The Sizewell C Project

6.9 Volume 8 Freight Management Facility

Chapter 12 Groundwater and Surface Water

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Contents

Tables

Plates

None provided.

Figures

Appendices

None provided.

12. Groundwater and Surface Water

12.1 Introduction

12.1.1 This chapter of **Volume 8** 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 Seven Hills freight management facility (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 Seven Hills freight management facility 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 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 other assessments as following:

- **Appendix 11A** of this volume: Freight Management Facility: Phase 1 Desk Study Report 2020;
- **Appendix 11B** of this volume: Conceptual site models;
- **Appendix 11C** of this volume: Impact assessment tables;
- **Freight Management Facility Flood Risk Assessment** (**FRA**) (Doc Ref. 5.8); and
- **Water Framework Directive** (**WFD**) **Compliance Assessment Report** (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[1] This document has been withdrawn but still constitutes good advice and should be referred to in the absence of alternative guidance.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,** identifies and describes legislation, policy and guidance of relevance to the assessment of the potential 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**.

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.**

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**.

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**.

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**.

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).
- Strategic 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**.

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 (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**.

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**.

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**.

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, Appendix 6A** to **6C.**

12.3.6 The Government's Good Practice Guide for EIA states that the following potential environmental effects should be considered for the 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. The assessment of identified

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 consultation and engagement with statutory consultees throughout the design and assessment process as outlined in **Volume 1, Appendix 6O**.

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 receptors 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 receptors 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 phase, operational phase and the removal of the proposed development and reinstatement of the site, rather than the assessment of any specific years.

e) Assessment criteria

12.3.16 As described in **Volume 1**, **Chapter 6**, 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** 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.
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 primary and tertiary 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 are 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

		Value / Sensitivity of Receptor			
		Very Low	Low	Medium	High
	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**, 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 Report** (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 **Freight Management Facility FRA** (Doc Ref. 5.8) 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 Report** (Doc Ref. 8.14), and **Freight Management Facility FRA** (Doc Ref. 5.8).

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: Freight Management Facility: Phase 1 Desk Study Report which includes the Landmark Envirocheck Report for the site and study area, and details of the site walkover.

iii. Future baseline

12.3.37 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

12.3.38 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

12.3.39 The following assumptions have been made in this assessment:

- All assessment considers development within the site parameters as set out in the description of development at **section 2.3** of **Chapter 2** of this volume of the **ES** and as illustrated in on the work plans reproduced in **Appendix 2A** of this volume.
- Excavation works carried out as part of the proposed development 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**.

- 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.

12.3.40 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 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 the Freight Management Facility: Phase 1 Desk Study Report provided in **Appendix 11A** of this volume.

a) Current baseline

i. Site walkover

12.4.3 A site visit from public roads 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. Additionally, it was an opportunity to identify potential visual or olfactory contamination present at the site at the time of the visit.

12.4.4 The majority of the site comprises agricultural fields with the remainder being a section of Felixstowe Road. The site is located to the south-east of the A12 and A14 junction south-east of Ipswich and is bounded by the A14 to the

north, Felixstowe Road to the south and arable land to the east and west. No hazards or evidence of contamination were observed during the site visit. Further details on observations made during the site visit including photographs can be found in the Phase 1 Desk Study Report provided in **Appendix 11A** of this volume.

ii. Topography

12.4.5 The site is located within the catchment of the River Orwell. Based on online mapping, the site is generally flat and sits at approximately 25m Above Ordnance Datum (AoD).

iii. Geology

12.4.6 There is the potential for Made Ground to be encountered related to the construction of existing roads, railway, former sand and gravel pits, and farmer's tips.

12.4.7 Online BGS mapping indicates that the site is underlain by superficial deposits of the Kesgrave Catchment Subgroup which fluvial sands and gravels and lacustrine and organic silts, clays and peats of the pre-diversionary River Thames, and the pre-glacial soils developed on such deposits.

12.4.8 The bedrock geology beneath the site is comprised of the Crag Formation which is described as coarse-grained, poorly sorted abundantly shelly sands.

12.4.9 The majority of BGS borehole scans and trial pits within the outer study area are clustered along the A12 and A14. Most were drilled for the construction of the A14 in 1976. There are three BGS boreholes located on-site and five located within the inner study area. A review of the available logs has indicated that the Kesgrave Catchment Group was recorded from approximately 0.9m to 6.7m below ground level (m bgl). The Crag Formation was encountered from approximately 4.3m to 13.1m bgl. London Clay was encountered underlying the Crag Formation, with the depth not proven.

