The Keadby 3 Low Carbon Gas Power Station Project

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The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

Land at and in the vicinity of the Keadby Power Station site, Trentside, Keadby, North Lincolnshire

Environmental Statement Volume II - Appendix 11G: Aquatic Ecology Survey Report

The Planning Act 2008

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Applicant: Keadby Generation Limited

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GLOSSARY

Abbreviation	Description
AGI	Above Ground Installation
ASPT	Average Score Per Taxon
BMWP	Biological Monitoring Working Party
CCI	Community Conservation Index
CCP	Carbon Capture and Compression
ES	Environmental Statement
FSSR	Fine Sediment Sensitivity Rating
INNS	Invasive Non-native Species
LWS	Local Wildlife Site
NVC	National Vegetation Classification
PEA	Preliminary Ecological Appraisal
PSI	Proportion of Sediment-sensitive Invertebrates
RDL	Red Data List
WFD	Water Framework Directive
WHPT	Whalley, Hawkes, Paisley & Trigg

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1.0 INTRODUCTION

1.1 Background

1.1.1 This report accompanies **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**) and provides data on aquatic macroinvertebrates, aquatic plants and fish in support of the Ecological Impact Assessment (EcIA) of the Proposed Development.

1.1.2 The terms of reference used to describe the Proposed Development in this report are broadly consistent with those defined within the main chapters of the Environmental Statement (ES) (ES Volume I - **Application Document Ref. 6.2**).

1.1.3 The Proposed Development Site encompasses an area of approximately 69.7 hectares (ha) which includes circa 20.7ha of land for construction laydown.

1.1.4 The Proposed PCC Site comprises an area of approximately 18.7ha of the Proposed Development Site within the wider Keadby Power Station site that is located within Keadby Common. Overhead electricity transmission lines associated with the existing National Grid 400kV Substation bisect the Proposed PCC Site. Land to the south of these overhead lines within the Proposed PCC Site is proposed for administration/ control room/ warehouse buildings and car parking areas and an above ground installation (AGI) for the gas connection. The area of the Proposed PCC Site on which the power generation (CCGT), carbon capture and compression (CCP) and associated stacks will be developed is referred to as the 'Main Site' herein.

1.2 Scope

1.2.1 An initial Preliminary Ecological Appraisal (PEA) of the ecological constraints and opportunities associated with the site was made by AECOM in March 2020, including the identification of requirements for further protected species surveys. The findings of the habitat and scoping survey were compiled as a Preliminary Ecological Appraisal (PEA) report (submitted as **Appendix 11C** (ES Volume II - **Application Document Ref. 6.3**)) which should be referred to for a more detailed overview of the site conditions and habitats present.

1.2.2 This habitat information was used to identify locations within the potential zone of influence of the Proposed Development that might support habitats of importance for aquatic macroinvertebrate, plant and fish species.

1.2.3 The PEA report identified a number of waterbodies (refer to **Figure 11G.1** (ES Volume II - **Application Document Ref. 6.3**)) as requiring further survey for macroinvertebrates and plants due to the potential for these waterbodies to experience impacts and effects from construction, operation and/ or decommissioning of the Proposed Development:

- four field drains (Drains 1 (Glew Drain), 2, 3 and 4) in association with the Main Site, where construction works for the Proposed Development would be focussed;
- the Stainforth and Keadby Canal due to it being considered as a potential water supply for the Proposed Development; and
- Keadby Boundary Drain Local Wildlife Site (LWS) because it is located adjacent to the Main Site and is connected to and downstream of the four field drains identified above. The LWS was surveyed by AECOM in 2017 and the results of this survey remain valid and are incorporated into this report.

1.2.4 Watercourses that would only be affected by very localised and short duration construction works (e.g. potential installation of electrical connections and/ or replacement of existing bridges) were scoped out as the potential ecological impacts and effects are sufficiently understood and the gathering of aquatic macroinvertebrate and plant survey data were therefore not needed to inform EcIA. The drains scoped out on this basis were Keadby Common Drain adjacent to Chapel Lane, Glew Drain and the Hatfield Waste Drain. Relevant information on these drains is provided in **Appendix 11C**: PEA report (ES Volume II - **Application Document Ref. 6.3**).

