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14.0 WATER RESOURCES, FLOOD RISK & DRAINAGE

14.1 Introduction

14.1.1 This chapter addresses the potential effects of the construction, operation (including maintenance) and decommissioning of the Proposed Development on surface water, flood risk and drainage. It identifies key water resources and sensitivities and highlights potential direct and indirect impacts on them from the Proposed Development.

14.1.2 This chapter is supported by Figure 14.1 presented in ES Volume II, a Flood Risk Assessment (FRA) presented in Appendix 14A in ES Volume III and an Outline Drainage Strategy presented in Appendix 14B in ES Volume III.

14.1.3 The FRA in Appendix 14A in ES Volume III, details the existing levels of flood risk associated with the Site and the surrounding area, quantifies the volume of surface water on the Site requiring management, identifies the impacts that the Proposed Development would have upon these aspects, and suggests potential mitigation or control measures to reduce the impact and manage the risk of flooding.

14.1.4 The Outline Drainage Strategy for the Proposed Development in Appendix 14B in ES Volume III provides guidance and information with regards to the effective and safe drainage of surface water for the Site. The final drainage design will be completed during the detailed design stage.

14.1.5 Other than the risk of groundwater flooding, potential impacts and effects associated with groundwater underlying the Site are addressed within Chapter 12: Geology, Hydrogeology and Land Contamination, due to overlap between the two subject areas.

14.1.6 The assessment of cumulative effects on water resources, flood risk and drainage associated with the Proposed Development and other committed developments in the vicinity are described in Chapter 17: Cumulative and Combined Effects.

Scope of Assessment for Water Resources, Flood Risk and Drainage

14.1.7 The scope of assessment for this chapter comprises assessment of the following potential impacts:

- permanent loss of two surface waterbodies within the Proposed Development Site during construction;
- potential change to the surrounding ditches (culverting/ extension to culverts/ installation of fencing);
- potential temporary changes to surface water flows within Flood Zone 3 during construction;
- change to the impermeable area within the Site and associated changes to surface water flows during operation;
- potential loss of floodplain storage as the footprint of the Proposed Development is located in Flood Zone 3 (although the Site benefits from existing maintained defences);
- pollution of surface watercourses within or near the Site during construction due to spillages or polluted surface water runoff entering the watercourse (if appropriate pollution prevention measures are not implemented); and

- pollution of surface watercourses within or near the Site during operation, due to spillages or polluted surface water runoff entering the watercourse (if appropriate pollution prevention measures are not implemented).

14.2 Legislative and Planning Policy Context

European Legislation

14.2.1 The European Union (EU) Water Framework Directive (WFD) (2000/60/EC) is the primary European legislation setting the context for this assessment. The purpose of the Directive is to establish a framework for the protection and improvement of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater.

14.2.2 The Directive requires the UK to classify the current condition of key waterbodies (giving a 'status' or 'potential') and to set objectives to either maintain the condition, or improve it where a waterbody is failing minimum targets. Any activities or developments that could cause deterioration within a nearby waterbody, or prevent the future ability of a waterbody to reach its target status, must be mitigated so as to reduce the potential for harm and allow the aims of the WFD to be realised.

National Legislation

14.2.3 The Water Resources Act 1991 (as amended) sets out the relevant regulatory controls that provide protection to waterbodies and water resources (from abstraction pressures and pollution).

14.2.4 Other relevant national legislation which set out requirements related to control and protection of water resources and flood risk management includes:

- the Flood and Water Management Act 2010 (FWMA) – see paragraph 13.2.6 and paragraph 13.2.7;
- the Water Act 2003 and Water Act 2014 which govern the control of water abstraction, discharge to water bodies, water impoundment, conservation and drought provision;
- the Environment Act 1995 which established the Environment Agency and its statutory role in water resource protection;
- the Environmental Protection Act 1990 which provides for integrated pollution control; and
- the Land Drainage Act 1991 which provides for drainage management related to non-main rivers.

14.2.5 A number of specific regulations have been enacted to enact European and national legislation. These regulations include:

- the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003;
- the Water Environment (WFD) Regulations 2015;
- the Anti-Pollution Works Regulations 1999;
- the Control of Pollution (Oil Storage) (England) Regulations 2001;

- the Environmental Damage Regulations 2009;
- the Flood Risk Regulations 2009;
- the Water Resources Act (Amendment) (England and Wales) Regulations 2009;
- the Environmental Permitting (England and Wales) Regulations 2016 which control discharge of water to surface water and groundwater; and
- the Water Supply (Water Quality) Regulations 2010.

14.2.6 The FWMA, enacted by Government in 2010 in response to The Pitt Review (Pitt, 2008) designated unitary authorities, such as North East Lincolnshire Council (NELC), as Lead Local Flood Authorities (LLFAs). As a LLFA, NELC has responsibilities to lead and co-ordinate local flood risk management. Local flood risk is defined as the risk of flooding from surface water run-off, groundwater and ditches and watercourses (collectively known as ordinary watercourses).

14.2.7 The FWMA also formalises the flood risk management roles and responsibilities for other organisations including the Environment Agency, water companies and highways authorities establishing them as Risk Management Authorities (RMAs). The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency.

Planning Policy Context

National Planning Policy Framework

14.2.8 The NPPF sets out 12 planning principles as guidance for local councils for the creation of their local plan; the following principles are directly applicable to the water environment:

"10. Meeting the challenge of climate change, flooding and coastal change – support the transition to a low carbon future in a changing climate taking full account of (inter alia) flood risk and coastal change; and

"11. Conserving and enhancing the natural environment – development should minimise pollution and other adverse effects on the local and natural environment and should plan positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure".

Planning Practice Guidance

14.2.9 The Planning Practice Guidance (Ministry of Housing, Communities and Local Government, 2016) contains guidance in relation to water supply, wastewater and water quality, and flood risk management. It also provides advice and information on how planning can and should protect water quality; ensure the delivery of adequate water and wastewater infrastructure for new development, and ensure development is protected from flood risk and does not increase flood risk elsewhere.

Non-Statutory Technical Standards for Sustainable Drainage Systems (2015)

14.2.10 The Non-Statutory Technical Standards for Sustainable Drainage Systems (Defra, 2015) was published in March 2015 and is the current guidance for the design, maintenance and operation of Sustainable Drainage Systems (SuDS). The standards set out the following:

- peak run-off rates should be as close as is reasonably practicable to the pre-development equivalent values ('Greenfield' rate), but should never exceeds the pre-development run-off rate;
- the drainage system should be designed so that flooding does not occur on any part of a development site for a 1 in 30 year rainfall event, and that no flooding of a building (including basement) would occur during a 1 in 100 year rainfall event; and
- pumping should only be used when it is not reasonably practicable to discharge by gravity.

14.2.11 The Proposed Development will also be considered by the Environment Agency in terms of the Land Drainage Act 1991 and the Water Resources Act 1991. Consent from the Environment Agency will be required for any proposed discharges to controlled waters.

Regional Policy

East Inshore and East Offshore Marine Plans

14.2.12 The East Inshore and East Offshore Marine Plans (Defra, 2014) are guidance documents for developers to ensure the sustainable development of the marine area and protection of the marine ecosystem.

14.2.13 The East Inshore Marine Plan area includes the coastline stretching from Flamborough Head to Felixstowe, extending out to the seaward limit of the territorial sea (approximately 12 nautical miles). It also includes:

- any area submerged at mean high water spring tide;
- the waters of any estuary, river or channel, so far as the tide flows at mean high water spring tide; and
- waters in any area which is closed (permanently or intermittently) by a lock or other artificial means against the regular action of the tide, but into and from which seawater is caused or permitted to flow (continuously or from time to time).

14.2.14 This includes the tidal limits for the Humber Estuary, which incorporates areas of North East Lincolnshire. The East Inshore Marine Plan states "*A clean and healthy marine environment, including healthy beaches and good water quality, are important to tourism and recreation*". Relevant district wide policies include:

- Policy TR1: Proposals for development should demonstrate that during construction and operation, in order of preference:

  a) they will not adversely impact tourism and recreation activities;

  b) how, if there are adverse impacts on tourism and recreation activities, they will minimise them;

c) how, if the adverse impacts cannot be minimised, they will be mitigated; and

d) the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.

- Policy TR2: Proposals that require static objects in the East Inshore Marine Plan areas, should demonstrate, in order of preference:

a) that they will not adversely impact on recreational boating routes;

b) how, if there are adverse impacts on recreational boating routes, they will minimise them;

c) how, if the adverse impacts cannot be minimised, they will be mitigated; and

d) the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.

14.2.15 In addition, the following policy in relation to climate change is also applicable:

- Policy CC1: Proposals should take account of:

a) how they may be impacted upon by, and respond to, climate change over their lifetime;

b) how they may impact upon any climate change adaptation measures elsewhere during their lifetime; and

c) where detrimental impacts on climate change adaptation measures are identified, evidence should be provided as to how the proposal will reduce such impacts.

14.2.16 No works are required within the river or to flood defences within the East Inshore Marine Plan area in proximity to the Site therefore no Deemed Marine Licence is required.

Grimsby and Ancholme Catchment Flood Management Plan (Environment Agency 2009)

14.2.17 The role of Catchment Flood Management Plans (CFMP) are to identify flood risk management policies which will assist all key decision makers in the catchment to deliver sustainable flood risk management for the long term. The Grimsby and Ancholme CFMP considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding).

14.2.18 The Site is located within the Grimsby and Ancholme CFMP study area. This region specific CFMP explores flood risk from surface water, groundwater, main rivers and ordinary watercourses but will not account for tidal flooding.

14.2.19 The Grimsby and Ancholme CFMP identifies the Oldfleet Drain (a main river) to be a main source of fluvial flood risk to the Humber Trade Zone Industrial Area, which includes the site and surrounding area. No other site-specific information is found in the report.

Flamborough Head to Gibraltar Point Shoreline Management Plan (SWHECA, 2010)

14.2.20 The Site is potentially vulnerable to tidal flooding from the Humber Estuary and the Site location falls into 'Sub Area 4: Immingham, Grimsby and Buck Beck' of the local Flamborough Head to Gibraltar Point Shoreline Management Plan (SMP).

14.2.21 The purpose of an SMP is to identify the most sustainable approach to managing the flood and coastal erosion risks to the coastline in the short-term (0 to 20 years), medium term (20 to 50 years) and long term (50 to 100 years).

14.2.22 The report identifies the Site to be in an area of low to high flood risk depending on the flood source, where the LLFA and the Environment Agency are already working towards managing the risk. However it is also an area that will be affected by climate change due to the low lying land and its coastal location, and so will need ongoing maintenance and defence improvements.

Humber Flood Risk Management Strategy (Environment Agency, 2008)

14.2.23 The Site lies within 'Area 24 - Immingham to West Grimsby' of the Humber Flood Risk Management Strategy (FRMS). Policies to manage the risk of flooding in this area are:

- defences here will be improved as necessary to protect the large number of people, businesses and nationally important industry from tidal flooding;
- develop plans to improve the defences near North Killingholme and Stallingborough within the next five years; and
- the Environment Agency will work closely with other authorities and developers to ensure the risk is managed effectively together.

Anglian Water Surface Drainage Policies

14.2.24 The Drainage Strategy presented within Appendix 14B in ES Volume III, states Anglian Water policies regarding surface water drainage should be considered. The following should occur on Site where appropriate:

- discharge by infiltration to the ground;
- discharge to an open surface water body;
- discharge to a surface water sewer;
- discharge to a combined sewer; and/or
- discharge to a foul sewer.

14.2.25 Discharge rates and volumes are to be limited to the equivalent Greenfield Runoff rate (with on-site attenuation for all events up to the 1 in 100 rainfall event plus climate change). Flooding must also not occur on any part of the development for the 1 in 30 year rainfall event.

Local Planning Policy

North East Lincolnshire Local Plan 2013 to 2032 (NELC, 2018)

14.2.26 The following policies of the recently adopted North East Lincolnshire Local Plan 2013 to 2032 (NELC, 2018) are considered relevant to the Proposed Development:

- SO2 – Climate Change;
- Policy 33 – Flood Risk;
- Policy 34 – Water Management;
- Policy 43 – Green Space and Recreation; and
- Policy 48 – Safeguarding waste facilities and related infrastructure.

North and North East Lincolnshire Strategic Flood Risk Assessment (SFRA) (North East Lincolnshire Council, 2011) and Addendum (NELC, 2016)

14.2.27 The North and North East Lincolnshire SFRA was written in 2011 and provides the LPAs with information to make objective judgements about flooding, both when making decisions on land allocations for development plans and when determining planning applications for development in their areas.

14.2.28 The SFRA provides a series of maps detailing the hydrological features in the vicinity of the Site, identifying the responsibilities for these by the North East Lindsay Internal Drainage Board (IDB) (for Significant Ordinary Watercourses) and the Environment Agency (for Main Rivers), and presents records of historical flooding incidents in the vicinity. The SFRA identifies the South Humber Bank as a strategic employment site as defined in the NELC Local Plan, and also provides site-specific guidance for developers to consider in regard to mitigation of any identified flood risks from all sources.

14.2.29 An Addendum to the SFRA was completed in April 2016 containing updated maps for a tidal defence breach hazard scenario provided by the Environment Agency. No specific policies are presented in relation to the Site.

North and North East Lincolnshire Preliminary Flood Risk Assessment (Entec, 2011)

14.2.30 The North and North East Lincolnshire Preliminary Flood Risk Assessment (PFRA) was a high level screening exercise that compiled information on significant local flood risk from past and future floods, based on readily available information at the time. The PFRA also included the identification of 'flood risk areas', and outlines the responsibilities of key stakeholders. Local flood risk was defined in the PFRA as flood risk originating from sources other than Main Rivers, the sea and large reservoirs; principally meaning flood risk from surface water runoff, groundwater and Ordinary Watercourses. This main definition of 'local flood risk' was further clarified:

- it includes lakes and ponds;
- it does not consider flooding from sewers unless this is wholly or partly caused by rainwater or other precipitation entering or otherwise affecting the system;
- it does not include flooding from water supply systems (for example burst water mains); and

- it considers the interaction with flooding from main rivers, the sea and sewers.