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

iv. Hydrogeology

12.4.11 The Environment Agency classifies the Kesgrave Catchment Subgroup as a secondary A aquifer[2].

[2] Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

12.4.12 The Environment Agency classifies the Crag Group as a principal aquifer[3].

12.4.13 The outer 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.

12.4.14 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 15m AoD, approximately 10m bgl at the site. These contours are based on data from 1976 and are only indicative of current levels. However, the hydrogeological regime is not considered likely to have changed substantially in the intervening years. Further ground investigation would be needed to establish current groundwater levels at the site. On-site historical borehole logs available from the BGS report water strikes within the Crag aquifer at approximately 5m bgl.

12.4.15 The site is located on the Felixstowe Peninsula Crag and Chalk groundwater body (groundwater body ID GB40501G401800) (Ref. 12.34). According to the Environment Agency 2016 classification, this groundwater body has been classified as being of Good quantitative and Poor chemical status with an overall water body classification of Poor. The Poor chemical status has been attributed to impacts from agriculture as evidence by elevated nitrate concentration in groundwater. The site falls within a groundwater nitrate vulnerable zone.

v. Surface water features

12.4.16 The site is not located within a WFD river water body catchment. The site is however located within the catchment of the Orwell transitional water body catchment (water body ID GB520503613601) (Ref. 12.35). A balancing pond to manage drainage from the A14 is located immediately adjacent to the northern boundary of the site. A second balancing pond is located within the A14/A12 roundabout to the north-west of the site. Manor Ponds is located approximately 400m south-west of the site. According to the Environment Agency 2016 classification the Orwell transitional water body has an overall classification of Moderate ecological potential.

[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

vi. Water quality

12.4.17 The 2016 physico-chemical and chemical data presented on Catchment Data Explorer have been reviewed for the Orwell transitional water body. Chemical status of the water body is Good.

12.4.18 Physico-chemical data indicate that Orwell transitional water body is at High WFD status for dissolved oxygen and moderate status for dissolved inorganic nitrogen.

12.4.19 No groundwater quality data is available for the proposed development.

vii. Groundwater and surface water interaction

12.4.20 Given the local geology and assumed depth to groundwater of 5 to 10m bgl it is considered that there is no substantial connection between groundwater and the surface water features identified on site. There may be a local interaction between discrete water bodies in the Kesgrave Catchment Subgroup and surface water in areas where Made Ground is not present. Given the depth to the Crag deposits, it is considered unlikely that there will be a hydraulic connection between the underlying bedrock and surface water on site, however, where the Crag deposits outcrop to the south of the site, there is the potential that the Crag deposits are in hydraulic continuity with Manor Ponds, its associated watercourses and the nearby fen meadow habitat.

viii. Water abstractions

Groundwater

12.4.21 The Landmark Envirocheck Report provided in **Appendix 11A** of this volume, identified one licensed groundwater abstraction within the outer study area. The abstraction is detailed in **Table 12.4** and presented 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)
7/35/10/*G/0085	624000, 239900 (569m south of proposed development). Borehole north of Levington Hall, Levington.	Chalk	General Agriculture: Spray Irrigation – Direct. Seasonal – 01 April to 30 September	13,009,000

12.4.22 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 isolated farm buildings and residential properties in the outer study area. It is likely that the properties within the village of Bucklesham obtain their water from a mains source of supply.

Surface water

12.4.23 The Landmark Envirocheck Report provided in **Appendix 11A** of this volume indicates that there is one licensed surface water abstraction within the outer study area. Both are detailed in **Table 12.5** and presented on **Figure 12.1** of this volume**.**

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

Licence Number	Location (Including NGR)	Source	Purpose	Maximum Annual Abstraction (m^3).
7/35/10/*S/0054	623010, 240110 (931m south west of proposed development, stream at Decoy Wood, Nacton)	Surface water.	General Agriculture: Spray Irrigation – Storage Seasonal - Abstraction only 01 Apr to 31 Oct	1,091,000

ix. Fluvial geomorphology

12.4.24 Geomorphology and hydromorphology are key factors contributing to whether a water body can achieve or maintain good ecological status.

12.4.25 The Orwell transitional water body is designated as a heavily modified water body. The geomorphology of the River Orwell is of sufficient quality to support good status, while the hydrological regime does not support good status.

x. Flood risk

12.4.26 The East Suffolk Council Strategic FRA did not identify any historic flooding as having occurred within the site.

12.4.27 The Environment Agency's Flood Map for Planning indicates that the site is located in Flood Zone 1, and therefore has a low risk of flooding from tidal or fluvial sources. Risks associated with groundwater, sewer and reservoir flooding at the site are also considered to be low. The Environment Agency's long-term flood risk mapping shows that the large majority of the site is at very low risk of surface water flooding, with two isolated areas of low risk, the first located within the centre of the site and associated with topographical low point. The second area is a possible surface water flow route associated with the two ponds north of the site boundary. At the western extend of the

site boundary on Felixstowe Road, there is an area of high surface water flood risk which could affect access and egress.

