted during the removal and reinstatement of the proposed development.

12.6.102 The assessment of groundwater and surface water flows and levels is considered in this chapter, and there are no further combined effects beyond those stated in the preceding section.

12.6.103 The assessment of contamination on groundwater and surface water is considered inherently within the geology and land quality assessment provided in **Chapter 11** of this volume and no further combined effects are anticipated.

12.6.104 The assessment of terrestrial ecology is considered in **Chapter 7** of this volume.

12.7 Mitigation and monitoring

a) Introduction

12.7.1 Primary and tertiary mitigation measures which have already been accounted for as part of the assessment are summarised in **section 12.5** of this chapter. Where further mitigation is required, this is referred to as secondary mitigation, and where reasonably practicable, secondary mitigation measures have been proposed.

12.7.2 This section describes the proposed secondary mitigation measures for groundwater and surface water, as well as describing any monitoring required of specific receptors/resources or for the effectiveness of a mitigation measure.

b) Mitigation

12.7.3 A ground investigation would be undertaken to confirm ground conditions, contamination status, and other ground related risks. This would be completed prior to the commencement of construction works. Where the ground investigation and subsequent generic risk assessments identify unacceptable levels of contamination and ground related risks, further detailed quantitative risk assessment followed by, where necessary, remediation of soil and groundwater contamination prior to construction may be required.

12.7.4 Intrusive ground investigation would also be undertaken post operation of the proposed development as part of the removal and reinstatement phase. This ground investigation would confirm the ground conditions, contamination status, and other ground related risks at the site following the operational phase. Remediation of soil or ground contamination would be undertaken if deemed necessary to ensure that the site was suitable for use as agricultural land.

12.7.5 Active management and maintenance of the drainage infrastructure would be required to ensure the continued efficacy of the surface water drainage system.

12.7.6 A flood risk emergency plan would be developed to identify safe access and escape routes, demonstrate free and safe movement of people during a design flood and set out the potential for evacuation before a more extreme event.

c) Monitoring

12.7.7 A programme of short-term gas, surface water and groundwater monitoring would be designed as part of the ground investigation which will take place prior to detailed design, and would be required prior to construction works commencing. The results of this would determine the need for whether further long-term gas and groundwater monitoring is required.

12.7.8 Implementation of a contamination watching brief by suitably qualified and experienced personnel would be completed when excavating areas of potential contamination risk.

12.8 Residual effects

12.8.1 The following tables present a summary of the groundwater and surface water assessment. They identify the receptor(s) likely to be impacted, the level of effect, and where the effect is deemed to be significant, the tables include the mitigation proposed and the resulting residual effect.

Table 12.8: Summary of effects for the construction phase.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Crag groundwater (Principal Aquifer).	Reduction in the rate/volume of water discharging to ground.	Temporary SuDS and WMZs. Ensuring all site activities are carried out in accordance with the **CoCP** (Doc Ref. 8.11).	Minor adverse.	Not required.	Minor adverse **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor beneficial **(not significant)**.
Head Deposits groundwater (Secondary Aquifer (Undifferentiated)).	Reduction in the rate/volume of water discharging to ground.		Negligible	Not required.	Negligible **(not significant)**.
	Lowering of groundwater levels.		Negligible	Not required.	Negligible **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor beneficial **(not significant)**.
Lowestoft Formation	Reduction in the rate/volume of water discharging to ground.		Negligible	Not required.	Negligible **(not significant)**.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
(diamicton) groundwater (Secondary Aquifer (Undifferentiated)).	Lowering of groundwater levels.		Negligible	Not required.	Negligible **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor beneficial **(not significant)**.
Groundwater abstraction 800m south-east.	Reduction in groundwater availability to the abstraction.		No effect.	Not required.	No effect **(not significant)**.
Potential PWS.	Reduction in groundwater availability to the PWS.		No effect.	Not required.	No effect **(not significant)**.
	Contamination mobilised during construction migrating to the PWS.		Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial **(not significant)**.
Existing buildings.	Groundwater control measures attributing to subsidence risk.		No effect.	Not required.	No effect **(not significant)**.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
River Yox (Main River).	Alteration of the surface water flow regime.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures.	Minor adverse/no effect.	Not required.	Minor adverse **(not significant)**.
	Contamination of the watercourse.		Negligible	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary.	Negligible **(not significant)**.
Tributary of River Yox (ordinary watercourse).	Contamination of the watercourse.		Negligible		Negligible **(not significant)**.
	Alteration of the surface water flow regime.		Negligible/no effect.	Not required.	Negligible **(not significant)**.
Existing Pond within the site.	Contamination of the watercourse.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures. Buffer zone.	Minor adverse.	Ground investigation and relevant risk assessments completed prior to detailed design and construction works. Remediation of soil and groundwater if necessary.	Minor adverse **(not significant)**.
Surface water abstraction.	Contamination of the source.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground. Adoption of pollution prevention measures.	No effect.	Ground investigation and risk assessment. Remediation of soil and surface water receptor if necessary.	No effect **(not significant)**.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Flood risk to surrounding areas.	Loss of functional floodplain storage or displacement of sea or river water.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground.	No effect.	Not required.	No effect **(not significant)**.