14.2.31 No policies outlined in the PFRA are considered relevant to this Site.

North East Lincolnshire Local Flood Risk Management Strategy (Amec Foster Wheeler, 2016)

14.2.32 As the LLFA, NELC is responsible for managing flood risk from 'local' sources. Their Local Flood Risk Management Strategy (LFRMS) report presents the summary of NELC's preferred approach to managing flood risk from the following 'local' sources:

- surface run-off;
- groundwater; and
- ordinary watercourses (generally small rivers and streams).

14.2.33 The LFRMS contains a list of objectives for the strategy, which include:

- Objective 1 – to improve the understanding (of both communities and flood risk management partners) of the roles and responsibilities for flood risk management in North East Lincolnshire;
- Objective 2 – to improve the understanding of local flood risk;
- Objective 3 – to reduce the risk of flooding from local sources in the communities;
- Objective 4 – seek to implement flood risk management actions that contribute to wider social, economic and environmental outcomes and sustainable development;
- Objective 5 – create a strong collaborative approach across stakeholders to address risks from all sources of flooding;
- Objective 6 – raise public awareness and engage with local people about local flood risks, and help the communities to manage their own risks;
- Objective 7 – contribute to planning and development decisions to ensure new development is appropriate; and
- Objective 8 – contribute to effective emergency flood response.

14.2.34 The LFRMS refers to the South Humber bank as the 'energy estuary', and states that managing flood risk will be important in ensuring that these businesses can operate in a safe environment. Disruption from flooding would otherwise lead to significant disruption which could damage the local economy.

14.2.35 It continues to state that in order to develop stronger communities NELC aims to establish a new relationship with the community to promote a culture of independence. The LFRMS acknowledges that communities will also need to play a greater role than before in reducing their own flood risks, becoming more resilient and ensuring that they are prepared for flooding without relying on the Council to provide all the solutions.

North East Lincolnshire Council SuDS Guide (NELC, 2016)

14.2.36 The NELC SuDS Guide (2016) provides introductory advice on how best to approach the development of SuDS proposals within schemes. The report is designed to reiterate

the wide range of industry guidance already available and to highlight the importance of SuDS. It states the aims of SuDS as being to:

- reduce the risk and impacts of flooding;
- remove pollutants from urban runoff at source;
- provide amenity benefits; and
- contribute to improving and enhancing biodiversity.

14.2.37 The guidance also provides information on the criteria needed to support planning application submissions and reiterates that under the NPPF, all major developments must incorporate SuDS and must ultimately succeed in all four of the aims listed above.

14.2.38 The guide acknowledges each site will warrant a different approach to the composition of SuDS applied, dependent on many factors such as, topography, shape, size and underlying permeability. The LPA offers pre-application advice on development proposals, and therefore it is recommended prior to the detailed design process, the LLFA (NELC) be consulted.

Internal Drainage Board (IDB) Byelaws

14.2.39 IDBs are responsible for managing water levels in the watercourses designated to each IDB and work in partnership with other authorities to actively manage and reduce the risk of flooding within the Board's district. They have permissive powers under the Land Drainage Act 1991 (as amended by the 1994 Act) (UK Parliament, 1991) to undertake maintenance on any watercourse within their district other than 'Main Rivers' and to supervise all matters relating to the drainage of land within their districts. Permissive powers means that IDBs are permitted to undertake works on ordinary watercourses but the responsibility remains with the riparian owner as the IDBs are not obligated. IDBs can undertake works on watercourses outside their drainage district in order to benefit the district. IDBs may make byelaws, approved by the relevant Minister, for securing the efficient working of the drainage systems.

14.2.40 North East Lindsey (NEL) IDB operates in the location of the Site. The following NEL IDB byelaws are relevant to the Proposed Development:

- Byelaw 3 – control of introduction of water and increase in flow or volume of water;
- Byelaw 4 – control of sluices etc.;
- Byelaw 6 – diversion or stopping up of watercourses;
- Byelaw 7 – detrimental substances not to be put into watercourses;
- Byelaw 10 – no obstructions within 7m of the edge of the watercourse;
- Byelaw 15 – banks not to be used for storage;
- Byelaw 16 – not to dredge or raise gravel, sand etc;
- Byelaw 17 – fences, excavations, pipes etc.; and
- Byelaw 18 – interference with sluices.

Environment Agency, Defra and Her Majesty's Government Guidance

14.2.41 The 'Gov.co.uk' website currently provides the following guidance from Defra, the Environment Agency and Her Majesty's Government (HMG):

- Pollution Prevention for Businesses (PPB) (Environment Agency, 2016) - provides details of what businesses and organisations should do at work to avoid pollution incidents, including the permissions need to dispose of waste in England;
- Discharges to surface water and groundwater: environmental permits (Defra and Environment Agency, February, 2016) - when an environmental permit to discharge liquid effluent or waste water to surface water or onto the ground is needed, and how to apply;
- Manage water on land: guidance for land managers (Environment Agency, February, 2015) - How to manage water use, levels, drainage and irrigation, and avoid pollution from waste water;
- Dispose of business or commercial waste (HMG, 2018);
- Reporting an environmental incident (HMG, 2018);
- Storing oil at your home or business (HMG, 2018);
- Oil storage regulations for businesses (Defra and Environment Agency, May 2015) - how to store oil, design standards for tanks and containers, where to locate and how to protect them, and capacity of bunds and drip trays; and
- Check Permission to do work on a river, flood defence or sea defence (HMG, 2018) - in England.

Construction Industry Research and Information Association (CIRIA) Guidance

14.2.42 The CIRIA guidance of relevance to the Proposed Development includes:

- CIRIA C635 Designing for exceedance in urban drainage - good practice. (CIRIA, 2006), which provides guidance on site drainage and landscape design to minimise the risk from exceedance flows and any overland flow entering the Proposed Development buildings;
- Guidance C532 - Control of Water Pollution from Construction Sites (CIRIA, 2010), which brings together the Environment Agency guidance but goes into greater detail with regard to sources of water on construction sites, pollutants and pathways. In addition, it provides guidance on planning for the type and location of suitable control measures; and
- Guidance C753 - The SuDS Manual (CIRIA, 2007), which provides best practice guidance on the planning, design, construction, operation and maintenance of SuDS to facilitate their effective implementation within developments.

14.3 Assessment Methodology and Significance Criteria

14.3.1 The framework applied in this assessment of likely significant effects of the Proposed Development on water resources, flood risk and drainage, was the standard Institute of Environmental Management & Assessment State of Environmental Impact Assessment Practice in the UK (IEMA, 2011) methodology. This standard assessment methodology for Environmental Impact Assessments (EIAs) is adopted by the Environment Agency for flood risk management development works and UK water companies when assessing the potential impact of works on the water environment as a whole. Given that the mitigation measures associated with drainage of the Proposed Development will be finalised at the detailed design stage, the assessment has taken a robust approach by assessing the likely effects prior to mitigation, then a pragmatic and precautionary assessment of the likely residual effects arising from the Proposed Development post mitigation.

14.3.2 As described in Chapter 5: Construction Programme and Management it is noted that the Proposed Development may be constructed in two phases. For the purposes of this assessment the 'worst case' would be the construction and operation of a two steam stream development in a single phase. The worst case is the only scenario assessed in this chapter.

14.3.3 The assessment has considered all of the potential water resource receptors as shown on Figure 14.1 in ES Volume II and consists of the following sequential elements:

- description of the baseline conditions for water resources, flood risk and drainage in order to characterise the current environment;
- forecasting of the potential future baseline conditions;
- evaluation of the likely significant effects on water resources, flood risk and drainage during the construction, maintenance and operational phases of the Proposed Development;
- identification of specific mitigation measures to protect water resources from flood risk and protect drainage; and
- evaluation of the likely residual effects on water resources, flood risk and drainage after the implementation of specific mitigation measures.

Significance of Effects Criteria

14.3.4 The assessment of the impacts of the Proposed Development on water environment receptors considers how sensitive the receptors in the Study Area may be to changes in conditions arising from the Proposed Development. Three sets of criteria are considered in this assessment, which adopts the IEMA 2011 approach:

a) characterising the importance of the receptor – in terms of sensitivity and value;

b) determining the nature of the impacts and effects – in terms of magnitude, probability, reversibility and duration; and

c) classifying the significance of the effects of the Proposed Development with reference to the importance of the receptor and the nature of the impact.

14.3.5 The IEMA 2011 approach identifies that the most common methodology used to evaluate significance of an effect is to compare the sensitivity, value and importance of the receiving environment (the receptor sensitivity and value) with the nature of the predicted effect (magnitude, probability, reversibility and duration).

Characterising the Importance of the Receptor

14.3.6 The evaluation of a receptor's importance takes into account quality, scale, rarity and substitutability where:

- quality is a measure of the physical condition of the attribute;
- scale requires consideration of the geographical scale at which the attribute matters to both policy makers and stakeholders, at all levels;
- rarity requires consideration of whether the water feature is commonplace or scarce, at the scale at which it matters; and
- substitutability requires consideration of whether water attributes are replaceable over a given time frame.

14.3.7 The assessment of the value and importance of the receptor is based on uses – from flood defence and drainage to nature conservation designations reflecting ecological value and other ecosystem services such as recreation and abstraction/discharges reflecting human value. These sensitivities and values in the context of Water Resources, Flood Risk and Drainage are defined in Table 14.1.

Table 14.1: Criteria for Characterising the Importance of the Receptor (based upon IEMA 2011 guidance)

RECEPTOR IMPORTANCE	SENSITIVITY	VALUE
High	**High** vulnerability to temporary or permanent changes to water resource (including water quality, abstractions, discharges and pollution incidents), hydrology, flood risk and drainage	**Water resources**: Watercourse having a WFD classification as shown in a River Basin Management Plan (River Basin Management Plan (RBMP)), and Q95 < 1.0 m^3/s; Principal Aquifer (not within SPZ 1) [Cyprinid or Salmonid fishery] **Water abstraction**: 500-1,000 m^3/day **Receptors to flood risk**: 'more vulnerable' development **Receptors to drainage**: 'more vulnerable' development **Other key considerations:** Designated for relevant environmental features at international (Special Protected Area, Special Area of Conservation or Ramsar Site) or national level (Site of Special Scientific Interest, National Nature Reserve or equivalent). **Use:** Frequently used by people e.g. for recreation, abstraction. WFD Drinking Water Protected Area.

RECEPTOR IMPORTANCE	SENSITIVITY	VALUE
Medium	**Medium** vulnerability to temporary or permanent changes to water resource (including water quality, abstractions, discharges and pollution incidents), hydrology, flood risk and drainage	**Water resources**: Watercourse detailed in the Digital River Network but not having a WFD classification as shown in a RBMP; Secondary Aquifer **Water abstraction**: 50-499 m^3/day Receptors to flood risk: less vulnerable development* **Receptors to flood risk**: 'more vulnerable' development* **Receptors to drainage**: 'more vulnerable' development* **Other key considerations:** Designated for relevant environmental features at regional (e.g. Sites of Metropolitan Importance) or district level (e.g. Local Nature Reserves) **Use:** Occasionally used by people e.g. for recreation, abstraction
Low	**Low** vulnerability to temporary or permanent changes to water resource (including water quality, abstractions, discharges and pollution incidents), hydrology, flood risk and drainage	**Water resources**: Surface water sewer, agricultural drainage ditch; non-aquifer **Water abstraction**: <50m^3/day **Receptors to flood risk**: 'water compatible' development **Receptors to drainage**: 'water compatible' development **Other key considerations:** Not designated for relevant features, but may contain habitats or populations assemblages of species that appreciably enrich the local habitat resource (e.g. species rich hedgerows, ponds). **Use:** Infrequently used by people e.g. for recreation, abstraction
Negligible	**Negligible** vulnerability to temporary or permanent changes to water resource (including water quality, abstractions, discharges and pollution incidents),	**Water resources**: Surface water sewer, agricultural drainage ditch; non-aquifer **Water abstraction**: <50 m^3/day **Receptors to flood risk**: 'water compatible' development **Receptors to drainage**; 'water compatible'

RECEPTOR IMPORTANCE	SENSITIVITY	VALUE
	hydrology, flood risk and drainage	development **Other key considerations:** Not designated for relevant features **Use:** Not used by people e.g. for recreation, abstraction

Evaluation of the Nature of the Effects

14.3.8 The assessment framework takes into consideration a wide range of impacts that may be incurred as a result of the Proposed Development. The potential nature of an impact of the Proposed Development is considered as high, medium, low or negligible based on the criteria set out in Table 14.2. The nature of the impact and its effect is considered separately and collectively in terms of the magnitude, probability, reversibility, duration and direction of the impact of the Proposed Development. In this approach, the 'magnitude' includes the spatial extent of the effect; the 'probability' refers to the time period over which the effect will likely reoccur; and consideration is given to whether the effect is permanent or reversible. Closer proximity of the receptor to the Site increases the likelihood of direct and indirect impacts on hydrology and water quality.

14.3.9 Impacts may be adverse or beneficial, depending on the circumstances. They are quantified where practicable and the degree or magnitude of impact is assessed on a qualitative scale, to facilitate comparison with impacts on other environmental receptors.

14.3.10 In the context of the Proposed Development, short-term effects are considered to be those associated with construction or decommissioning, and which cease when construction/ decommissioning works are completed; long-term effects are those associated with the Proposed Development once completed and operational and which last for the life of the Proposed Development during operation and periods of maintenance. Effects may be permanent (irreversible) or temporary (reversible) and direct or indirect as well as adverse or beneficial.