12.4.28 Further information on flood risk at the site is provided in the **Freight Management Facility FRA** (Doc Ref. 5.8) which has been submitted as part of this application for development consent.

xi. Water dependent historic and ecological environment sites

12.4.29 The Nacton Meadows Site of Special Scientific Interest (SSSI) is located approximately 900m south-west of the site and is presented on **Figure 7.1** of this volume. The SSSI is a fen-meadow habitat and is likely to have a degree of dependence on groundwater and surface water.

12.4.30 There are a series of scheduled monuments located to the east of the site associated with a barrow cemetery as presented on **Figure 9.1** of this volume. The closest scheduled monument is approximately 100m south-east of the site. Whilst not dependent on groundwater, there is the potential that they could be impacted from changes to the hydrogeological regime.

xii. Existing buildings

12.4.31 Changes in groundwater level have the potential to affect building foundations. There are no existing buildings present on-site and the surrounding land is predominantly of agricultural use. However, there are several residential properties, farms and associated buildings within the outer study area. The closest building to the site is Keepers Cottage which is located 350m south-east of the site boundary.

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

xiii. Potential for existing contamination

12.4.33 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.

12.4.34 The potential sources of contamination at the proposed development are presented in the PCSM provided in **Appendix 11B** in **Chapter 11** of this volume.

xiv. Summary of key receptors

12.4.35 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 Group groundwater (principal aquifer).	Medium	Medium
Kesgrave Catchment Subgroup (secondary A aquifer).	Low	Medium
Groundwater abstractions.	Medium	Medium
Potential PWS.	Medium	Medium
Nacton Meadows SSSI.	High	Medium
Barrow cemetery scheduled monuments.	Medium	Medium
Existing buildings.	Medium	Low
Balancing ponds.	Very low	Low

b) Future baseline

12.4.36 Committed developments have been considered as future receptors in the assessment of groundwater and surface water impacts during the construction and operational phases of the proposed development.

Table 12.7: Committed developments

Planning Application Ref.	Site Address	Description of development	Date of Approval	Status	Distance (m)
DC/19/4510/OUT	Levington Lane Bucklesham Suffolk	The erection of up to 33 dwellings with associated landscaping, vehicular access and parking provision. All matters reserved aside from access.	Awaiting approval	Awaiting approval	800
DC/17/5016/FUL	Red House Farm Bridge Road Levington	Demolition and replacement on similar footprint. This will be used for the purpose of running rural based	09/05/2018	Construction has not commenced	960

Planning Application Ref.	Site Address	Description of development	Date of Approval	Status	Distance (m)
	Suffolk IP10 0LZ	skills leisure courses and the storage of camping equipment for proposed boutique camping site. Change of use of agricultural land to allow for the provision of 5 bell tents on wooden platforms along with separate toilet and washing facilities.			

12.4.37 The construction timeline for these committed developments is unconfirmed. However, the planning permission requires construction to commencement within three years of the 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 developments will have been constructed prior to 2022. These committed developments have therefore been considered as future receptors as part of the baseline for the groundwater and surface water assessments.

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

12.4.39 As the length of the construction, operational and removal and reinstatement phases of the proposed development will cover a 9-12 year period, changes to the WFD status of the Orwell transitional 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. 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.

12.4.40 The future baseline of the Orwell transitional 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 Orwell transitional water body will be maintained as the future baseline include:

- the unfavourable balance of costs and benefits to improve the status of dissolved inorganic nitrogen, which is currently Moderate; and
- the cause of adverse impacts on the status of angiosperms and invertebrates is unknown, which is currently Moderate for both biological quality elements.

12.4.41 Due to the Moderate biological status and the Moderate physico-chemical status which are not anticipated to improve, the ecological status would 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**, 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 in the following section, 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 No primary mitigation measures are embedded for the construction phase.

ii. Operational phase

12.5.5 A sustainable drainage system (SuDS) as set out in the **Outline Drainage Strategy** provided in **Volume 2**, **Appendix 2A** would be implemented for operation of the freight management facility to allow surface water run-off to infiltrate into the ground. Ongoing management and maintenance of drainage structures will be maintained throughout operations.

12.5.6 The current proposal is to introduce a package sewage treatment plant and to drain the effluent to ground through SuDS infiltration devices. Tankering to works is an alternative option should the flow be insufficient for the low-flow package treatment plant.

iii. Removal and reinstatement

12.5.7 The removal of the proposed development would include the removal of any related foul water, drainage and SuDS measures and infrastructure within the site (except the widened sections of Felixstowe Road which would be retained as permanent highway, with only road markings and signage for the access to the site would be removed). 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

12.5.8 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.