1.2.5 There are other waterbodies associated with the Proposed Development Site however these either will not be affected by the Proposed Development (i.e. North Soak Drain) or only hold water in the wetter months of the year (i.e. Drain 5, **Figure 11G.1** (ES Volume II - **Application Document Ref. 6.3**)). Therefore, these waterbodies were scoped out and are not considered further in this report. Similarly, the River Trent as a tidal river reach has been scoped out – refer to **Appendix 11C**: PEA report (ES Volume II - **Application Document Ref. 6.3**) for further explanation of the reasons for this.

1.2.6 Fish surveys were not considered necessary given the availability of existing baseline data collected by the Environment Agency; the greater mobility of fish species meaning that they are unlikely to be specifically dependent on habitats within the limited zone of influence of the Proposed Development, and the mitigation embedded into the design of the Proposed Development which is suitable to minimise potential for adverse impacts and effects. Instead, relevant desk study information was collated and is presented in this report.

1.2.7 The purpose of the survey work completed, and this report is to:

- provide species data and information on the aquatic macroinvertebrate[1], aquatic plant[2] and fish species and assemblages within the relevant areas of the Proposed Development Site;
- present the above data in a manner that allows the results to be used to support an assessment of relative nature conservation value, including review against relevant criteria (see Section 2 of this report);
- identify potential aquatic invasive non-native species (INNS) constraints to construction and operation of the Proposed Development; and
- inform the options for impact avoidance, mitigation and/ or compensation to be considered.

1.2.8 The purpose of this report is to provide baseline technical information only. It does not seek to include recommendations, specify mitigation, or make an ecological impact assessment of the Proposed Development. The formal EcIA is provided as **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I – **Application Document Ref. 6.2**), and this report comprises an appendix to that chapter.

1.3 Summary Habitat Conditions

1.3.1 The PEA report (**Appendix 11C** (ES Volume II - **Application Document Ref. 6.3**)) provides a summary of the habitat conditions present within each of the waterbodies which may experience impacts from construction, operation and/ or decommissioning of the Proposed Development. Further information on each of the waterbodies surveyed is provided below to support the interpretation of the results highlighted in this report. The locations of these is provided on **Figure 11G.1** (ES Volume II - **Application Document Ref. 6.3**). Photographs of the waterbodies are provided in the **Appendix 11C** (ES Volume II - **Application Document Ref. 6.3**).

Drain 1 (Glew Drain)

1.3.2 Drain 1 (Glew Drain) is a linear drainage ditch located on the northern boundary of the Main Site. It is an extension of the drainage ditch designated as the Keadby Boundary Drain LWS but Drain 1 is not part of the LWS. As such, the

[1] Aquatic macroinvertebrates are those invertebrate species that are easily visible without magnification i.e. species and life stages greater than 0.5 mm in size (The British Standards Institution, 2012).

[2] Restricted to 'macrophytes' i.e. larger plants of fresh water which are easily seen with the naked eye, or which usually form colonies, including all aquatic vascular plants, bryophytes, stoneworts (Characeae) and macro-algal growths (The British Standards Institution, 2014).

designated and undesignated sections have been surveyed, assessed and reported separately (see below for information on the LWS).

1.3.3 Drain 1 has a channel width between 1 and 2m and a substrate dominated by silt. Water depths range between 0.1 and 0.6m, with water depths shallowest towards the eastern end of the drain. The drain is over-deepened with steep earth banks approximately 3m in height and supporting rank semi-improved grassland. Bankside trees are absent and there is no shading of the channel. Flow noted during surveys was negligible (less than 10cm/sec).

1.3.4 The other drainage ditches associated with Keadby Common/ the Main Site flow into Drain 1 (Drains 2 to 5, Drain 4 connects via Drain 3).