14.3.11 After specific mitigation measures have been set out, the residual significance of the effects is re-assessed using the same criteria.

Table 14.2: Criteria for Determining the Nature of Effect

NATURE OF EFFECT	MAGNITUDE OF EFFECT	PROBAB-ILITY	REVERSIB-ILITY	DURATION
High	Large-scale (regional to waterbody) effects on flows, water resources, water levels and/or wetted areas, with flood risk and drainage significantly influenced outside their normal operating envelope. Large-scale (regional to waterbody) effects on the river channel, banks or sediment dynamics, which are likely to have a consequent effect on watercourse hydrodynamics. Large-scale (regional to waterbody) effects on water quality, which affects suitability of the water quality to support Good or High ecological status.	High likelihood of direct effects on water resources, flood risk, drainage, hydrology and water quality	Effects on water resources, flood risk, drainage, hydrology and water quality are irreversible	Long term effects on water resources, flood risk, drainage, hydrology and water quality
Medium	Medium-scale (local to waterbody) changes to flows, water resources, water levels and/or wetted areas, with flood risk and drainage. Medium-scale (local to waterbody) effects on the river channel, banks or sediment dynamics, such as changes to erosional and depositional character that have a limited influence on channel function. Medium-scale (local to waterbody) effects on water quality, but not predicted to lead to deterioration in ecological status.	Medium likelihood of direct effects OR high likelihood of indirect effects on water resources, flood risk, drainage, hydrology and water quality	Effects on water resources, flood risk, drainage, hydrology and water quality are partially reversible	Medium term effects on water resources, flood risk, drainage, hydrology and water quality

NATURE OF EFFECT	MAGNITUDE OF EFFECT	PROBAB-ILITY	REVERSIB-ILITY	DURATION
Low	Small-scale (up to local) changes on flows, water resources, water levels and/or wetted areas, with flood risk and drainage, within their normal operating envelope. Small-scale (up to local) effects on the river channel, banks or sediment dynamics, with little or no consequent effects on watercourse hydrodynamics. Small-scale (up to local) effects on water quality, within the usual variability for the Site.	Low likelihood of direct effects OR medium likelihood of indirect effects on water resources, flood risk, drainage, hydrology and water quality	Effects on water resources, flood risk, drainage, hydrology and water quality are mostly reversible	Short term effects on water resources, flood risk, drainage, hydrology and water quality
Negligible	Little or no changes on flows, water resources, water levels and/or wetted areas, with flood risk and drainage Little or no effects on the river channel, banks or sediment dynamics. Little or no effects on water quality.	Low likelihood of direct or indirect effects on water resources, flood risk, drainage, hydrology and water quality	Effects on water resources, flood risk, drainage, hydrology and water quality are fully reversible	At most temporary effects on water resources, flood risk, drainage, hydrology and water quality
	DIRECTION			
Adverse	Negative effects on water resources, flood risk, drainage, hydrology and water quality available for use by people and wildlife			
Beneficial	Positive effects on water resources, flood risk, drainage, hydrology and water quality available for use by people and wildlife			

Assessment of the Significance of the Effects

14.3.12 Overall, effects have been assessed in terms of the importance of the receptor (see Table 14.1) and the magnitude of change (see Table 14.2). This is described for the construction, maintenance and operational phases, prior to the implementation of mitigation. The approach of this assessment is then to assess and evaluate the significance of these effects on the receptors.

14.3.13 The classification of the significance of effects (adapted from IEMA State of Environmental Impact Assessment Practice in the UK (IEMA, 2011)) can be summarised as:

- **Negligible** - imperceptible effects to the water environment for a receptor;

- **Minor** - a limited, very short or highly localised effect on a water receptor of high or medium importance, or a wide extent or long duration effect on a water receptor of low quality/importance. A minor effect would not prevent compliance with legislation, standards or policy for water resources, flood risk; drainage or water quality;

- **Moderate** - a local scale medium magnitude of change on a water resource of high quality; or a large (reversible) effect on a water resource of medium quality/importance. A moderate effect would not affect the long-term status of a water receptor complying with compliance with legislation, standards or policy for water resources, flood risk; drainage or water quality; or

- **Major** - a magnitude of change on a water resource of high quality/importance resulting in a deterioration of water receptor status; preventing compliance with legislation, standards or policy for water resources, flood risk; drainage or water quality.

Table 14.3: Classification of the Significance of the Effects (adapted from Figure 6.3 in IEMA, 2011)

		RECEPTOR IMPORTANCE			
		HIGH	**MEDIUM**	**LOW**	**NEGLIGIBLE**
NATURE OF EFFECT	**HIGH**	Major	Major	Moderate or Minor	Negligible
	MEDIUM	Major	Moderate	Minor	Negligible
	LOW	Moderate or Minor	Minor	Negligible	Negligible
	NEGLIGIBLE	Negligible	Negligible	Negligible	Negligible

14.3.14 In the IEMA 2011 guidance (see 'Figure 6.3 EIA significance evaluation matrix' on page 61 of the guidance report), a 'major' effect is equivalent to 'very substantial/ substantial', a 'minor' effect is equivalent to 'slight', and a 'negligible' effect is equivalent to 'not significant'. The adapted classifications presented in Table 14.3 however allow comparison with the other ES chapters.

14.3.15 Major and moderate effects are considered to be significant for the purposes of EIA. If a major adverse or moderate adverse effect were to be identified, then mitigation measures would be developed to reduce or mitigate this effect. After specific mitigation measures have been set out (see Section 14.7), the residual effects are assessed using the same criteria (see Table 14.3).

14.3.16 It should be noted that these criteria form a starting point to guide decisions on the significance of effects. Decisions have been based on professional judgement.

Sources of Information/Data to Establish Baseline

14.3.17 In order to identify and characterise the surface water receptors within the Study Area considered as part of this assessment, available data on surface water quality and quantity within the vicinity of the Site have been obtained.

14.3.18 A number of sources of information and websites have been consulted, as summarised in Table below.

Table 14.4: Sources of Information

PURPOSE	SOURCE	COMMENTS
Identification of Hydrological Features	1:10,000 Ordnance Survey (OS) mapping Environment Agency 1 m resolution LiDAR data	Identifies the location of local hydrological features and provides topographic elevations.
Identification of Land Use	StreetCheck (StreetCheck, 2018)	Identifies the type of land use
Identification of Existing Flood Risk	1:10,000 OS mapping	Provides indicative ground levels of the Site and surrounding area.
	Environment Agency Flood Map for Planning[1] (Environment Agency, 2018)	Identifies fluvial/ tidal inundation extents.
	Environment Agency Flood Risk from Surface Water Map (Environment Agency, 2018)	Identification of flood risk from surface water runoff from land.
	Environment Agency Flood Risk from Reservoirs Map (Environment Agency, 2018)	Provides information on the risk of flooding from reservoirs (artificial sources).
	Environment Agency Groundwater Vulnerability map (Defra, 2018)	Identification of groundwater vulnerability designations.
	British Geological Survey (BGS) records & Soilscapes Map (Cranfield Soil and Agrifood Institute, 2018)	Provides details of geology (bedrock and superficial deposits), soil type and hydrogeology in the vicinity of the Site.
	North and North East Lincolnshire Strategic Flood Risk Assessment (SFRA) and Addendum	Assesses local flood risk from fluvial/tidal, sewers, overland flow, groundwater and artificial sources.
	North East Lincolnshire Preliminary Flood Risk Assessment (PFRA)	Indicative risk of flooding from the local drainage system and minor watercourses
	Grimsby and Ancholme Catchment Flood Management Plan (CFMP)	Outlines flood risk sources within the plan area and how these may be managed in the future.

[1] See Annex 1 of the FRA in Appendix 14A in ES Volume III

PURPOSE	SOURCE	COMMENTS
	Flamborough Head to Gibraltar Point Shoreline Management Plan (SMP)	Outlines the proposals for how the tidal flood risk in the area will be managed by the Environment Agency in the future.
Identification of Historical Flooding	North and North East Lincolnshire Strategic Flood Risk Assessment (SFRA) and Addendum North East Lincolnshire Preliminary Flood Risk Assessment (PFRA) North East Lincolnshire Local Flood Risk Management Strategy (LFRMS)	Details of historical flooding and local flooding records.
Details of Proposed Development	Indicative Layout Drawings (see Figure 4.1 in ES Volume II)	Provides the layout of the Proposed Development.
Surface Water Drainage Plans	1:10,000 OS Mapping Existing Site Drainage Plans (included within Appendix 14B (Drainage Strategy) in ES Volume III)	Identifies existing site drainage, public drainage system near the Site and details of existing surface water runoff from the Site.

Consultation Summary

14.3.19 Consultation undertaken with statutory consultees to inform this assessment, including a summary of comments raised through the formal EIA Scoping Opinion presented within Appendix 1B in ES Volume III and in response to the formal consultation are summarised in Table 14.5 below.

Table 14.5: Consultation Summary

CONSULTEE	DATE	SUMMARY OF RESPONSE	HOW COMMENTS HAVE BEEN ADDRESSED IN CHAPTER
Environment Agency	Letter response to NELC on 03/08/18 (EA Ref. AN/2018/127698/01-L01) And follow up telephone conversation 06/11/18	The proposed content of the EIA is considered appropriate in relation to issues within Environment Agency remit, which include flood risk. Advice was provided by the Environment Agency on the Environmental Permitting required for the Proposed Development Advice was provided by the Environment Agency on the requirements of the FRA for the Proposed Development	Key aspects of Environmental Permitting have been reviewed and are being agreed with the Environment Agency with pre-application advice provided. In the context of the baseline and changes brought about by the Proposed Development, appropriate permits will be obtained from the Environment Agency, which will specify appropriate mitigation and monitoring, if applicable. The FRA considers all sources of flooding, and demonstrates that the Proposed Development will be safe for the lifetime of the Proposed Development, without increasing risk elsewhere and where possible reducing flood risk overall. Evidence has been included in this chapter of the ES that appropriate mitigation measures including flood resilience techniques have been incorporated into the Proposed Development.

CONSULTEE	DATE	SUMMARY OF RESPONSE	HOW COMMENTS HAVE BEEN ADDRESSED IN CHAPTER
North East Lindsey Drainage Board	Letter response to NELC on 10/08/18	Confirmation from the Board that the LPA has approve a proposed scheme for the provision, implementation and future maintenance of a surface water drainage system for the Proposed Development. Confirmation that the Board support the use of SuDS and the drainage policies of NELC. Guidance that although any discharge should be limited to the greenfield rate, Middle Drain Pump Station was designed to allow for areas of development. Any potential increase in discharge arising from the Proposed Development would be subject to the drainage system being able to convey the flows (modelling required) and a development charge payable to the Board. Under the terms of the Land Drainage Act. 1991 the prior written consent of the Board is required for any proposed temporary or permanent works or structures within any watercourse including infilling or a diversion.	LPA engaged with regard to the provision of a surface water drainage system, with development of an Outline Drainage Strategy. SuDS have been integrated into the Proposed Development outline design. Discharge will be limited to the Greenfield runoff rate. Prior approval will be sought for any structures or permanent works within watercourses.

CONSULTEE	DATE	SUMMARY OF RESPONSE	HOW COMMENTS HAVE BEEN ADDRESSED IN CHAPTER
North East Lincs. Council	Letter response to NELC on 10/08/18	The Proposed Development will require sustainable surface water drainage techniques to be used. The Proposed Development not to be commenced until a scheme for the provision of surface water drainage works has been approved in writing by the Local Planning Authority.	SuDS have been integrated into the Proposed Development outline design. LPA engaged with regard to the provision of a surface water drainage system, with development of an Outline Drainage Strategy. Such Strategy demonstrates the prevention of increased risk of flooding by ensuring the provision of a satisfactory means of surface water disposal.
Anglian Water (AW)	Letter response to NELC on 15/08/18	Clarify on what the requirement for wastewater services during the construction phases of the Proposed Development. Recommendation that reference is made to the existing foul sewerage networks and sewerage treatment within the ES. The use of sustainable drainage systems for the Proposed Development was encouraged. Early engagement with Anglian Water recommended in order to address any foul water infrastructure issues.	Pre-application discussions have been undertaken with Anglian Water regarding the anticipated operational foul drainage requirements. This is acknowledged within the ES and will be progressed at detailed design. SuDS have been integrated into the Proposed Development. As above, pre-application discussions have been undertaken with Anglian Water regarding the anticipated operational foul drainage requirements.

14.4 Baseline Conditions

Site Description

14.4.1 An overview of the Site and surroundings is provided in Chapter 3: Description of the Proposed Development Site and a detailed description of the Proposed Development is provided in Chapter 4: The Proposed Development. In the context of the water resources, flood risk and drainage, an overview of the Site and surrounding area is presented below and sensitive receptors within the water environment are identified.

14.4.2 The Site is located in Flood Zone 3 (as shown on the Flood Map for Planning (Rivers and Sea)). Flood Zone 3 is land that has a 1 in 100 or greater annual probability of river flooding (1% Annual Exceedance Probability (AEP)); or land that has a 1 in 200 or greater annual probability (0.5% AEP) of sea flooding. However, the Site benefits from the presence of tidal flood defences along the south bank of the Humber Estuary which are maintained by the Environment Agency.

14.4.3 The Main Development Area of the Site (as shown on Figure 14.1), measuring approximately 7 ha, is located to the east of the existing South Humber Bank Power Station and to the west of the cooling water pumping station. The Main Development Area currently comprises a vegetated area through which passes the underground water cooling pipes connecting the South Humber Bank Power Station and the cooling water pumping station and associated access road. The Main Development Area also includes two man-made ponds.