12.5.9 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.

12.5.10 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:

- 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 to be contained within the site, with infiltration to ground. A low bund is proposed 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 existing surface drainage networks 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.

- A swale to be constructed across the northern boundary and part of the eastern boundary and to the south of the widened Felixstowe Road to ensure that surface water run-off would be contained within the site and infiltrated into the underlying strata. The design of the swales and underground attenuation tanks to consider the ground conditions of the site.

- Foul sewage arising on-site during construction will be tankered off-site until the operational arrangements are in place.

- 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.

12.5.11 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, where relevant, removal and reinstatement of the proposed development (if required).

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 compaction of soils due to construction vehicles, materials storage and the excavation of the attenuation tanks 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 low value superficial aquifer and a minor adverse effect for the medium value Crag aquifer. The effect would be **not significant**.

12.6.4 Current groundwater levels at the site have not been established, however, data available from BGS boreholes at the site indicate that groundwater level in the Crag aquifer may be around 5m bgl. BGS borehole logs indicate that the Crag deposits are not encountered until depths of 4.3m bgl, and no water strikes were observed within the superficial Kesgrave Catchment Group deposits. Pad foundations are expected to be used for the structures built on site, therefore no requirement for piling has been identified. It is anticipated that the underground attenuation tanks will be designed to be constructed within the superficial deposits and will not intercept the underlying Crag aquifer to avoid potential uplift from hydraulic pressures from groundwater. It is therefore anticipated that groundwater would not be encountered during construction and groundwater control measures would not be required. There would therefore be **no effect** on the underlying aquifers with respect to dewatering activities.

12.6.5 The barrow cemetery scheduled monuments are located more than 100m from the site and are unlikely to be affected by any local changes to the hydrogeological environment due to no groundwater control measures being anticipated at the site during construction. It is therefore concluded that there would be **no effect** on the scheduled monuments with respect to groundwater level and flow.

12.6.6 The groundwater abstractions are understood to abstract from the Chalk aquifer, which is expected to experience no discernible change resulting from the proposed development. The abstractions are also located more than 560m from the site and are unlikely to be affected by any local changes to the hydrogeological environment. It is concluded that there would be **no effect** on the abstractions with respect to groundwater level and flow.

12.6.7 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 any PWS in the outer study area with respect to groundwater level and flow.

12.6.8 It is concluded that there would be **no effect** on the high value Nacton Meadows SSSI with respect to groundwater level and flow. This is due to there being no anticipated requirement for groundwater control measures at the site during construction and its distance from the site of more than 800m. Nacton Meadows SSSI is also therefore unlikely to be affected by any local changes to the hydrogeological environment.

12.6.9 It is concluded that there would be **no effect** on the medium value existing buildings in terms of groundwater level and flow. This is because there is no anticipated requirement for dewatering at the site during construction.

ii. Contamination of groundwater

12.6.10 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.

- 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.

12.6.11 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.

12.6.12 Due to the permeability of the Kesgrave Formation, there is a potential pathway for contamination to reach the Crag aquifer. 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.

12.6.13 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**.

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

12.6.15 The barrow cemetery scheduled monuments are located more than 100m from the site, and whilst there is the potential for contaminated groundwater to migrate to the scheduled monuments via preferential pathways generated by the construction activities, they are unlikely to be affected by any local changes to the hydrogeological environment. Compared to the existing baseline, the level of risk to the monuments remains the same and the effect is classified as negligible which is **not significant**.

12.6.16 The groundwater abstractions are understood to abstract from the Chalk aquifer, which will be protected from the migration of contamination by the overlying London Clay deposits. The abstractions are also located more than 560m from the site and it is considered that there is no pathway for contaminative sources from the construction activities to impact the abstractions. It is concluded that there would be **no effect** on the abstractions with respect to groundwater quality.

12.6.17 There are no known PWS in the inner study area, however there is the potential for as yet unidentified PWS to be within the inner 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**.

12.6.18 It is considered that there is no pathway for contaminative sources from the construction activities to impact groundwater receptors beyond the inner study area. Groundwater receptors identified in the baseline environment as provided in **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. Contamination of surface waters

12.6.19 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. Surface water receptors identified in the baseline environment provided in **section 12.4** of this chapter which are situated in the outer study area are therefore assessed for the effects from contaminative sources during the construction phase.

12.6.20 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 Nacton Meadows SSSI, balancing ponds and Manor Pond, increasing existing pressures on these watercourses.