Drain 2

1.3.5 This linear drainage ditch is located on the southern boundary of the Main Site. The channel width is approximately 2-3m with water depths between 0.2 and 0.5m. The substrate within the drain is dominated by silt and flow was observed to be negligible (less than 10cm/sec). The drain has earth banks, and the southern bank is dominated by dense willow scrub which overhangs the drain and casts heavy shade over approximately 70% of the channel.

Drain 3

1.3.6 This linear drainage ditch is located on the western boundary of the Main Site between the Main Site and the former Keadby Ash Tip. The channel width is approximately 1m with water depths between 0.2 and 0.5m. The substrate within the drain is dominated by silt and flow was observed to be negligible (<10cm/sec). The drain has earth banks, one of which supports dense scrub, shading approximately 20% of the channel.

Drain 4

1.3.7 This linear drainage ditch bisects the Main Site. The channel width is approximately 0.5m – 1.0m. The water depth is very shallow (0.1m) and the channel was dry in places. No flow was apparent at the time of survey. The substrate within the drain is dominated by silt and at the time of survey there was no flow. The drain has earth banks.

Stainforth and Keadby Canal

1.3.8 The Stainforth and Keadby Canal is a navigable canal. It is designated as Stainforth and Keadby Canal Corridor LWS for its rich aquatic flora, and also for the mosaic of associated bankside habitats.

1.3.9 At the location of the Proposed Development Site, it is approximately 40m wide and greater than 1m in depth, with a substrate dominated by silt. At the time of survey flow was negligible (less than 10cm/sec). The banks of the canal are vertical and where visible are concrete. Bankside trees and scrub are present

on the northern bank of the canal, however given the width of the canal, shading to the channel is negligible. The southern bank supports a tow path with mown grassland margins.

1.3.10 The canal is relevant to the Proposed Development because it is the preferred source of cooling water for the Proposed Development (refer to paragraph 4.3.51 which describes the Canal Water Abstraction Option in **Chapter 4**: The Proposed Development (ES Volume I – **Application Document Ref. 6.2**). Should this option be selected, a new intake structure would be constructed within the canal, located adjacent to the intake currently under construction for Keadby 2 Power Station (refer to **Figure 3.3** in ES Volume III – **Application Document Ref. 6.4**). Any water abstraction from the canal would be subject to the regulatory regimes applicable to the approved abstraction for Keadby 2 Power Station. Given these considerations, a detailed analysis of the macroinvertebrate community was not considered necessary. Instead, the main purpose of the survey was to identify any aquatic INNS that may pose a constraint on use of the canal as a cooling water supply.

Keadby Boundary Drain Local Wildlife Site (LWS)

1.3.11 This is a linear drainage ditch that is connected to the west of, and functionally part of, Drain 1 (Glew Drain). The LWS appears to discharge to Warping Drain to the north of the Proposed Development Site.

1.3.12 The drain is over-deepened with a channel width of approximately 2m. Water depths are variable but in the order of 0.3-0.7m, and flow is negligible (less than 10cm/sec). The substrate within the drain is equal parts clays and silts.

2.0 METHODS

2.1 Desk Study

2.1.1 A desk study was undertaken as part of the scope of works for the PEA, as described in **Appendix 11C** (ES Volume II - **Application Document Ref. 6.3**). Protected and notable aquatic macroinvertebrate and aquatic plant records were obtained from Lincolnshire Environmental Records Centre (LERC) and the Environment Agency Ecology and Fish Explorer Database (Environment Agency, 2020), for a search radius of 1km out from the Proposed Development Site. Records were restricted to those collated over the last 10 years (i.e. post-2010), as these are most likely to reflect the current (rather than historic) baseline conditions associated with the study area.