14.4.4 NEL IDB manages the wider land drainage ditch system in close proximity to the Site. As shown on Figure 14.1 in ES Volume II, in addition to the Humber Estuary to the east of the Site there are two other watercourses (Middle Drain and Oldfleet Drain) along with multiple land drains, within the Study Area. Oldfleet Drain flows north-east discharging into the Humber Estuary to the south-east of the Site. Middle Drain also flows north-east and is located to the north-east of Site. Drainage ditches run along the northern, eastern and southern perimeter of the Site.

Water Resources

Hydrology and Flood Risk Management Infrastructure

14.4.5 The nearest watercourse is Oldfleet Drain located approximately 140 m to the south of the Site (at its closest point) which is classed by the Environment Agency as a Main River. Middle Drain an Ordinary Watercourse, is located approximately 340 m to the north of the Site (at its closest point). A series of minor land drainage ditches (also Ordinary Watercourses) run along the northern, western, eastern and southern boundaries of the Site and convey surface water runoff discharges from the greenfield areas of the Site into Middle Drain and Oldfleet Drain towards the Humber Estuary.

14.4.6 Fluvial flood defences are present along Oldfleet Drain upstream of the Site, located approximately 270 m south-west, upstream of the railway line (see Figure 14.1 in ES Volume II). According to the information provided by the Environment Agency, these reduce the risk of flooding up to a 1% AEP (1 in 100 chance) event. However, alongside the Site (downstream of the railway line to the sea), no formal defences are present.

14.4.7 Middle Drain discharges via a pumping station located approximately 550 m north of the Site, and Oldfleet Drain that outfalls via a flapped culvert into the Humber Estuary approximately 450 m south-east of the Site. The tidal outfall of Oldfleet Drain comprises a flapped twin culvert through the raised coastal flood defence that enables runoff to discharge whilst tide levels are low enough and the flaps are open. Two additional outfalls from a land drain alongside the raised sea defence between the Site and the Middle Drain pumping station comprise two 150 mm diameter un-flapped pipes.

14.4.8 The Environment Agency's 'Flood Map for Planning' (see Annex 1 of the FRA in Appendix 14A in ES Volume III) identifies there to be existing tidal flood defences located approximately 25 m to the east of Site, extending from north-west to south-east alongside the Humber Estuary, which reduce the risk of flooding up to a 0.5% AEP (1 in 200 chance) event.

Surface Water Quality – Waterbody

14.4.9 The classification of waterbodies is reported in the 2015 cycle of the River Basin Management Plans (RBMP) (Defra and Environment Agency, 2015). The Humber RBMP assesses the pressures facing the water environment in the Humber river basin district and lists actions to address them. The Humber RBMP is in the second iteration of a series of six-year planning cycles and will be updated in 2021.

14.4.10 Some surface water bodies are designated as 'artificial' or 'heavily modified'. This is because they may have been created or modified for a particular use such as water supply, flood protection, navigation or urban infrastructure.

14.4.11 According to the Humber RBMP, by definition, artificial and heavily modified waterbodies are not able to achieve natural conditions. Instead the classification and objectives for these waterbodies, and the biology they represent, are measured against 'ecological potential' rather than status. For an artificial or heavily modified waterbody to achieve good ecological potential, the chemistry must be good. Chemical status is assessed by compliance with the environmental standards for chemicals that are listed in the Priority Substances Directive 2008/105/EC, which is a 'daughter' directive of the WFD. Chemical status is recorded as either 'good' or 'fail', in terms of whether the chemical status is compliant with environmental standards.

14.4.12 In addition, any modifications to the structural or physical nature of the waterbody that harm biology must only be those essential for its valid use. All other such modifications must have been altered or managed to reduce or remove their adverse impact, so that there is the potential for biology to be as close as possible to that of a similar natural waterbody. Often though, the biology will still be impacted and biological status of the waterbody may be less than good. The ecological status takes into account physio-chemical elements, biological elements and specific pollutants.

14.4.13 The Site is located 175 m from the Humber Estuary at its closest point. At this location the Humber is classified under the Water Framework Directive as an Estuarine and Coastal Water Body (GB 530402609201- Humber Lower). In the 2016 River Basin Management Plan cycle, the Humber Lower has an overall waterbody classification of 'Moderate' potential. The reasons cited for the continued failure of the water body to meet its WFD objectives include disproportionate cost and technical infeasibility.

Surface Water Quality – Waterbody - Local Land Drains adjacent to the Site

14.4.14 The local land drains located directly within and adjacent to the boundary of the Site are not classified under the WFD and no water quality information is provided within the Humber RBMP. The Environment Agency and the NEL IDB does not currently hold any water quality data for any of these local land drains.

14.4.15 Given that the surface water features are not detailed in the Digital River Network and do not have a WFD classification as shown in the Humber RBMP (Defra and Environment Agency, 2015) these features are considered to be water resource receptors of low importance with respect to water quality.

Topography

14.4.16 A review of 1 m resolution LiDAR data published by the Environment Agency (2018) identified that the Site is situated on land with levels ranging between 1.90 m Above Ordnance Datum (mAOD) and 4.25 mAOD, but the majority of the Site is generally flat and on average, in the region of 2 mAOD. The levels of the Site gently fall from west to east, towards the Humber Estuary.

Geology and Groundwater

14.4.17 The British Geological Survey, Geology of Britain Viewer (BGS, 2018) was used to identify the bedrock and superficial deposits beneath the Site. The Superficial Deposits present beneath the Site are identified as tidal flat deposits (clay and silt) underlain by Glacial Deposits. These are designated as unproductive strata with low permeability; however permeable sand layers are likely to contain groundwater.

14.4.18 The Bedrock underlying the Site is the Flamborough Chalk Formation and is designated as a 'Principal Aquifer', defined as *"layers of rock or drift deposits that…usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale"* (BGS, 2018). Available groundwater monitoring data indicates that groundwater within the Chalk is likely to be confined beneath the overlying low-permeability superficial deposits.

14.4.19 There are no geological faults identified beneath the Site.

14.4.20 Soils at the Site are described on the Cranfield Soil and Agrifood Institute's Soilscapes mapping website as "*loamy and clayey soils of coastal flats with naturally high groundwater*" (BGS, 2018).

14.4.21 The Site is not located within an Environment Agency designated groundwater Source Protection Zone (SPZ) (Environment Agency, 2018).

14.4.22 The Site is located in an area defined as a 'Principal Aquifer – High' vulnerability category on the Environment Agency's Groundwater Vulnerability Map (Environment Agency, 2018).

14.4.23 Further details on geology and ground conditions are provided in Chapter 12: Geology, Hydrogeology and Contaminated Land.

14.4.24 These classifications will be taken into account in detail when the proposed surface water runoff mitigation measures are developed further at the detailed design stage.

Sensitive Water Resource, Flood Risk and Drainage Receptors

14.4.25 This section presents the baseline water resources, flood risk and drainage baseline evidence for the Study Area identifying sensitive receptors and environmental conditions that could be influenced by the Proposed Development. Baseline conditions in terms of water resources, flood risk, drainage are outlined for the Site.

14.4.26 The key watercourses associated with the Site are summarised below and shown in Figure 14.1 as presented in the ES Volume II:

- the Humber Estuary -
  - located approximately 175 m to the east of the Site,
  - connectivity between the site and the Humber Estuary is via a pumping station (Middle Drain) and a flapped outfall (Oldfleet Drain) these are located approximately 550 m and 450 m from the Site;
- Oldfleet Drain -
  - 5 km long and 3 m wide,

  - flows north-west discharging into the Humber Estuary, south-east of Site, and
  - flows through agricultural fields and industrial land uses;
- Middle Drain -
  - 3 km long and 12.8 m wide,
  - flows north-west discharging into the Humber Estuary through Middle Pumping Station to the north-west of Site, and
  - flows through agricultural fields and industrial land uses;
- Land Drain 1 -
  - 1.1 km long and 5 m wide,
  - flows north-east along the northern boundary of Site;
- Land Drain 2 -
  - 1.6 km long and 3 m wide,
  - flows south along the western boundary of Site and east along the southern boundary of Site before discharging into the Land Drain 3 to the east of the Site, which discharges into the Humber Estuary via Middle Drain Pumping Station; and
- Land Drain 3 -
  - 1.2 km long and 4 m wide,
  - flows north-west along the Humber Estuary coastline to the east of Site, and
  - flows through agricultural fields and adjacent to the raised flood defences;
- Land Drain 4 -
  - 0.4 km long and 3 m wide,
  - transports flow from the northern boundary of the Site northwards, discharging into Middle Drain, and
  - flows through agricultural fields adjacent to industrial land uses;
- Land Drain 5 -
  - 0.38 km long and 3 m wide,
  - transports flow from the northern boundary of Site north discharging into Middle Drain, and
  - flows through agricultural fields; and
- Land Drain 6 -
  - 0.8 km long and 3.8 m wide,
  - flows south to the west of Site adjacent to the western side of Hobson Way discharging into Oldfleet Drain, and
  - flows through an unused and overgrown area.

Surface Water Abstractions

14.4.27 Information from the Envirocheck Report (see Appendix 12A in ES Volume III) indicates there are two abstractions for water within a 0.5 km radius of the Site, in addition to the South Humber Bank Power Station (SHBPS) cooling water abstraction from the Humber Estuary. The first is for cooling by Humberland Ltd from an unidentified stream (but temporary in status). The second is by NELC and is from Oldfleet Drain for Non-remedial River/ Wetland Support (a transfer between sources). The potential impacts on surface water abstractions are therefore not taken into account when describing the baseline conditions for the Proposed Development.

Discharges to Surface Water

14.4.28 Information from the Envirocheck Report (see Appendix 12A in ES Volume III) indicates there are six Licensed Discharge Consent records within a 0.5 km radius of the Site in addition to the SHBPS cooling water discharge to the Humber Estuary. All six are for trade effluent, trade discharge (process water) and a sewage discharge for treatment/final effluent. Four of these licences are listed as 'revoked' with two unknown. Two are for Middle Drain. The potential impacts on discharge to surface water are therefore not taken into account when describing the baseline conditions for the Proposed Development.

Point Source Pollutants

14.4.29 Pollution incidents are classified by the Environment Agency on the degree of Environment Agency manpower deployed (i.e. large, small) and likely environmental impact with regard to air, water and land. Incidents are classified as Category 1 (defined as major), Category 2 (significant), Category 3 (minor) or Category 4 (insignificant).

14.4.30 Information from the Envirocheck Report (see Appendix 12A in ES Volume III) indicates there have been no Category 1 (major) and no Category 2 (significant) incidents within 500 m of the Site within the last 20 years that have the potential to affect water receptors. The last two known pollution incidents occurred in 1992 with the locations and sources of the pollution unknown. Lower category recorded incidents are considered serious enough to have affected current baseline water quality, either temporarily, or in the long-term; either due to the historical nature of the incident or the classified category. Therefore, they are not taken into account when describing the baseline conditions for the Site.

Non-Point Source Pollutants

14.4.31 Within the study area, urban, industrial and commercial and agricultural runoff may enter the identified watercourses and may affect the status of such watercourses.

Flood Risk

14.4.32 The FRA prepared for the Proposed Development (Appendix 14A in ES Volume III) presents in detail the assessment of flood risks from all sources both to, and as a result of the Proposed Development. The following sections present a summary of this.

Tidal Sources

14.4.33 The Humber Estuary is located approximately 175 m to the east of the Site. The Humber Estuary poses the primary and most significant risk of flooding to the Site.

14.4.34 The Environment Agency's 'Flood Map for Planning' (see Annex 1 of the FRA in Appendix 14A in ES Volume III) identifies areas subject to fluvial/ tidal flood risk for the present day but does not include the benefits or impacts of any existing flood defences or climate change respectively. This illustrates that the Site is wholly located within

Flood Zone 3 ('high' risk) defined as land having a >0.5% AEP (greater than a 1 in 200 chance) of sea flooding.

14.4.35 In accordance with the NPPF, the requirements are to ensure any proposed developments are built to withstand tidal flooding up to a 1% AEP (1 in 100 chance) event taking into account the potential impacts of climate change. The Environment Agency's 'Flood Map for Planning' identifies there to be existing tidal flood defences located approximately 160 m to the east of the Site, extending from north-west to south-east alongside the Humber Estuary.

14.4.36 According to the additional information provided by the Environment Agency (see Annex 1 of the FRA in Appendix 14A in ES Volume III), the tidal defences protecting this Site consist of concrete floodwalls. They are in 'good' condition and reduce the risk of flooding up to a 0.5% AEP (1 in 200 chance in any year) event. The Environment Agency inspects these defences routinely to ensure potential defects are identified. The residual risk of flooding in the event of a defence breach scenario which has been considered in the FRA.

14.4.37 Based on the information provided by the Environment Agency, it has been determined through the FRA that during the existing baseline scenario the Site is at a 'low' risk of flooding from tidal sources with the defences in place, or resulting from overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 chance) of flooding. If the defences were to fail and breach during the existing scenario, the Site would be at a 'high' risk of flooding during either the 0.5% or 0.1% AEP (1 in 1000 chance) events.

Fluvial Sources

14.4.38 The nearest watercourse is Oldfleet Drain (Main River) located approximately 140 m to the south of the Site (at its closest point) which flows in a north-easterly direction. Middle Drain. This is classified by the NEL IDB as a Significant Ordinary Watercourse as defined by the SFRA, is managed by the NEL IDB and is located approximately 340 m to the north (at its closest point). A series of minor land drainage ditches (also Ordinary Watercourses) run along the northern, western and southern boundaries of the Site and to the east of the SHBPS site, and convey surface water runoff discharges from the greenfield areas of the Site to Oldfleet Drain and Middle Drain. These watercourses all pose a potential risk of fluvial flooding to the Site.