12.6.21 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 would involve excavations and has the potential to introduce contaminants during the construction phase.

12.6.22 Construction drainage would be contained within the site until the operational phase SuDS is operational. 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.

12.6.23 As detailed in **Appendices 11B** and **11C** of this volume, the risk on the Nacton Meadows SSSI, balancing ponds and Manor Pond from both lateral migration of existing contamination and discharge of contaminants from construction 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**.

iv. Flood risk

12.6.24 During construction, a temporary SuDS would be constructed for the majority of the site. This drainage system would retain surface water run-off within the site and enable infiltration. As 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 substantial increase in flood risk relating to surface water is anticipated and therefore **no effect** is predicted.

12.6.25 Further information on flood risk at the site is provided in the **Freight Management Facility FRA** (Doc Ref. 5.8) which has been submitted as part of this application for development consent.

v. WFD compliance

12.6.26 The site is located within the Orwell transitional WFD water body catchment and on the Felixstowe Peninsula Crag and Chalk WFD groundwater body.

12.6.27 The WFD assessment demonstrates that proposed construction activities would not have direct or indirect effects on the Orwell transitional and the Felixstowe Peninsula Crag and Chalk water bodies that would be sufficient to cause deterioration in the status of the water body or protected areas located within the water bodies.

12.6.28 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.

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

vi. Inter-relationship effects

12.6.29 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.

12.6.30 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); heritage (i.e. subsidence risk to scheduled monuments); 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.

12.6.31 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.

12.6.32 The assessment of contamination on groundwater and surface water is considered inherently within the geology and land quality assessment and no further combined effects are anticipated.

12.6.33 The assessment of terrestrial ecology and heritage are considered in **Chapter 7** and **Chapter 9** of this volume respectively.

c) Operation

i. Groundwater level and flow regime

12.6.34 It has been assumed that groundwater in the underlying aquifers would not be encountered during the operation phase, and therefore no groundwater dewatering control measures would 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 groundwater level and flow.

12.6.35 The presence of the underground attenuation tanks has the potential to impact on groundwater level and flow direction, however, the tanks are not anticipated to intercept the water table. Therefore, **no effect** is predicted.

12.6.36 The proposed works would increase the impermeable area of ground cover at the site due to the hardstanding used and the presence of the underground attenuation tanks. Appropriate drainage would be used including the incorporation of SuDS measures. This would allow infiltration to the superficial aquifer and would mean that although the spatial distribution of infiltration would be changed within the development area, the total volume of infiltration entering the ground would not be significantly changed relative to the groundwater system. The impact to the low value superficial aquifer

would be of medium-term, very low magnitude and the effect classified as negligible. The effect would be **not significant**.

12.6.37 Changes to the rate and distribution of recharge over the site area from the overlying Kesgrave superficial aquifer due to the presence of the concrete hardstanding, tarmac road surface and the underground storage tanks may affect the flow regime of the Crag Group groundwater locally at the site. The impact on the medium value Crag Group aquifer would be very low, and the effect on the Crag aquifer is classified as minor adverse. The effect would be **not significant**.

12.6.38 The barrow cemetery scheduled monuments are located more than 100m from the site and are unlikely to be affected by any local changes to the hydrogeological environment during operation. It is concluded that there would be **no effect** on the scheduled monuments.

12.6.39 The groundwater abstractions are understood to abstract from the chalk aquifer, which is expected to experience no discernible change resulting from the proposed development. The abstractions are also at more than 560m from the site and are unlikely to be affected by any local changes to the hydrogeological environment. It is concluded that there would be **no effect** on the abstractions with respect to groundwater level and flow.

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

12.6.41 It is concluded that there would be **no effect** on the high value Nacton Meadows SSSI with respect to groundwater level and flow. This is due to there being no requirement for groundwater control measures anticipated at the site during operation and its distance from the site of more than 800m. Nacton Meadows SSSI is therefore unlikely to be affected by any local changes to the hydrogeological environment.

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 from the delivery vehicles using the proposed development. It is not anticipated that substantial spills or leaks will occur from vehicles used for

commuting purposes by staff working at the proposed development. 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 SuDS for areas of impermeable surface cover would protect the underlying groundwater from hydrocarbon contamination.

12.6.44 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**.

12.6.45 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**.

12.6.46 The barrow cemetery scheduled monuments are located more than 100m from the site and, whilst there is the potential for contaminated groundwater to migrate to the scheduled monuments via preferential pathways generated by the operation activities, they are unlikely to be affected by any local changes to the hydrogeological environment. Compared to the existing baseline, the level of risk to the monuments remains the same and the effect is classified as negligible which is **not significant**.