2.1.2 The National Fish Populations Database was queried on 3rd March 2021 to collate supplementary desk study data on fish for this report. This data derives from surveys conducted by the Environment Agency over the period 2008-2018 (data available for all years except 2016). Data were obtained for the following locations on the River Trent in closest proximity to the Proposed Development:-

- Grove Wharf at Flixborough Seine Netting (Site ID 30499); and
- Humber at Island Farm Beam Trawl (Site ID 38269).

2.1.3 No fish data are available for the Stainforth and Keadby Canal, but the fish species present are likely to reflect the generalist species present in the River Trent. Supplementary info in support of this is available on the Scunthorpe Anglers (2020) website.

2.2 Field Study

2.2.1 The macroinvertebrate and plant field survey data collected for the Proposed Development Site includes results from surveys completed in 2020, and a previous survey of Keadby Boundary Drain LWS completed by AECOM in 2017.

2.2.2 The results of the 2017 survey remain valid and appropriate for use for the Proposed Development. Habitat conditions have not changed within Keadby Boundary Drain LWS, so it is considered that the aquatic macroinvertebrate and plant assemblages present will remain comparable to those found in 2017. Given this, a repeat survey of the LWS was not required in 2020 and the results of the 2017 survey are incorporated into this report.

Aquatic Macroinvertebrate Survey 2020 – Field Drains

2.2.3 Aquatic macroinvertebrate sampling of the four drains was carried out on 19th May 2020 by an experienced AECOM freshwater ecologist supported by an assistant.

2.2.4 The survey methods used were based on the aquatic macroinvertebrate sampling procedures standardised by the Environment Agency (Environment

Agency, 2014). These methods allow characterisation of aquatic macroinvertebrate communities and can be used to determine whether rare or notable species or communities are present.

2.2.5 An aggregate aquatic macroinvertebrate sample was taken along a 50m section of each drain, making sure to sample the full range of habitat conditions present. Due to the consistency in the habitat conditions present, it was considered that the drains would support a similar assemblage along their full length, and therefore sampling a 50m subset of each drain was considered appropriate to obtain representative samples of the aquatic macroinvertebrates present.

2.2.6 The samples were taken using a standard Freshwater Biological Association (FBA) pattern pond net (mesh size: 1mm). The habitats present were sampled by kick sampling for three minutes, followed by a one-minute hand search of larger substrates in accordance with the standard methods.

2.2.7 The samples collected were subsequently preserved in Industrial Methylated Spirits (IMS) for laboratory processing by AECOM.

Aquatic Macroinvertebrate Survey 2020 – Stainforth and Keadby Canal

2.2.8 The aquatic macroinvertebrate sampling of the canal was carried out on 14th July 2020 by two experienced AECOM freshwater ecologists.

2.2.9 A single sample was collected from the southern bank of the canal in proximity to the Canal Water Abstraction Option (sample location SE 82794 11447).

2.2.10 The survey method used was based on the Predictive SYstem for Multimetrics (PSYM) canal survey method (Pond Action, 2002). This method was used to characterise the aquatic macroinvertebrate community present in the canal and identify the presence of any INNS.

2.2.11 The method use comprised three components:

- one-minute hand search;
- two-minute sampling using a standard FBA pattern pond net (mesh size: 1mm) of the canal margin and any emergent plant habitats present; and
- four dredge hauls from deeper bottom sediments.

2.2.12 The sample was then ‘site-sorted’ for approximately 30 minutes on the banks of the canal to identify some of the macroinvertebrate families present and identify any potential INNS. Any taxa which required further identification (such as any non-native shrimps) were collected for laboratory analysis. The rest of the sample was preserved in IMS and stored in case of further requirement.

2.2.13 Once the sample was collected following the above standardised techniques, further sampling of the canal was undertaken in vicinity of the Canal Water Abstraction Option at suitable intervals along approximately 600m between SE 82636 11464 and SE 83232 11424. This used a combination of the dredge and

hand net to ensure any INNS potentially relevant to the Proposed Development were identified.