14.4.39 The Environment Agency's 'Flood Map for Planning' (see Annex 1 of the SHBEC FRA in Appendix 14A in ES Volume III) identifies there to be existing fluvial flood defences upstream of the Site, located approximately 270 m south-west along Oldfleet Drain, upstream of the railway line. According to the information provided by the Environment Agency, these fluvial flood defences comprise earth embankments. Their condition is 'fair' and will reduce the risk of flooding up to a 1% AEP (1 in 100 chance) event. The Environment Agency regularly inspect the defences to ensure potential defects are identified.

14.4.40 Alongside the Site (downstream of the railway line to the sea), the Environment Agency confirmed that the Oldfleet Drain channel capacity is sufficient to convey flows in excess of a 1% AEP (1 in 100 chance) event.

14.4.41 Based on the information provided by the Environment Agency, it has been determined through the FRA that the Site is at a 'very low' risk of fluvial flooding from Oldfleet Drain or Middle Drain. No detailed modelled flood outlines are available for the local land drains around the Site perimeter, consequently, for the purposes of this assessment, Oldfleet Drain is considered to pose a risk of fluvial flooding to the Site.

Groundwater Sources

14.4.42 Groundwater flooding can occur when groundwater levels rise above ground surface levels. The underlying geology has a major influence on where this type of flooding takes place; it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

14.4.43 The Environment Agency's 'Areas Susceptible to Groundwater Flooding' map is illustrated in Annex 2 of the Joint Lincolnshire Flood Risk and Drainage Management Strategy (LFRDMPF, 2012). The map is divided into 1 km^2 grid-squares in which a percentage is given for what proportion of the 1 km^2 is considered to be susceptible to groundwater emergence. This map illustrates that the Site lies within a 1 km grid square of which up to 25% of the area is considered to potentially be at risk of groundwater emergence.

14.4.44 In 2006, RSK Group was commissioned by Centrica to undertake a ground investigation as part of the design phase for a Site Protection and Monitoring Programme (SPMP) for the SHBPS. The following summary from the ground investigation is based on the document 'Site Protection and Monitoring Programme Review for South Humber Bank Power Station' (RSK, September 2011). This document provides a review and summary and states that the intrusive ground investigation inferred that groundwater flowed towards the south-east and recorded resting groundwater depths across a monitoring well network ranging from 0.22 m below casing top (bct) to 1.55 m bct.

14.4.45 The risk of groundwater flooding within the Proposed Development area within the Site through the FRA is therefore considered to be 'low' to 'medium'.

Artificial Sources – Reservoirs and Canals

14.4.46 The Environment Agency defines a reservoir as an artificial body of water which can hold >25,000 cubic meters or more of water, above ground level as specified in The Reservoirs Act (1975) (HMSO, (1975)). The closest reservoir to the Site is located approximately 13 km south-east of Site north of Rothwell, west of Cuxwold. The Environment Agency 'Flood Risk from Reservoirs' map (Environment Agency, 2018) illustrates that there is very low flood risk to Site from reservoirs in the event of a breach scenario.

14.4.47 There are no artificial sources of flood risk, such as reservoirs or canals in close proximity to the Site. It is therefore considered that there these sources pose very low flood risk to the Site.

Surface Water Runoff to the Site - Overland Flow of Rainfall Runoff

14.4.48 The Environment Agency 'Flood Risk from Surface Water' map (Environment Agency, 2018) identifies the vast majority of the Site to be at a 'very low' risk from surface water flooding (<0.1% AEP event). Small areas along the roads and along adjacent land drains within the Site are identified to be at a 'low', 'medium' and 'high' risk from surface water flooding (>0.1% AEP, 3.3% to 1% AEP event and >3.3% AEP event respectively). The Main Development Area within the Site is illustrated as being predominantly at a 'very low' risk from surface water flooding, with very small areas at 'low risk' at the topographic low points.

14.4.49 Additionally, this information is supported by the fact that there are no significantly raised ground levels adjacent to the Site that could generate sufficient rates/ volumes of surface water runoff to pose a risk of overland flow coming into the Site.

14.4.50 The risk of surface water flooding within the Proposed Development area within the Site from elsewhere is therefore considered to be 'low' to 'very low'.

Existing Drainage Infrastructure

14.4.51 The existing surface water drainage infrastructure within the Site is illustrated in drawings in Annex 1 of the Outline Drainage Strategy (Appendix 14B in ES Volume III). There is no formal drainage network for the Main Development Area.

14.4.52 There are two existing man-made ponds within the Main Development Area of the Site (see 'Pond 1' and 'Pond 2' presented in Figure 14.1 in ES Volume II). These have no formal drainage function. Pond 1 was previously used as a settlement pond for commissioning purposes for SHBPS but levels are now maintained naturally by surface water as the drainage pipes connected to it are now redundant.

14.4.53 The boiler blowdown of the SHBPS discharges into effluent basins with buried outlet pipes connected to the cooling water pumping station at the far eastern extent of the Site. Surface water from the rooftop and access road areas of the Site is currently collected via gullies and conveyed into these effluent basins via buried surface water pipelines. A body of standing water located adjacent to the cooling water pumping station to the east of the Site is a holding channel for water in and out of the cooling pipes, as presented in Figure 14.1 in ES Volume II. The combined water is discharged off Site into the Humber Estuary.

14.4.54 It is assumed that the land drains located around the perimeter of the Site (Land Drains 1 and 2 presented in Figure 14.1 in ES Volume II) accept lateral drainage of surface water from the greenfield areas of the Site, including the Main Development Area. These eventually discharge to the Humber Estuary via Middle Drain Pumping Station (to the north of the Site).

14.4.55 The NPPF requires that the Proposed Development should not increase flood risk on the Site and the surrounding area. Therefore, surface water runoff rates leaving the Site should not exceed the existing runoff rate. The existing surface water greenfield runoff rates for the Main Development Area (i.e. the part of the Site where new impermeable areas will be created as part of the Proposed Development) were calculated using FEH Web Service catchment descriptors and Depth Duration Frequency (DDF) FEH2013 model data for the local catchment area. The detailed calculation parameters used for the runoff rates can be found in the Outline Drainage Strategy (Appendix 14B).

14.4.56 A review of OS mapping and the Environment Agency's 1 m LiDAR data identified that Pond 1 and Pond 2 presented on Figure 14.1 in ES Volume II are both situated at the lowest ground levels within the Site (i.e. they are not elevated above any adjacent ground levels). It is assumed that both ponds are static/ hydrologically unconnected to the local land drains and collect direct rainwater and runoff from the surrounding higher ground levels within the Site boundary.

14.4.57 Pond 1 and Pond 2 and the cooling water chamber are considered to pose a 'very low' risk of surface water flooding to the Main Development Area within the Site. The risk to the Site from overland flow of surface water generated adjacent to the Site, or from waterbodies located within the Site is considered to be 'low' in small areas, but largely 'very low'.

14.4.58 The risk to the Site from overland flow of surface water generated adjacent to the Site, or from waterbodies located within the Site is considered to be 'low' in small areas, but largely 'very low'.

Summary of Baseline Character of the Receptors

14.4.59 Only watercourses in close proximity (hydraulic connectivity) to the Site and with the significant potential to be affected by the Proposed Development have been considered

further within this impact assessment. The baseline description has been used to characterise each reach of the water resources study area, with the assessment summarised in Table 14.6. This was undertaken following the characterisation methodology specified in Table 14.1.

Table 14.6: Importance of Identified Surface Water Feature/Receptor

RECEPTOR / WATERCOURSE	SENSITIVITY	VALUE	RECEPTOR IMPORTANCE
Humber Estuary	**High** vulnerability to temporary or permanent changes in water resources (including water quality), as well as discharges/ pollution incidents, flood risk and drainage	**High**	**High**
Oldfleet Drain	**Low** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions/ discharges / pollution incidents, flood risk and drainage	**High (**precautionary approach given moderate WFD waterbody status)	**Medium**
Middle Drain	**Low** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions / discharges / pollution incidents, flood risk and drainage	**Medium**	**Low**
Local Land Drain 1	**High** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions / discharges / pollution incidents, flood risk and drainage	**Negligible**	**Low** (precautionary approach given proximity to site)
Local Land Drain 2	**High** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions / discharges / pollution incidents, flood risk and drainage	**Negligible**	**Low** (precautionary approach given high value/importance)

RECEPTOR / WATERCOURSE	SENSITIVITY	VALUE	RECEPTOR IMPORTANCE
Local Land Drain 3	**Medium** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions / discharges / pollution incidents, flood risk and drainage	**Low**	**Low**
Local Land Drain 4	**Low** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions / discharges / pollution incidents, flood risk and drainage	**Negligible**	**Low**
Local Land Drain 5	**Low** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions / discharges / pollution incidents, flood risk and drainage	**Negligible**	**Low**
Local Land Drain 6	**Negligible**	**Negligible**	**Negligible**
Ponds 1 and 2	**Medium** vulnerability to temporary or permanent changes in water resources (including water quality), as well as abstractions / discharges / pollution incidents, flood risk and drainage	**Negligible**	**Low**

14.4.60 The Humber Estuary has a high sensitivity based on vulnerability given the distance and connectivity from the Proposed Development, but high value and importance based on its international designations and moderate WFD classification. The likely character of this watercourse has been assessed as **'High'** to allow further consideration of effects.

14.4.61 Oldleet Drain has a low sensitivity, based on the vulnerability given its distance from the Proposed Development but a High value and importance based on its WFD status classification (Moderate). **The likely character of this watercourse has been assessed as 'Medium' to allow further consideration of effects**.

14.4.62 Middle Drain has a low sensitivity, based on the vulnerability, given its distance from the Proposed Development but a medium value and importance due to receiving water from land drains 4 and 5 directly from the Proposed Development. **The likely character**

of this watercourse has been assessed as 'Low' to allow further consideration of effects.

14.4.63 The watercourses surrounding the Proposed Development, primarily Land Drain 1 and Land Drain 2 have a high sensitivity (based on vulnerability) due to their proximity to the Site but both are of negligible value and importance. **As a precautionary approach, the likely character of these watercourses has been assessed as 'Low' to allow further consideration of effects.**

14.4.64 Land Drain 3 has a medium sensitivity (based on vulnerability) as it is the main receiving watercourse receiving waters indirectly from the Site. However, it is further in proximity from the Proposed Development and has low value and importance; therefore the likely character of Land Drain 3 has been assessed as low. **As a precautionary approach, the likely character of this watercourse has been assessed as 'Low' to allow further consideration of effects.**

14.4.65 Land Drain 4 and Land Drain 5 have a low sensitivity and are of negligible value and importance - **the likely character of these watercourses are assessed as 'Low' to allow further consideration of effects**.

14.4.66 Land Drain 6 has been assessed as negligible sensitivity, on account of no known flow pathways from Site to watercourse, and the reaches are of negligible value or importance. **The likely character of this watercourse has been assessed as 'Negligible' and has therefore been scoped out of further assessment.**

14.4.67 The southern pond (Pond 1) is connected to the Site drainage via an abandoned surface water drain. No information has been provided regarding the existing northern pond (Pond 2). They have been assessed as high sensitivity as they are within the Main Development Area but are of low negligible importance given their use. **The likely character of these surface waterbodies has been assessed as 'Low' to allow for further consideration of effects.**

14.5 Development Design and Impact Avoidance

14.5.1 As stated in Section 14.3 above this assessment of likely effects of the Proposed Development on water resources, flood risk and drainage follows the methodology outlined within the Institute of Environmental Management and Assessment State of Environmental Impact Assessment Practice in the UK (IEMA, 2011). As such, this assessment assesses the completely unmitigated development scenario first, and then later states the reductions in the impacts and effects following the application of any necessary mitigation.

14.5.2 The mitigation required following the assessment is outlined in Section 14.7 and includes what is often referred to as embedded mitigation i.e. mitigation already assumed in the form of best practice measures or measures built into the design of the Proposed Development.

14.6 Likely Impacts and Effects

14.6.1 This section presents the impact assessment for the receptors with low, medium or high character identified in the previous section. Those with negligible character have not been considered further. The Proposed Development has the potential to affect water resources (primarily via WFD through water quality), flood risk (surface water only) and drainage. This includes both local water quality and suspended sediment quality from construction activities, and potential long-term benefits of improved flood risk resilience and drainage through water attenuation on Site. The Proposed Development has the potential to change local dilution patterns through changes in surface water flow pathways and temporary changes to the quantity of flow in the watercourses.

14.6.2 Construction, maintenance and operational activities from the Proposed Development are considered to potentially alter the water resources (water quality), flood risk and drainage of local watercourses with direct surface water interactions from Site runoff. These are primarily associated with Land Drain 1, Land Drain 2 and Land Drain 3. There is also the potential for these effects to continue to adjacent receiving watercourses, primarily Oldfleet Drain and Middle Drain as well as Land Drain 4 and Land Drain 5 (downstream in receiving watercourses for Land Drain 1).

14.6.3 Potential impacts from **construction activities** have been identified as follows:

- **Potential Impact A** - permanent loss of both surface waterbodies (Pond 1 and 2) within the Main Development Area during construction;
- **Potential Impact B** - potential change to the surrounding ditches (culverting/extension to culverts/installation of fencing);
- **Potential Impact C** - potential loss of tidal floodplain storage and temporary changes to fluvial flood water flow routing within Flood Zone 3 during construction (although the Site benefits from flood defences);
- **Potential Impact D** - pollution of surface watercourses within or near the Proposed Development Site during construction due to spillages or polluted surface water runoff entering the watercourse (if an appropriate Construction Environmental Management Plan (CEMP) is not adhered to);
- **Potential Impact E** - change to the impermeable area within the Site, and associated changes to surface water flows during construction;

14.6.4 Potential impacts from **maintenance and operational activities** have been identified as follows:

- **Potential Impact F** - change to the impermeable area within the Site, and associated changes to surface water flows during maintenance and operation of the Proposed Development;
- **Potential Impact G** - potential loss of tidal floodplain storage as the footprint of the Proposed Development is located in Flood Zone 3 (although the Site benefits from flood defences);
- **Potential Impact H** - pollution of surface watercourses within or near the Site during maintenance and operation, due to spillages or polluted surface water runoff entering the watercourse (if materials are not appropriately stored at the Site in accordance with an appropriate operational Environmental Management System and/or an appropriate drainage system is not implemented and maintained).