12.6.47 The groundwater abstractions are understood to abstract from the Chalk aquifer, which will be protected from the migration of contamination by the overlying London Clay deposits. The abstractions are also located more than 560m from the site and it is considered that there is no pathway for contaminative sources from the operation activities to impact the abstractions. It is therefore concluded that there would be **no effect** on the abstractions with respect to groundwater quality.

12.6.48 There are no known PWS in the inner study area, however there is the potential for as yet unidentified PWS to be within the inner 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 beneficial. The effect would be **not significant**.

12.6.49 It is considered that there is no pathway for contaminative sources from the operation activities to impact groundwater receptors beyond the inner study area. 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. Contamination of surface waters

12.6.50 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. Surface water receptors identified in the baseline environment in **section 12.4** of this chapter which are situated in the outer study area are therefore assessed for the effects from contaminative sources during the operation phase.

12.6.51 Contamination of surface waters may arise from the operation of the proposed development due to the introduction of new sources of contaminants or the disturbance and mobilisation of existing sources of contamination. If this occurs, these have the potential to adversely affect the biology and water quality of the Nacton Meadows SSSI, balancing ponds and Manor Pond, increasing existing pressures on these watercourses.

12.6.52 Water draining from the car parking areas of the facility would pass through bypass separators before discharging to the underground attenuation tanks and then to the swale. Implementation of appropriate pollution incident control will further reduce the risks of chemical spills or leaks run-off and prevent water contamination of the Nacton Meadows SSSI, balancing ponds and Manor Pond.

12.6.53 As detailed in **Appendices 11B** and **11C** of this volume, on the basis of implementation of the primary and tertiary mitigation measures detailed in **section 12.5** of this chapter, the risk on surface waters would 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**.

iv. Discharge of foul sewage

12.6.54 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. 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.

12.6.55 With the implementation of the primary and tertiary mitigation measures, the impact on the underlying aquifers at the site would be low. For groundwater of the low value Kesgrave Catchment Group aquifer and the medium value Crag aquifer the effect is classified as minor adverse. The effect would be **not significant.**

v. Flood risk

12.6.56 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.

12.6.57 Within the exception of the section encompassing Felixstowe Road, the majority of 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 attenuation, this increase in impermeable area would increase the surface water run-off and the associated flood risk both on and off site.

12.6.58 The increase in impermeable area associated with the proposed development would require sustainable management of surface water run-off through the attenuation 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** and therefore **no effect** is predicted.

12.6.59 Further information on flood risk at the site is provided in the **Freight Management Facility FRA** (Doc Ref. 5.8) which has been submitted as part of this application for development consent.

vi. WFD compliance

12.6.60 The site is located within the Orwell transitional WFD water body catchment and on the Felixstowe Peninsula Crag and Chalk WFD groundwater body.

12.6.61 The WFD assessment demonstrates that proposed operational activities would not have direct or indirect effects on the Orwell transitional and the Felixstowe Peninsula Crag and Chalk water bodies that would be sufficient to cause deterioration in the status of the water body or protected areas located within the water bodies.

12.6.62 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.

12.6.63 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.

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

vii. Inter-relationship effects

12.6.65 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.

12.6.66 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); heritage (i.e. subsidence risk to scheduled monuments); 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.

12.6.67 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.

12.6.68 The assessment of contamination on groundwater and surface water is considered inherently within the geology and land quality assessment and no further combined effects are anticipated.

12.6.69 The assessment of terrestrial ecology and heritage are considered in **Chapter 7** and **Chapter 9** of this volume respectively.

d) Removal and reinstatement

i. Groundwater level and flow regime

12.6.70 The proposed development would be removed and 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 low value superficial aquifer and a minor adverse

effect for the medium value Crag aquifer. These effects would be **not significant.**

12.6.71 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 removal and reinstatement 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 groundwater level and flow.

ii. Contamination of groundwater

12.6.72 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.

12.6.73 Due to the permeability of the Kesgrave Formation, there is a potential pathway for contamination to reach the Crag aquifer. 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.

12.6.74 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**.

12.6.75 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 removal and reinstatement activities is slightly increased during the removal and reinstatement phase and the effect is classified as minor adverse. The effects would be **not significant**.

12.6.76 The barrow cemetery scheduled monuments are located more than 100m from the site and whilst there is the potential for contaminated groundwater to migrate to the scheduled monuments via preferential pathways generated by the removal and reinstatement activities, they are unlikely to be affected

by any local changes to the hydrogeological environment. Compared to the existing baseline, the level of risk to the monuments remains the same and the effect is classified as negligible which is **not significant**.

12.6.77 There are no known PWS in the inner study area, however there is the potential for as yet unidentified PWS to be within the inner 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**.