Aquatic Macroinvertebrate Survey 2017 – Keadby Boundary Drain LWS

2.2.14 Aquatic macroinvertebrate sampling of Keadby Boundary Drain LWS was carried out on 3rd May 2017 by an experienced AECOM freshwater ecologist and an assistant. The survey followed the same methods used during the 2020 survey of Drains 1-4 on Keadby Common.

Analysis of Aquatic Macroinvertebrate Samples

2.2.15 Each of the samples collected (excluding the Stainforth and Keadby Canal sample) was sorted and analysed in a laboratory setting by suitably trained and experienced aquatic ecologists. Lists of the aquatic invertebrate taxa present were produced in line with Environment Agency guidance (Environment Agency, 2014). The aquatic macroinvertebrate samples were identified to 'mixed taxon level[3]' using a stereo-microscope. Most groups were identified to species level (where practicable), with the exception of the following:

- the crustacean *Crangonyx pseudogracilis*/ *floridanus* which was treated as a species complex[4];
- amber snails (Succineidae), which were identified to family;
- pea mussels (Pisidium species), which were identified to genus;
- worms (Oligochaeta) which were identified to order;
- mites (Hydracarina and Oribatei) which were identified to order;
- weevils (Curculionidae), which were identified to family;
- truefly larvae, which were identified to the maximum resolution possible;
- butterfly/ moth larva (Lepidoptera), which were identified to family;

[3] As described in Environment Agency (last issue: 2014) Freshwater macroinvertebrate analysis of riverine samples, Operational instruction 024_08

[4] *Crangonyx pseudogracilis* was first introduced to the UK in the 1930s is now widespread and common in many areas. Until recently it was the only non-native species of this genus known to be present in the UK. However, in 2017 a related non-native species *Crangonyx floridanus* was identified in the UK for the first time (Mauvisseau *et al*., 2018) but it may be have overlooked previously. The identification features available to distinguish the two species are slight and it is often not possible to place samples to species using routine laboratory identification techniques. Given this, and consistent with good practice, records of *Crangonyx* are treated in an aggregate sense within this report. For purposes of use of CCI scores later in this report, records of the aggregate are assigned the same score originally allocated to *Crangonyx pseudogracilis* before it was known that two species were present.

- springtails (Collembola) which were identified to order; and
- immature or damaged specimens, which were identified to the maximum resolution possible on a case-by-case basis.

2.2.16 The survey data was used to calculate metrics that can be used to inform an assessment of relative nature conservation value.

2.2.17 A Community Conservation Index (CCI) (Chadd & Extence, 2004) was calculated for the waterbody. The CCI classifies many groups of freshwater macroinvertebrates according to their scarcity and nature conservation value in Great Britain (as understood at the time that the classification was developed). Species scores range from 1 to 10, with 1 being very common and 10 being endangered (Table 1). However, in some cases, the references used in the CCI classification to define scarcity and value have since been superseded by more recent assessments (e.g. Seddon *et al*., 2014; Foster, 2010). The CCI cannot be modified to take account of such new information, but such information has been considered when making the wider assessment of nature conservation value provided in this report.

Table 1: Conservation Scores from the Community Conservation Index

Conservation Score	Conservation Status
10	Red Data Book (RDB) 1 (Endangered)
9	RDB2 (Vulnerable)
8	RDB3 (Rare)
7	Notable (but not RDB status)
6	Regionally notable
5	Local
4	Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats)
3	Frequent (species not in categories 10-5, which occur in up to >10-25% of all samples from similar habitats)
2	Common (species not in categories 10-5, which occur in up to >25-50% of all samples from similar habitats)
1	Very common (species not in categories 10-5, which occur in up to >50-100 % of all samples from similar habitats)

2.2.18 The overall CCI derived provides an indication of the relative conservation value of the community sampled, based on a combination of the rarity of the different aquatic macroinvertebrate taxa present and overall community richness, as explained below in Table 2. As indicated above, in some cases expert judgment

has been used to moderate these assessments with reference to current information on status and distribution.