14.6.5 These potential impacts are assessed below against the applicable sensitive receptors.

Construction

Potential Impact A *- Permanent loss of both surface waterbodies within the Main Development Area during construction of the Proposed Development*

14.6.6 The design proposals include the removal of two existing man-made ponds within the Main Development Area (Pond 1 and Pond 2), considered to be of 'Low' importance (see Table 14.6). As these waterbodies do not serve a drainage purpose to areas

outside of the Main Development Area their removal will not have an impact on Site drainage.

14.6.7 The impact of this construction activity on the Pond 1 and Pond 2 receptors is of high magnitude and has a medium probability of short term adverse effects on the water resources, but negligible reversibility and negligible magnitude on the flood risk and the drainage mechanisms. The overall nature of the effects is therefore considered to be 'Medium'.

14.6.8 **Given the likely character of Pond 1 and Pond 2 is a 'Low' importance receptor and the nature of the effect is 'Medium', the likely significance of the effect from this construction activity is considered to be 'Minor' adverse.**

Potential Impact B *- Potential change to the surrounding ditches (culverting/extension to culverts/installation of fencing)*

14.6.9 The only fluvial water receptor potentially affected directly as a result of construction activity is Land Drain 1 considered to be of 'Low' importance (see Table 14.6). The proposed access from South Marsh Road will cross Land Drain 1 using a new culvert or extension of the existing culvert in the north-eastern corner of the Main Development Area. There is subsequently the potential for impacts on this watercourse as a result of constructing a culvert. This activity could reduce its conveyance capacity and discharge ability if the bridge is not free-span in design. Water could then potentially back-up to the west along the drain, increasing the risk of localised fluvial flooding.

14.6.10 The magnitude of impacts of this construction activity will be high given it is located immediately within the watercourse corridor, but is likely to impact only a short, very localised reach of the watercourse. The impact of construction will be low probability given the likely rarity of any fluvial flood event occurring from this watercourse. The nature of the effect of the construction activity has therefore been assessed as 'Medium': with low probability long term but reversible adverse effects on the flood risk and the drainage.

14.6.11 **Given that the likely character of Land Drain 1 is considered to be a 'Low' importance receptor and the nature of the effects is 'Medium', the likely significance of the effect from this construction activity is 'Minor' adverse.**

Potential Impact C *- Potential loss of tidal floodplain storage and temporary changes to fluvial flood water flow routing as the footprint of the Proposed Development is located within tidal Flood Zone 3 during construction of the Proposed Development (although the Site benefits from flood defences)*

14.6.12 The Environment Agency's modelling has illustrated that there is a very low/ negligible risk of fluvial flooding to the Site from Land Drains 1 to 5, Middle Drain or Oldfleet Drain, considered to be of 'Low', 'Low and 'Medium' importance respectively (see Table 14.6). The residual high risk of tidal flooding (Flood Zone 3) would only be incurred if the Humber Estuary defences were overtopped during a low probability/rare event or experienced an unlikely breach failure.

14.6.13 No land raising is proposed at the Site (only re-levelling to infill Pond 1 and Pond 2) but stockpiles of construction materials will temporarily be present within the Site. Therefore, if a defence breach/overtopping event were to occur while material was stored, a reduction in the floodplain storage availability and localised flood water routing mechanisms could result in an adverse impact, as it could lead to partial displacement of the available tidal floodplain volume and divert floodwater around them. A small volume of floodplain might also be lost, attributed to that displaced by the new building walls. Construction activities could therefore increase the localised flood risk to the

neighbouring watercourses (Oldfleet Drain, Middle Drain, Land Drain 1, Land Drain 2, Land Drain 3, Land Drain 4 and Land Drain 5). However, these would already become fully submerged by the tide during such an event.

14.6.14 The magnitude of this adverse impact for all these watercourses is assessed as medium given the number of watercourses potentially impacted and their close proximity to the Site. However, since the overall nature of the effect of the construction activity is localised, it has been assessed as 'Low'. This is due to the low probability of an overtopping or breach failure event occurring, especially while materials were stockpiled. The impacts on flood risk would be short term and are reversible, as when the construction phase is completed, the stockpiles of materials will have been utilised.

14.6.15 Oldfleet Drain could be potentially impacted by temporary changes to the routing of floodwater and floodplain storage availability within Flood Zone 3 during construction. **Given that the likely character of Oldfleet Drain is considered to be a 'Medium' importance receptor and the nature of the effect is 'Low', the likely significance of the effect from this construction activity is assessed to be 'Minor' adverse.**

14.6.16 Middle Drain and Land Drains 1 to 5 could also be potentially impacted by temporary changes to the routing of floodwater and floodplain storage availability within Flood Zone 3 during construction**. Given that these watercourses are considered to be 'Low' importance receptors and the nature of the effect is 'Low', the significance of the effect from this construction activity is assessed to be 'Negligible'.**

Potential Impact D *- Pollution of surface watercourses within or near the Proposed Development Site during construction due to spillages or polluted surface water runoff entering the watercourse*

14.6.17 The predicted impacts of the Proposed Development construction works could lead to elevated risks of leakage or accidental spillage of construction materials and potential pollutants used on Site. These could migrate to nearby surface watercourses. Washout facilities (washing of tools, plant and equipment), storage and use of various liquids and soluble solids, unstable exposed soils, excavated materials, stored aggregates, contaminated road surfaces, and fuel storage and the handling of these could have the potential to result in pollution of water resources. Inappropriate disposal of waste materials associated with the construction phase of the Proposed Development could also have the potential to enter surface water. Contaminants could include highly alkaline sediments from concreting works, organic material, nutrients and pollutants; in turn, this could influence water quality.

14.6.18 Land Drains 1 and 2, considered to be of 'Low' importance (see Table 14.6), could be impacted by short term runoff associated with local stockpiling, construction works and drainage improvement works that could convey sediment and contaminants. Dilution capacity in the drains is expected to be low and therefore the runoff could have a potential impact. The magnitude of the impact is however low and the nature of the effects of the construction activity is assessed as 'Medium': with medium probability, reversible and medium term adverse effects on the water quality. **Given the likely character of Land Drain 1 and Drain 2 is 'Low' and the nature of the effect is 'Medium', the likely significance of the effects from this construction activity is assessed to be 'Minor' adverse.**

14.6.19 Land Drain 4 and Land Drain 5 receive water from Land Drain 1; and Land Drain 3 receives water from Land Drain 2 (all considered to be of 'Low' importance (see Table 14.6). Therefore, the nature of the effects of the construction activity is assessed as 'Low': with low probability, reversible and long term adverse effects on the water quality. **Given the likely character of Land Drain 3, Land Drain 4 and Land Drain 5 are**

'Low' and the nature of the effect is 'Low', the likely significance of the effects from this construction activity is '<u>Negligible</u>'.

14.6.20 Middle Drain, considered to be of 'Low' importance (see Table 14.6) receives water from Land Drain 4 and Land Drain 5 and therefore, the nature of the effects of the construction activity is assessed as 'Negligible': with negligible probability, reversible and long term adverse effects on water quality. **Given the likely character of Middle Drain is 'Low' and the nature of the effect is 'Negligible', the likely significance of the effects from this construction activity is '<u>Negligible</u>'.**

14.6.21 Humber Estuary (considered 'High' importance (see Table 14.6)) receives water indirectly via the land drains and then then Middle Drain and Middle Drain pumping station and Oldfleet Drain and its tidal flapped outfall. Therefore the nature of the effect of the construction activity on the Humber Estuary is assessed as 'negligible': with low probability, reversible and long term adverse effects on the water quality. **Given the likely character of the Humber Estuary is 'High' and the nature of the effects is 'Negligible', the likely significance of the effects from this construction activity is '<u>Negligible'</u>.**

14.6.22 Oldfleet Drain (considered to be of 'Medium' importance (see Table.14 6)) receives water indirectly from Land Drain 2 therefore the nature of the effect of the construction activity is assessed as 'Low': with low probability, reversible and long term adverse effects on the water quality. **Given the likely character of Oldfleet Drain is 'Medium' and the nature of the effects is 'Low', the likely significance of the effects from this construction activity is '<u>Minor</u>' adverse.**

<u>Potential Impact E</u> *- Change to the impermeable area within the Proposed Development Site, and associated changes to surface water flows during construction of the Proposed Development*

14.6.23 Land Drain 1 and Land Drain 2, considered to be of 'Low' importance (see Table 14.6), are currently understood to receive lateral inflows of surface water runoff from the greenfield area of the Main Development Area. During construction of the Proposed Development, the impermeable land use area is expected to increase by up to 6.5 ha (to be confirmed at the detailed design stage), which could result in a significant increase in the rates and volumes of surface water runoff, thus is an increase in flood risk to the Site and neighbouring land-uses if no mitigation was to be implemented.

14.6.24 The magnitude of this impact is therefore assessed as 'High' - given the extensive area of permeable greenfield land-use that will be lost and that the impacts within the Site boundary are located within immediate proximity to the Land Drains. The nature of the effect of the construction activity is assessed as 'High': with high probability, short term effects on flood risk and drainage that are non-reversible in the short term.

14.6.25 **Given the likely character of these watercourses is 'Low' and the nature of the effect is 'High', the likely significance of effect from this construction activity is '<u>Moderate</u>' adverse in the absence of any mitigation.**

<u>Maintenance and Operation</u>

<u>Potential Impact F</u> *- Change to the impermeable area within the Site, and associated changes to surface water flows during maintenance and operation*

14.6.26 As with Potential Impact E, during maintenance and operation of the Proposed Development the impermeable area within the Proposed Development Site is expected to increase by up to 6.5 ha (to be confirmed at the detailed design stage) generating increased rates and volumes of surface water runoff. Failure, blockage and capacity exceedance are also a potential risk to the Site and the surrounding area. These

impacts would again be limited to Land Drain 1 and Land Drain 2 with the same likely significance of effect; 'High'.

14.6.27 Land Drain 1 and Land Drain 2 could therefore be potentially impacted by changes to the impermeable area within the Site during maintenance and operation of the Proposed Development. **Given the likely character of these watercourses is 'Low' and the nature of the effect is 'High', the likely significance of effect from this operation activity is 'Moderate' adverse in the absence of any mitigation.**

Potential Impact G *- Potential loss of tidal floodplain storage as the footprint of the Proposed Development is located in Flood Zone 3 (although the Site benefits from flood defences)*

14.6.28 The predicted impacts of the Proposed Development in operation could lead to potential loss of floodplain storage as the footprint of the Proposed Development is located in Flood Zone 3. The Environment Agency's modelling has illustrated that there is a very low/ negligible risk of fluvial flooding to the Site from the Land Drains, Middle Drain or Oldfleet Drain, considered to be of 'Low', 'Low and 'Medium' importance respectively (see Table 14.6). The residual high risk of tidal flooding (Flood Zone 3) would only occur in the low probability event that the Humber Estuary defences were overtopped or experienced a breach failure.

14.6.29 No land raising is proposed at the Site and therefore, the volume displaced is likely to be limited to that of the walls of the new buildings within the Site. These are expected to only displace a negligible amount of floodwater, however a potential impact on the local watercourses (Oldfleet Drain, Middle Drain, Land Drain 1, Land Drain 2, Land Drain 3, Land Drain 4 and Land Drain 5) could be incurred. As a result of which, the tidal floodwater volume capacity is likely to be reduced if a defence breach/overtopping event were to occur.

14.6.30 No significant increase in the localised flood risk to the watercourses in the Study Area would likely be incurred, as these would be already be fully submerged by the tide. The magnitude of this impact on all watercourses in the Study Area is medium but as the nature of the effect of the operation activity is localised, it is assessed as 'Low': with low probability, long term adverse but reversible effects on the flood risk.

14.6.31 Oldfleet Drain could be potentially impacted by a potential loss of floodplain storage as the footprint of the Proposed Development is located in Flood Zone 3. **Given that the likely character of Oldfleet Drain is 'Medium' and the nature of the effect is 'Low', the likely significance of the effect from this operation activity is 'Minor' adverse.**

14.6.32 Middle Drain and Land Drains 1 to 5 could be potentially impacted by a potential loss of floodplain storage as the footprint of the Proposed Development is located in Flood Zone 3. **Given the likely character of these watercourses is 'Low' and the nature of the effect is 'Low', the likely significance of the effect from this operation activity is 'Negligible'.**

Potential Impact H *- Pollution of surface watercourses within or near the Site during maintenance and operation of the Proposed Development, due to potential spillages or polluted surface water runoff entering the watercourse*

14.6.33 The Proposed Development could lead to pollution of surface watercourses within or near the Site during maintenance and operation of the Proposed Development, due to spillages or polluted surface water runoff entering the watercourses within or near the Site. However, there will be minimal contaminated wastewater generated from the Proposed Development during maintenance and operation and any wastewater that is generated will predominantly be reused within the process. Any uncontaminated

surface water will be kept segregated and discharged directly to the land drainage system immediately adjacent to the southern or northern Site boundary. Whilst pollution prevention features such as SuDS would be included in the design, there could still be potential for leakage from the system to occur (albeit the risk is very low).