Table 12.9: Summary of effects for the operational phase.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Crag groundwater (Principal Aquifer).	Reduction in the rate/volume of water discharging to ground.	Water draining from the car parking areas will pass through appropriate drainage, including the incorporation of SuDS and bypass separators where necessary. This will allow infiltration to the superficial aquifer, whilst also protecting the underlying groundwater from hydrocarbon contamination.	Minor adverse.	Management and maintenance of the SuDS. Longer term gas and groundwater monitoring if necessary.	Minor adverse **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Contamination of the groundwater from foul sewage.		No effect.		No effect **(not significant)**.
Head Deposits groundwater (Secondary Aquifer (undifferentiated)).	Reduction in the rate/volume of water discharging to ground.		Negligible		Negligible **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Lowestoft Formation (diamicton) groundwater (Secondary Aquifer (undifferentiated)).	Reduction in the rate/volume of water discharging to ground.		Negligible		Negligible **(not significant)**.
	Leaching/migration of contamination in soils to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor beneficial.		Minor beneficial **(not significant)**.
	Contamination of the groundwater from foul sewage.		No effect.		No effect **(not significant)**.
Groundwater abstraction 800m south-east.	Reduction in groundwater availability to the abstraction.		No effect.		No effect **(not significant)**.
Potential PWS.	Reduction in groundwater availability to the PWS.		Minor adverse.		Minor adverse **(not significant)**.
	Contamination mobilised during operation migrating to the PWS.		Minor beneficial.		Minor beneficial **(not significant)**.
River Yox (Main River).	Alteration of the flow regime.	Infiltration ponds and swales will be incorporated into the design. Buffer zone.	No effect.	Management and maintenance of the SuDS.	No effect **(not significant)**.
	Chemical spills or leaks.	Water draining from the site will pass through bypass separators where necessary.	Negligible	Remediation of soil and surface water receptor if necessary.	Negligible **(not significant)**.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Tributary of River Yox (ordinary watercourse).	Alteration of the flow regime.	Infiltration ponds and swales will be incorporated into the design. Buffer zone.	No effect.	Management and maintenance of the SuDS.	No effect **(not significant)**.
	Chemical spills or leaks.	Water draining from the site will pass through bypass separators where necessary.	Negligible	Remediation of soil and surface water receptor if necessary.	Negligible **(not significant)**.
Existing pond within the site.	Chemical spills or leaks.	Water draining from the site will pass through bypass separators where necessary.	Negligible		Negligible **(not significant)**.
Surface water abstraction.	Contamination of the source.		No effect.		No effect **(not significant)**.
Flood risk to surrounding areas.	Loss of functional floodplain storage or displacement of sea or river water.	Infiltration ponds and swales will be incorporated into the design.	No effect.	Not required.	No effect **(not significant)**.

Table 12.10: Summary of effects for the removal and reinstatement phase.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Crag groundwater (Principal Aquifer).	Leaching/migration of contamination in soils to groundwater.	Appropriate drainage design. Ensuring all site activities are carried out in accordance with the **CoCP** (Doc Ref. 8.11).	Minor adverse.	Further ground investigation and risk assessment post operation to confirm the risks at the time of removal and reinstatement and identify areas requiring further remediation.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor beneficial **(not significant)**.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Head Deposits groundwater (Secondary Aquifer (undifferentiated)).	Leaching/migration of contamination in soils to groundwater.		Minor adverse	Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor beneficial **(not significant)**.
Lowestoft Formation (diamicton) groundwater (Secondary Aquifer (Undifferentiated)).	Leaching/migration of contamination in soils to groundwater.		Minor adverse.		Minor beneficial **(not significant)**.
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor beneficial **(not significant)**.
Groundwater abstraction 7/35/03/*G/0076.	Reduction in groundwater availability to the abstraction.		No effect.	Not required.	No effect **(not significant)**.
Potential PWS.	Reduction in groundwater availability to the PWS.		No effect.	Not required.	No effect **(not significant)**.
	Contamination mobilised during removal and reinstatement migrating to the PWS.		Minor adverse.	Further ground investigation and risk assessment post operation to confirm the risks at the time of removal and reinstatement and identify areas requiring further remediation. Remediation of soil and groundwater due to incident occurring during the operational phase if necessary.	Minor beneficial. **(not significant)**.
River Yox (Main River).	Contamination of the river.	Controls measures adopted during the decommissioning	Negligible	Remediation of soil and surface water receptor due to incident occurring	Negligible **(not significant)**.

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
Tributary of River Yox (ordinary watercourse).	Contamination of the river.	phase of the site would be as described for the construction phase. Implementation of appropriate pollution incident control. Spill kits would be available on-site at all times. Sand bags or stop logs would also be available for deployment on the outlets from the site drainage system in case of emergency spillages.	Negligible	during the operational or removal and reinstatement phase if necessary.	Negligible **(not significant)**.
Existing pond within the site.	Contamination of the controlled waters.		Minor adverse.		Minor adverse **(not significant)**.
Surface water abstraction.	Contamination of the source.		No effect.		No effect **(not significant)**.
Flood risk to surrounding areas.	Loss of functional floodplain storage or displacement of sea or river water.	Isolation of the site from the wider environment to prevent off-site effects, with drainage to ground.	No effect.	Not required.	No effect **(not significant)**.

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