Table 2: Community Conservation Index Interpretation Guidance (Chadd & Extence, 2004)

Community Conservation Index (CCI)	Expected conservation value
< 5	Low conservation value
5 to 10	Moderate conservation value
10 to 15	Fairly high conservation value
15 to 20	High conservation value
> 20	Very high conservation value

2.2.19 Calculations were also made to determine the proportion of sediment sensitive aquatic macroinvertebrates present using the Proportion of Sediment-sensitive Invertebrates (PSI) index (Extence *et al*., 2013). Using this approach, individual taxa of aquatic macroinvertebrate are assigned a Fine Sediment Sensitivity Rating (FSSR) ranging from A to D, as detailed in the **Annex A**. The PSI score for each aquatic macroinvertebrate sample was derived from individual species scores and abundances. The derived PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, where low scores correspond to waterbodies with high fine sediment cover. The PSI score therefore provides an indication of the extent to which waterbodies are influenced by fine sediments, and therefore by inference the potential sensitivity of the associated aquatic macroinvertebrate community to changes in silt load and deposition.

2.2.20 The aquatic macroinvertebrate data were also analysed to generate Whalley, Hawkes, Paisley & Trigg (WHPT) and Average Score Per Taxon (ASPT) values (WFD-UKTAG, 2014). This assigns numerical value to taxa according to their sensitivity to organic pollution. The average of the values for each taxon in a sample, known as ASPT is a stable and reliable index of organic pollution. Therefore, these assessments indicate to what extent an aquatic macroinvertebrate community is exposed to organic pollution (further information is provided in **Annex B**). It is important to note that these indices can vary between geological regions and habitat types. Ditches for example are unable to support many of the high-scoring taxa associated with fast flowing habitats. Therefore, the resultant metrics should be reviewed with an awareness of their potential limitations and the site-specific context.

Aquatic Plant Survey 2020 – Field Drains

2.2.21 The boundary drains were surveyed on 15th July 2020 to record their associated emergent and aquatic flora. The survey was completed by an appropriately experienced and trained botanist who is also an aquatic plant specialist. The lead surveyor was supported by an experienced assistant.

2.2.22 The survey was made by walking within the channel of the drains, where safely accessible and not obstructed by dense growth of emergent flora. These latter areas were bypassed as necessary before re-entering the channel at the next available access point. A list of all emergent and aquatic plant species encountered was made for each drain and their relative abundance recorded using the 'DAFOR' scale as follows:

- D = Dominant (greater than 75% total cover);
- A = Abundant (51 to 75% total cover);
- F = Frequent (26 to 50% total cover);
- O = Occasional (11 to 25% total cover; and
- R = Rare (1 to 10% total cover).

2.2.23 The prefix L is used where species were noted as Local (patchy) in distribution. If a species appeared to be intermediate between two categories, it has generally been assigned to the lower category.

Aquatic Plant Survey – Stainforth and Keadby Canal

2.2.24 The aquatic plant survey of the Stainforth and Keadby Canal was carried out on 14th July 2020 by two experienced AECOM freshwater ecologists, including an aquatic plant specialist.

2.2.25 The survey was made by walking the tow path along the southern bank of the canal in the vicinity of the Potential Canal Water Abstraction Option (approximately 300m total survey length, 150m either side of the Potential Canal Water Abstraction Option – refer to **Figure 3.3** (ES Volume III – **Application Document Ref. 6.4**)). All aquatic and marginal plant species observed were recorded and their relative abundance recorded using the DAFOR scale as detailed above. Deeper water areas were sampled by grapnel, and the northern bank of the canal was inspected using binoculars.

Aquatic Plant Survey 2017 – Keadby Boundary Drain LWS

2.2.26 Aquatic plant survey of Keadby Boundary Drain LWS was carried out on 17th July 2017 by an experienced AECOM freshwater ecologist and followed the same methods as the other aquatic plant surveys conducted on the drains in 2020.