14.6.34 The impacts associated with contamination of surface water (with sediments, fuels etc.) arising from the maintenance and operation of the Proposed Development are considered to be the same as those assessed in relation to leakage from the drainage system. Implementation of the mitigation measures would mean that the risk of contamination of site runoff is low. The mitigation set out in the Outline Drainage Strategy for the Proposed Development (Appendix 14B) will be developed further through the detailed design phase.

14.6.35 Land Drain 1 and Land Drain 2 could be impacted by short-term contaminated runoff during maintenance and operation of the Proposed Development. The magnitude of the impact however is expected to be low and the nature of the impact during maintenance and operation of the Proposed Development is assessed as 'Medium': with medium probability, reversible and medium term adverse effects on the water quality. **Given the Likely Character of Land Drain 1 and Land Drain 2 is 'Low' and the nature of the effect is 'Medium', the likely significance of the effect from this maintenance and operation activity is 'Minor' adverse.**

14.6.36 Land Drain 4 and Land Drain 5 receive water from Land Drain 1; and Land Drain 3 from Land Drain 2. Given that the magnitude of the impacts on Land Drain 1 and 2 are assessed as low, the nature of the effect during maintenance and operation of the Proposed Development on Land Drains 3, 4 and 5 is also assessed as 'Low': with low probability, reversible and long term adverse effects on the water quality. **Given the likely characters of Land Drain 3, Land Drain 4 and Land Drain 5 are 'Low' and the nature of the effect is 'Low', the likely significance of the effect from this operation activity is 'Negligible'.**

14.6.37 Middle Drain receives water from Land Drain 4 and Land Drain 5. Given that the magnitude of the impacts on Land Drain 1 and 2 are assessed as low, the nature of the effect in operation on Middle Drain is assessed as 'Negligible'. **Given the likely character of Middle Drain is 'Low' and the nature of the effect is 'Negligible', the likely significance of the effect from this maintenance and operation activity is 'Negligible'.**

14.6.38 Oldfleet Drain receives water indirectly from Land Drain 2. Given that the magnitude of the impacts on Land Drain 1 and 2 are assessed as low, the nature of the effect in maintenance and operation of the Proposed Development on Oldfleet Drain is assessed as 'Low': with low probability, reversible and long term adverse effects on the water quality. **Given the likely character of Oldfleet Drain is 'Medium' and the nature of the effect is 'Low', the likely significance of the effect from this operation activity is 'Minor' adverse.**

14.6.39 Humber Estuary (considered 'High' importance (see Table 14.6) receives water indirectly via the land drains and then Middle Drain and Middle Drain pumping station and Oldfleet Drain and its tidal flapped outfall. Therefore the nature of the effect in maintenance and operation of the Proposed Development on the Humber Estuary is assessed as 'negligible': with low probability, reversible and long term adverse effects on the water quality. **Given the likely character of the Humber Estuary is 'High' and the nature of the effects is 'Negligible', the likely significance of the effects from this activity is 'Negligible'.**

Decommissioning

14.6.40 Decommissioning of the Proposed Development will see the removal of all above ground structures down to ground level such that the Main Development Area is cleared with only areas of hardstanding remaining.

14.6.41 It is assumed that all underground infrastructure will remain in-situ; however, all connection and access points will be sealed or grouted to ensure disconnection. On this basis, decommissioning impacts are expected to be limited to on-site waterbodies in close proximity to the Proposed Development and will be the same as construction impacts, as discussed above.

14.7 Mitigation and Enhancement Measures

14.7.1 A number of legislative and best practice mitigation and enhancement measures which will be followed during the construction, maintenance and operation of the Proposed Development are detailed in this section.

Construction

14.7.2 The measures set out below will be required of any contractors undertaking construction work in relation to the Proposed Development.

14.7.3 As a general measure to protect surface water from a range of potentially dangerous activities associated with construction of this type, best practice will be implemented through a CEMP and contractors undertaking works within the Site will comply with relevant guidance during construction, including, but not limited to, the Environment Agency Guidance for Pollution Prevention and associated Pollution Prevention Guidance Notes. The CEMP will cover: guidance for the contractor(s) ensuring that Proposed Development construction personnel are fully aware of the potential impact to water resources associated with the proposed construction works and procedures to be followed in the event of an accidental pollution event occurring. This will be included in the Site induction and training, with an emphasis on procedures and guidance to reduce the risk of water pollution.

Water Resources

14.7.4 Pollution Plans to deal with accidental pollution will be drawn up and agreed with the Environment Agency and NEL IDB, prior to construction of the Proposed Development commencing and any necessary equipment (e.g. spillage kits) shall be held on the Site and all Site personnel will be trained in their use. The Environment Agency and NELC will be informed immediately in the unlikely event of a suspected pollution incident.

14.7.5 Measures set out in the Environment Agency, Defra and HMG guidance listed in Section 14.2.41 will be followed in the storage of materials within the Main Development Area of the Site. Examples of such measures include:

- placing arisings and temporary stockpiles away from drainage systems, and directing surface water away from stockpiles to prevent erosion;
- implementing containment measures including drip trays, bunding or double-skinned tanks of fuels and oils, storing all chemicals in accordance with their Control of Substances Hazardous to Health (COSHH) guidelines and providing spill kits in areas of fuel/oil storage;

- keeping plant and machinery away from surface water bodies wherever possible and installing drip trays beneath oil tanks/ engines/ gearboxes and hydraulics, which are checked and emptied regularly;
- locating refuelling and delivery areas away from surface water drains; and
- protecting exposed ground and stockpiles as appropriate and practicable to prevent windblown migration of potential contaminants, and using water suppression if there is a risk of fugitive dust emissions.

Flood Risk

14.7.6 Construction works undertaken adjacent to, beneath and within watercourses will comply with relevant guidance during construction, including the Environment Agency, Defra and HMG guidance (see paragraph 14.2.41) and the requirements of NELC.

14.7.7 The CEMP will incorporate measures aimed at preventing an increase in flood risk during the construction works associated with the Proposed Development. Examples of measures that will be implemented in the Main Development Area within Flood Zone 3 include:

- storing topsoil and other construction materials is not possible outside of tidal Flood Zone 3. A permit will therefore need to be obtained from the Environment Agency;
- maintaining connectivity between the floodplain and the River Humber, with no increases in ground level within the floodplain as far as practicable (other than the infilling of Ponds 1 and 2).

14.7.8 The construction contractor will be required to produce a Flood Emergency Response Plan which will provide details of the response to an impending flood and include:

- a 24 hour availability and ability to mobilise staff in the event of a flood warning;
- the removal of all plant, machinery and material capable of being mobilised in a flood for the duration of any holiday close down period;
- details of the evacuation and site closedown procedures; and
- arrangements for removing any potentially hazardous material and anything capable of becoming entrained in floodwaters, from the temporary works areas.

14.7.9 The Flood Emergency Response Plan would utilise the Environment Agency Flood Warning Service (Environment Agency, 2018). The construction supervisor will be notified of any potential flood occurring by use of the Floodline Warnings Direct service. Further details are included within the FRA presented in Appendix 14A in ES Volume III.

Drainage

14.7.10 It is proposed in the Outline Drainage Strategy (presented in Appendix 14B in ES Volume III) that surface water is to be collected within the Site and conveyed to a surface water attenuation pond SuDS feature via the use of gullies, drainage ditches/ swales, where possible. Site topography is conducive for flows to be gravity drained to a new surface water attenuation pond located at the eastern edge of the Main Development Area. It is proposed that this attenuation pond will outfall into one of the existing land drainage ditches located along the northern or southern boundaries of the

Site (either Land Drain 1 or Land Drain 2 respectively) using a flow control mechanism such as a Hydro-Brake to limit the discharge to the existing greenfield rates.

14.7.11 Plans for any discharge and/or disposal of potentially contaminated water will be agreed in advance with the Environment Agency, Anglian Water, the NEL IDB and NELC where appropriate (and permits obtained as required). Such plans would include the following:

- all foul water from any site compound (including temporary toilets) would either be tankered away to an appropriate disposal facility by a licensed waste disposal contractor or treated on Site in a septic tank. Any potentially contaminated water will be tested, and if it is not of a suitable quality, agreed disposal procedures will be followed. Construction drainage details will be developed in consultation with the Environment Agency;

- any waters removed from excavations by de-watering will be discharged appropriately, subject to the relevant licenses being obtained; and

- foundations and services will be designed and constructed to prevent the creation of pathways for the migration of contaminants and will be constructed of materials that are suitable for the ground conditions and designed use. No discharges from any self-contained wheel wash and localised wheel wash would be permitted to discharge into any surface water system.

14.7.12 Facilities will be provided during the construction phase of the Proposed Development, where necessary, to ensure controlled discharge of any surface water runoff that might occur. It would be a contractual requirement of the contractor to ensure that any runoff from the Site does not cause pollution or flooding.

14.7.13 Measures to be considered on the finalisation of detailed design include implementation of temporary drainage through the construction design and/or CEMP include:

- installation of measures such as silt fences and appropriately sized settlement tanks/ponds to reduce sediment load;

- cut-off ditches or geotextile silt-fences, installed around excavations, exposed ground and stockpiles to prevent uncontrolled release of sediments from the Proposed Development;

- regular cleaning of site access points to prevent build-up of dust and mud;

- installation of valves to isolate the settlement tank/ ponds in the event of a polluted discharge;

- installation of oil interceptors (notably the outflow from the settlement pond/tank) to reduce the potential risk for contamination of groundwater and surface water;

- separate drainage for all potentially polluted waters (including washdown areas, stockpiles and other areas of risk for water pollution) which are to be tankered away from the Site.

14.7.14 In addition, if monitoring demonstrates unsatisfactory levels of solids or other pollutants, measures would be implemented (e.g. changes to site drainage and settlement facilities and/or use of flocculants) to control suspended solids or other polluted discharge to watercourses.

14.7.15 A septic tank is likely to be used for treatment of sanitary or domestic wastewater from offices/administration/welfare facilities during the construction period. This septic tank will be emptied as required and tankered off Site to a waste water treatment plant.

Maintenance and Operation

14.7.16 Throughout its lifetime, the Proposed Development will be regulated by the Environment Agency through an Environmental Permit, which will include conditions relating to handling, storage and use of diesel and other chemicals, including emergency procedures in line with the use of Best Available Techniques (BAT). These measures will be in place to prevent pollution during plant maintenance and operation in accordance with the Permit.

Water Resources

14.7.17 A number of the impact avoidance measures employed during the construction phase of the Proposed Development will remain for the maintenance and operational phases (where relevant), and will be implemented through the Site operator's Environmental Management System (EMS). For example:

- plans to deal with accidental pollution and any necessary equipment (e.g. spillage kits) will be held on Site and all Site personnel will be trained in their use, for example the plan will incorporate details on how to appropriately deal with accidental spillages to ensure they are not drained to any surface water system;
- containment measures will be implemented, including bunding or double-skinned tanks for fuels and oils, and all chemicals will be stored in accordance with their COSHH guidelines; and
- oil interceptors will be incorporated into the drainage system to prevent material entering the surface water drainage system or local waterbodies.

Flood Risk

14.7.18 The operator of the Proposed Development will be required to subscribe to the Environment Agency's Flood Warning and Alert Service in the area.

14.7.19 As a precaution, flood resilience measures will be incorporated into the Proposed Development design to minimise the amount of damage and reduce the recovery time in the unlikely case of the Site becoming inundated. During the detailed design and construction of the Proposed Development the opportunity will be taken to adopt flood resilient design techniques.

14.7.20 The following resilient measures have been identified as possible options for inclusion at the Site, subject to final design:

- critical equipment and a safe place of refuge for people (as outlined in the FRA in ES Appendix 14A in ES Volume III) will be raised/ provided on an upper level of the building respectively above the 0.1% AEP event plus an allowance for climate

change scenario flood water level of 4.55 mAOD (as estimated by AECOM until further information is provided by the Environment Agency[2]) for the year 2115 as per Environment Agency guidance on climate change allowances;

- boundary walls and fencing could be designed with high water resistance materials and/or effective seals to minimise water penetration for low depth, short duration floods; and
- tanks could be bunded to a level higher than the 0.5% AEP plus climate change event breach flood level.

14.7.21 The following measures might also be considered for inclusion in the Proposed Development:

- pipelines and storage tanks designed to withstand the water pressures associated with high return period event flooding;
- tanks securely tethered in such a way as to ensure the infrastructure remains secure should flooding occur;
- electrical supply entering the Proposed Development from height and down to required connections;
- use of flood barriers on access points;
- protecting wiring for operational control of the Proposed Development, telephone, internet and other services by suitable insulation in the distribution ducts to prevent damage;
- materials with low permeability up to 0.3 m and acceptance of water passage through building at higher water depths;
- flood proofing including the use of flood resistant building materials, use of water resistant coatings, use of galvanised and stainless steel fixings and raising electrical sockets and switches;
- utilising floor materials that are able to withstand exposure to floodwater without significant deterioration and that can be easily cleaned, e.g. concrete-based or stone;
- incorporating water resistant services within the buildings, i.e. avoid services using ferrous materials;
- design of the Proposed Development to drain water away after flooding;

[2] Position Statement in Para. 4.15 in the Flood Risk Assessment (Appendix 14A in ES Volume III)

- providing access to all spaces to permit drying and cleaning;
- carefully considering the type of usage and layout of ground floor areas to minimise the potential impact on business operations following a flood; and
- suitable waterproofing measures to development located below ground i.e. tanking below ground storage areas etc.

Drainage

14.7.22 An Outline Drainage Strategy outlining how surface water would be managed post-development has been produced and is presented in Appendix 14B in ES Volume III.

14.7.23 The Floods and Water Management Act 2010 places responsibility on local planning authorities, supported by the Environment Agency, to ensure new developments are unlikely to increase overall risk of flooding and requires SuDS criteria to be incorporated into the design. Post-development runoff volumes and rates should therefore be approximate to greenfield runoff rates.