12.6.78 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. 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. Contamination of surface waters

12.6.79 Contamination of surface waters arising from removal and reinstatement activities through the disturbance/mobilisation of existing sources of contamination or introduction of new sources/contaminants have the potential to adversely affect the biology and water quality of the balancing ponds.

12.6.80 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 would involve excavations and has the potential to introduce contaminants during the removal and reinstatement phase.

12.6.81 The site would be isolated from the wider environment until the removal and reinstatement works have ceased. 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.

12.6.82 As detailed in **Appendices 11B** and **11C** of this volume, the risk on balancing ponds 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**.

12.6.83 It is considered that there is no pathway for contaminative sources from the removal and reinstatement activities to impact surface water receptors beyond the inner study area. Surface water 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.

iv. Flood risk

12.6.84 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.

12.6.85 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.

12.6.86 Further information on flood risk at the site is provided in the **Freight Management Facility FRA** (Doc Ref. 5.8) which has been submitted as part of this application for development consent.

v. WFD compliance

12.6.87 The site is located within the Orwell transitional WFD water body catchment and on the Felixstowe Peninsula Crag and Chalk WFD groundwater body.

12.6.88 The WFD assessment demonstrates that proposed removal and reinstatement activities would not have direct or indirect effects on the Orwell transitional and the Felixstowe Peninsula Crag and Chalk water bodies that would be sufficient to cause deterioration in the status of the water body or protected areas located within the water bodies.

12.6.89 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.

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

vi. Inter-relationship effects

12.6.91 This section provides a description of the identified inter-relationship effects that are anticipated to occur on surface water and groundwater receptors

between the individual environmental effects arising from the removal and reinstatement phase of the proposed development.

12.6.92 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); heritage (i.e. subsidence risk to scheduled monuments); 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.

12.6.93 The assessment of contamination on groundwater and surface water is considered inherently within the geology and land quality assessment and no further combined effects are anticipated.

12.6.94 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.

12.6.95 The assessment of terrestrial ecology and heritage are considered in **Chapter 7** and **Chapter 9** of this volume respectively.

12.7 Mitigation and monitoring

a) Introduction

12.7.1 Where possible, mitigation measures have been proposed where a significant effect is predicted to occur. 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 to this is referred to as secondary mitigation.

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. The requirements, scope, frequency and duration of a given monitoring regime are set out, as far as possible.

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 commencement of construction works. Where the ground investigation and subsequent generic risk assessments identifies unacceptable levels of contamination and ground related risks, further detailed quantitative risk assessment followed by, where necessary, and the

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 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 and groundwater monitoring would be designed as part of the ground investigation which will take place prior to construction works commencing. The results of this short-term monitoring would determine whether further long-term gas, and groundwater monitoring is required during the construction and operational phases.

12.8 Residual effects

12.8.1 **Tables 12.8**, **12.9** and **12.10** 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 Group groundwater (principal aquifer).	Reduction in the rate/volume of water discharging to ground.	Temporary SuDS and water management zones. Ensuring all site activities are carried out	Minor adverse.	Ground investigation and relevant risk assessment completed prior to detailed	Minor adverse. (**not significant**)
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.		Minor beneficial (**not significant**)

Receptor	Impact	Primary or Tertiary Mitigation.	Assessment of Effects.	Additional Mitigation.	Residual Effects.
	Migration of contamination through preferential pathways to groundwater.	in accordance with the **CoCP** (Doc Ref. 8.11).	Minor adverse.	design and construction works. Remediation of soil and groundwater if necessary. Longer term gas and groundwater monitoring if necessary.	Minor beneficial (**not significant**)
Kesgrave Formation groundwater (secondary A aquifer).	Reduction in the rate/volume of water discharging to ground.		Negligible		Negligible effect. (**not significant**)
	Lowering of groundwater levels.		No effect.		No effect. (**not significant**).
	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 within the outer study area.	Reduction in groundwater availability to the abstraction.		No effect.		No effect. (**not significant**).
	Contamination mobilised during construction migrating to the abstraction.		No effect.		No effect. (**not significant**).
Barrow Cemetery scheduled monuments.	Groundwater control measures attributing to subsidence risk.		No effect.		No effect. (**not significant**).
	Contamination mobilised during construction migrating to the monument.		Negligible.		Negligible (**not significant**).
Potential PWS.	Reduction in groundwater availability to the PWS.		Minor adverse.		Minor adverse. (**not significant**).