14.7.24 In order to ensure that flood risk is not increased, in accordance with the NPPF, Environment Agency, NELC and NEL IDB requirements, surface water discharge of surface water runoff from the Main Development Area within the Site will be restricted to the existing greenfield runoff rate to prevent an increased risk of flooding downstream. The Proposed Development includes an attenuation pond as a surface water attenuation solution, to ensure water runoff rates assessed and presented within the FRA (Appendix 14A in ES Volume III) are not exceeded.

14.7.25 SuDS standards require that the first choice of surface water disposal should be to discharge to infiltration systems. SuDS systems/units shall also contribute to improving the water quality and sediment control. Attenuation will be achieved by limiting discharge through an appropriate flow attenuation device.

14.7.26 In line with the NPPF, Defra, Environment Agency, NELC and NEL IDB advisory recommendations, best practice guidelines and local planning policy, SuDS techniques detailed in the CIRIA SuDS Manual (CIRIA, 2007) will be used as a preferential option. A summary of potential SuDS techniques which could be used at the Site are found in Table 5 of the Outline Drainage Strategy (presented in Appendix 14B in ES Volume III). This is not an exhaustive list of techniques and so other options could be explored at the detailed drainage design stage for the Proposed Development.

14.7.27 Surface water will be collected on Site from the Main Development Area and conveyed into a surface water attenuation pond SuDS feature at the eastern extent of the Main Development Area via the use of drainage gullies, ditches/swales (where possible). It is proposed that this attenuation pond will outfall into one of the existing Land Drains as shown on Figure 14.1 in ES Volume II located along the southern or northern boundaries of the Site using a flow control mechanism such as a Hydro-Brake to limit the discharge to greenfield rates. The detailed drainage design phase will need to confirm that the bed levels of the local land drains into which the attenuation solution will discharge are appropriate relative to the bed levels of the storage solution to ensure they are positively drained by gravity (i.e. to confirm that no additional pumping is required).

14.7.28 As the Middle Drain pumping station discharges into the tidal Humber Estuary, it may be the case that during some high-tide events, discharges into the southern drain become restricted. Design for this will be allowed for during the outline and detailed design phases of the Proposed Development. To illustrate the effect that this may have

on the storage volume, a conservative assumption that no discharge is allowed into the drain during the duration of the critical storm has been applied.

14.7.29 In order to reduce the additional risk of failure, blockage and capacity exceedance above that of the design events for the drainage infrastructure, maintenance of the system will be incorporated in general site management and remains the responsibility of EP SHB Limited. A manual will be prepared detailing each drainage feature on Site, the maintenance required, timescales for maintenance and who is responsible for undertaking the maintenance. It is expected the Site owners will ultimately be responsible for maintenance of the Site drainage system including all pipes, discharge structures and any SuDS implemented on Site in accordance with the recommendations in the SuDS Manual.

14.7.30 The details set out in the Outline Drainage Strategy (presented in Appendix 14B in ES Volume III) represent a high-level outline drainage design concept which will be developed through detailed design phase in response to requirements identified through the detailed design process.

Decommissioning

14.7.31 The impact avoidance measures for decommissioning will be similar to those identified above for construction.

14.7.32 A detailed Decommissioning Environmental Management Plan will be prepared to identify required measures to prevent pollution during this phase of the development, based on the detailed decommissioning plan.

14.8 Limitations or Difficulties

14.8.1 The following assumptions have been applied throughout this assessment process, but are not considered to significantly affect the robustness of the assessment:

- a conceptual design for the Proposed Development and drainage strategy has been completed and whilst detailed design will be undertaken prior to construction of the Proposed Development, it is unlikely that detailed design will change the outcome of the assessment; and
- similarly, as no details of construction techniques are available, it is assumed that standard best practice construction techniques would be used.

14.8.2 Further information of the connections associated with the existing ponds and drainage network will be sought at the detailed drainage strategy design phase.

14.9 Residual Effects and Conclusions

14.9.1 A summary of the residual effects is provided in Table 14.6 (using the approach set out in Table 14.3). Only those effects during construction, maintenance and operation of the Proposed Development that have been assessed as ‘minor’, ‘moderate’ or ‘major’ prior to mitigation are included (i.e. not those classified as ‘negligible’). Mitigation measures relevant to each activity associated with a potentially significant adverse effect are set out in Table 14.7 and also outlined in the Framework CEMP in Appendix 5A in ES Volume III.

14.9.2 Table 14.6 also confirms whether the incorporation of the mitigation measures identified above will result in a reduction in the magnitude and/or probability of impacts on sensitive water receptors or whether they have a net adverse or beneficial impact.

Table 14.6: Summary of Residual Effects

IMPACT FROM ACTIVITY	DESCRIPTION OF POTENTIAL EFFECTS (PRIOR TO MITIGATION)		MITIGATION MEASURES (IMPACT AVOIDANCE)	DESCRIPTION OF RESIDUAL EFFECTS	
	DESCRIPTION	SIGNIFICANCE		DESCRIPTION	SIGNIFICANCE
CONSTRUCTION					
A - permanent loss of both surface waterbodies within the Site during construction of the Proposed Development	Pond 1 and Pond 2 are of **low** character receptor importance. Loss of these surface water bodies has the potential to affect water resources, flood risk and drainage with a **medium** nature of effect.	**Minor adverse**	New surface water attenuation pond SuDS feature and improved drainage via gullies, drainage ditches/swales where possible.	Incorporation of these mitigation measures will reduce the probability of effects occurring to low, and in the event of the effect occurring, reduce the magnitude to negligible.	**Negligible**
B - potential change to the surrounding land drains (culverting)	If an access bridge from South Marsh Road is proposed across Land Drain 1 in the north-eastern corner of the Main Development Area, then there is the potential for an impact on the flood risk from the watercourse; with a **medium** nature of effect.	**Minor adverse**	Any proposed culvert beneath the bridge will be adequately sized to convey the equivalent maximum flow as the ditch itself currently exhibits. This existing flow capacity would need to be assessed at the detailed design stage to inform the choice of culvert size used. Agreement would need to be sought from the NEL IDB on the structure used.	The new culvert would reduce the probability of effects occurring to medium, and in the event of the effect occurring, reduce the magnitude to negligible.	**Negligible**

IMPACT FROM ACTIVITY	DESCRIPTION OF POTENTIAL EFFECTS (PRIOR TO MITIGATION)		MITIGATION MEASURES (IMPACT AVOIDANCE)	DESCRIPTION OF RESIDUAL EFFECTS	
	DESCRIPTION	SIGNIFICANCE		DESCRIPTION	SIGNIFICANCE
C - potential loss of floodplain storage and temporary changes to flood water flow routing within Flood Zone 3 during construction of the Proposed Development (although the Site benefits from flood defences)	The Environment Agency's modelling has illustrated that there is a very low/negligible risk of fluvial flooding to the Site from the Land Drains 1 to 5, Middle Drain or Oldfleet Drain. The residual high risk of tidal flooding (Flood Zone 3) would only be incurred in the unlikely event that the Humber Estuary defences were overtopped or experienced a breach failure. Oldfleet Drain is of **medium** character receptor importance. Construction activities have the potential to affect the water quality of these drains with the nature of the effect of **low** (medium probability, reversible and medium term adverse effects on the water quality). The rest of the watercourses have a low character receptor importance and low impact as a result of construction activities.	**Minor adverse and Negligible**	No mitigation is considered necessary to further reduce the residual risk of floodwater re-routing to the local watercourses due to any stockpiles in the event of an overtopping or breach failure in the Humber Estuary defences.	n/a	**n/a**

IMPACT FROM ACTIVITY	DESCRIPTION OF POTENTIAL EFFECTS (PRIOR TO MITIGATION)		MITIGATION MEASURES (IMPACT AVOIDANCE)	DESCRIPTION OF RESIDUAL EFFECTS	
	DESCRIPTION	SIGNIFICANCE		DESCRIPTION	SIGNIFICANCE
D - pollution of surface watercourses within or near the Site during construction of the Proposed Development	Land Drain 1 and Land Drain 2 are each of **low** character receptor importance. Construction activities associated with the Proposed Development have the potential to affect the water quality of these drains with the nature of the effect of **medium** (medium probability, reversible and medium term adverse effects on the water quality). Oldfleet Drain is of **medium** character receptor importance. Construction activities have the potential to affect the water quality of these drains with the nature of the effect of **low** (medium probability, reversible and medium term adverse effects on the water quality).	**Minor adverse**	Temporary drainage and settlement Installation of measures such as silt fences, appropriately sized settlement tanks/ponds to reduce sediment load, vehicle restrictions and siting of materials and contingency measures. Mitigation measures and best practice outlined in a CEMP.	Incorporation of these mitigation measures will reduce the probability of effects occurring to low, and in the event of the effect occurring, reduce the magnitude to low.	**Negligible**

IMPACT FROM ACTIVITY	DESCRIPTION OF POTENTIAL EFFECTS (PRIOR TO MITIGATION)		MITIGATION MEASURES (IMPACT AVOIDANCE)	DESCRIPTION OF RESIDUAL EFFECTS	
	DESCRIPTION	SIGNIFICANCE		DESCRIPTION	SIGNIFICANCE
E - change to the impermeable area within the Site, and associated changes to surface water flows during construction of the Proposed Development	Land Drain 1 and Land Drain 2 are currently understood to receive lateral inflows of surface water runoff from the greenfield area of the proposed Main Development Area. The likely character of these watercourses is **low** with the nature of the effect of **high** (high probability, reversible and high short term adverse effects on the flood risk and drainage).	**Moderate adverse**	It is proposed that as part of the Outline Drainage Strategy for the Site that discharge rates and volumes of surface water runoff from the Proposed Development are restricted to the existing greenfield runoff rates up to the 1% AEP event including a +40% allowance for climate change in accordance with the Environment Agency, NELC, NEL IDB and NPPF PPG requirements. It is proposed that this will be achieved through directing runoff into an attenuation SuDS feature (pond) allocated at the eastern edge of the Proposed Development. This will have a controlled outfall (such as a HydroBrake) to limit the discharges into Land Drain 1 or Land Drain 2. This would potentially reduce the runoff rates and volumes into Land Drain 2 or Land Drain 1 respectively.	Incorporation of these mitigation measures will reduce the probability of effects occurring to low, and in the event of the effect occurring, reduce the magnitude to medium.	**Minor Adverse**

IMPACT FROM ACTIVITY	DESCRIPTION OF POTENTIAL EFFECTS (PRIOR TO MITIGATION)		MITIGATION MEASURES (IMPACT AVOIDANCE)	DESCRIPTION OF RESIDUAL EFFECTS	
	DESCRIPTION	SIGNIFICANCE		DESCRIPTION	SIGNIFICANCE
MAINTENANCE AND OPERATION					
F - change to the impermeable area within the Site, and associated changes to surface water flows during maintenance and operation of the Proposed Development	As per Potential Impact E (above).	As per Potential Impact E (above) - **Moderate adverse**	As per Potential Impact E (above). It is also proposed as part of the Outline Drainage Strategy for the Site that in order to reduce the risk of blockage, failure and capacity exceedance of the drainage infrastructure, maintenance of the system defined in a manual will be incorporated in general site management procedures and remains the responsibility of EP SHB.	As per Potential Impact E (above).	As per Potential Impact E (above) - **Minor adverse**

IMPACT FROM ACTIVITY	DESCRIPTION OF POTENTIAL EFFECTS (PRIOR TO MITIGATION)		MITIGATION MEASURES (IMPACT AVOIDANCE)	DESCRIPTION OF RESIDUAL EFFECTS	
	DESCRIPTION	SIGNIFICANCE		DESCRIPTION	SIGNIFICANCE
G- potential loss of floodplain storage as the footprint of the Proposed Development is located within Flood Zone 3	The Environment Agency's modelling has illustrated that there is a very low/negligible risk of fluvial flooding to watercourses. The residual high risk of tidal flooding (Flood Zone 3) would only be incurred in the unlikely event that the Humber Estuary defences were overtopped or experienced a breach failure. No land raising is proposed at the therefore it is limited but potential impact on the local watercourses as a result of the tidal floodwater volume capacity being reduced if a defence breach/overtopping event were to occur resulting from the building walls alone present within the Site as these would only partly displace a negligible amount of floodwater. No significant increase in the localised flood risk to the neighbouring watercourses would therefore be incurred, as	**Minor adverse**	Flood Emergency Response Plan. Emergency Access and Egress from Site. Place of Safe Refuge & Critical Equipment elevated above the maximum breach floodwater level.	Incorporation of these mitigation measures will reduce the probability of effects occurring to low, and in the event of the effect occurring, reduce the magnitude to low.	**Negligible**

IMPACT FROM ACTIVITY	DESCRIPTION OF POTENTIAL EFFECTS (PRIOR TO MITIGATION)		MITIGATION MEASURES (IMPACT AVOIDANCE)	DESCRIPTION OF RESIDUAL EFFECTS	
	DESCRIPTION	SIGNIFICANCE		DESCRIPTION	SIGNIFICANCE
H - pollution of surface watercourses within or near the Site during operation of the Proposed Development	Land Drains 1 and 2 are of **low** character. Construction activities have the potential to affect the water quality of these drains with the nature of the effect of **medium** (medium probability, reversible and medium term adverse effects on the water quality). Oldfleet Drain is of **medium** character. Construction activities have the potential to affect the water quality of these drains with the nature of the effect of **low** (medium probability, reversible and medium term adverse effects on the water quality).	**Minor adverse**	Impact avoidance measures including spill kits and contaminant measures to be integrated into the operator's Environmental Management System	Incorporation of these mitigation measures will reduce the probability of effects occurring to low, and in the event of the effect occurring, reduce the magnitude to low.	**Negligible**

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