Receptor	Impact	Primary or Tertiary Mitigation.	Assessment of Effects.	Additional Mitigation.	Residual Effects.
	Contamination mobilised during construction migrating to the PWS.		Minor adverse.		Minor beneficial (**not significant**).
Nacton Meadows SSSI	Reduction in groundwater availability to the SSSI.		No effect.		No effect. (**not significant**).
	Contamination mobilised during construction migrating to the SSSI.		No effect.		No effect. (**not significant**).
	Contamination of the controlled waters.		Negligible		Negligible (**not significant**).
Existing buildings.	Groundwater control measures attributing to subsidence risk.		No effect.		No effect. (**not significant**).
Balancing ponds and Manor Pond.	Contamination of the controlled waters.	Surface water would be contained within the site with drainage to ground. Adoption of pollution prevention measures.	Negligible	Ground investigation and risk assessment. Remediation of soil and surface water receptor if necessary.	Negligible (**not significant**).
Flood risk to surrounding areas	Loss of functional floodplain storage or displacement of sea or river water	Surface water would be contained within the site 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 Group 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 petrol/oil interceptors where necessary. This will allow infiltration to the superficial aquifer, whilst also protecting the underlying groundwater from hydrocarbon contamination.	Minor Adverse.	Longer term gas, groundwater and surface water monitoring if necessary. Management and maintenance of the SuDS	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**).
Kesgrave Formation groundwater (secondary A aquifer).	Reduction in the rate/volume of water discharging to ground.		Minor Adverse.		Minor effect. (**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**).
Groundwater abstraction within the outer study area.	Reduction in groundwater availability to the abstraction.		No effect.		No effect. (**not significant**).
	Contamination mobilised during operation migrating to the abstraction.		No effect.		No effect. (**not significant**).
Barrow Cemetery scheduled monuments.	Reduction in groundwater availability to the monument.		No effect.		No effect. (**not significant**).
	Contamination mobilised during operation migrating to the monument.		Negligible.		Negligible (**not significant**).

Receptor	Impact	Primary or Tertiary Mitigation.	Assessment of Effects.	Additional Mitigation.	Residual Effects.
Potential PWS.	Reduction in groundwater availability to the PWS.		Minor adverse.		Minor effect. (**not significant**).
	Contamination mobilised during operation migrating to the PWS.		Minor adverse.		Minor effect. (**not significant**).
Nacton Meadows SSSI	Contamination of the controlled waters.	The operational drainage system would incorporate SuDS measures. Water draining from the site will pass through bypass separators. Foul sewage would either pass through a septic tank or a package treatment works.	Negligible	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible (**not significant**).
Balancing ponds and Manor Pond.	Contamination of the controlled waters.		Negligible		Negligible (**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**).

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 Group groundwater (principal aquifer).	Reduction in the rate/volume of water discharging to ground.	Appropriate drainage design. Remediation of on-site	Minor adverse.	Further GI and risk assessment post operation to confirm the risks at the	Minor adverse. (**not significant**).

Receptor	Impact	Primary or Tertiary Mitigation.	Assessment of Effects.	Additional Mitigation.	Residual Effects.
	Leaching/ migration of contamination in soils to groundwater.	contamination required. Ensuring all site activities are carried out in accordance with the **CoCP** (Doc Ref. 8.11).	Minor adverse.	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**).
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor beneficial. (**not significant**).
Kesgrave Formation groundwater. (secondary A aquifer).	Reduction in the rate/volume of water discharging to ground.		Negligible.		Negligible (**not significant**).
	Leaching/migration of contamination in soils to groundwater.		Minor adverse.		Minor effect. (**not significant**).
	Migration of contamination through preferential pathways to groundwater.		Minor adverse.		Minor effect. (**not significant**).
Groundwater abstraction within the outer study area.	Reduction in groundwater availability to the abstraction.		No effect.		No effect. (**not significant**).
	Contamination mobilised during construction migrating to the abstraction.		Minor adverse.		Minor beneficial. (**not significant**).
Barrow Cemetery scheduled monuments.	Reduction in groundwater availability to the abstraction.		No effect.		No effect.

Receptor	Impact	Primary or Tertiary Mitigation.	Assessment of Effects.	Additional Mitigation.	Residual Effects.
	Contamination mobilised during construction migrating to the abstraction.		Negligible.		Negligible **(not significant)**.
Potential PWS.	Reduction in groundwater availability to the PWS.		No effect.		No effect.
	Contamination mobilised during construction migrating to the PWS.		Minor adverse.		Minor beneficial. (**not significant**).
Balancing ponds and Manor Pond.	Contamination of the controlled waters.	Control measures adopted during the decommissioning phase of the site would be as described for the construction phase. Implementation of appropriate pollution incident control.	Negligible.	Remediation of soil and surface water receptor due to incident occurring during the operational or removal and reinstatement phase if necessary.	Negligible (**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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