2.3 Nature Conservation Evaluation

2.3.1 Evaluation of the relative nature conservation value of the identified ecological features within a site (encompassing nature conservation designations, ecosystems, habitat and species) is required to inform EcIA. This report presents the evaluation of aquatic macroinvertebrate and aquatic plant species and assemblages, while the impact assessment is presented in **Chapter 11:**

Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**).

2.3.2 The method of evaluation that has been utilised has been developed with reference to the Chartered Institute of Ecology and Environmental Management (CIEEM) *Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater and Coastal and Marine – Second Edition* (CIEEM, 2019). These guidelines give advice on scoping and carrying out environmental assessments and place appraisal in the context of relevant policies. Data received through consultation, desk-based studies and field-based surveys are used to allow ecological features of nature conservation value or potential value to be identified, and the main factors contributing to their value described and related to available guidance.

2.3.3 Aquatic macroinvertebrate/ plant communities and individual species can be of nature conservation value for a variety of reasons, and their relative value should always be determined on a case by case basis to demonstrate a robust assessment process. Value may relate, for example, to the uniqueness of the assemblage, or to the extent to which species are threatened throughout their range, or to their rate of decline. The value of the species assemblages associated with the Proposed Development Site has been defined with reference to the geographical level at which it is considered to matter. This assessment has been made with reference to published guidance and criteria where available e.g. criteria to assess relative value within the context of Lincolnshire are given in Local Wildlife Site Guidelines for Lincolnshire (Greater Lincolnshire Nature Partnership (GLNP), 2013) and nationally in Guidelines for the Selection of Biological Sites of Special Scientific Interest (SSSIs) (Bainbridge *et al*., 2013).

2.3.4 The identified guidance and criteria are not definitive and other criteria have been applied as relevant and appropriate to reach a decision on relative nature conservation value. For example, the previously described CCI index has been used to inform assessment of nature conservation value for aquatic macroinvertebrates.

2.4 Limitations

2.4.1 There are no significant limitations to the work undertaken.

2.4.2 Suitable desk study datasets were identified to define the fish species associated with the Proposed Development. This dataset has been considered for species that may have been missed due to the sampling approach used, and these additional relevant species are assumed to be present (lamprey species). The lack of fish data specific to the Stainforth and Keadby Canal is not considered a relevant limitation for the reasons given earlier in this report. The Proposed Development only requires minor construction works on the canal in line with those undertaken for Keadby 2 Power Station, and any water abstraction would be subject to appropriate mitigation (fish screens) and the

requirements of statutory permitting regimes, as described in **Chapter 4**: The Proposed Development (ES Volume I – **Application Document Ref. 6.2**).

2.4.3 All surveys in 2017 and 2020 were undertaken in appropriate favourable weather conditions, and in the appropriate seasons for the habitats being assessed.

2.4.4 All plant species found were identified to species level, where technically feasible based on the material available and the season of survey. Certain plant species cannot always be identified reliably if they lack the features necessary to allow identification, for example mature fruit are typically required to allow certain identification of water-starwort species (*Callitriche* agg.) and watercress (*Nasturtium officinale* agg.).

2.4.5 Given the nature of aquatic macroinvertebrate surveys it is not possible to be certain that all of the species present in a waterbody will be detected. Where juvenile or damaged specimens were collected, species level identification is not always possible. Not all macroinvertebrate species that use waterbodies are present at all times of year and therefore some may be overlooked when surveying. Other species that may be present at other times of year, sporadically and/ or in low numbers may not have been recorded. This is not considered a significant limitation as standard methods were applied, and the data collected is considered representative of the conditions present and appropriate for assessment of value.

3.0 LEGISLATION, PLANNING POLICY AND RELATED GUIDANCE

3.1.1 The following wildlife legislation, planning policy and guidance is specifically relevant to the identification and assessment of potential constraints posed by the presence of the aquatic macroinvertebrate and aquatic plant species. At this stage of assessment, this legislation, policy and guidance is primarily listed to demonstrate that an appropriate level of survey and assessment has been undertaken to meet likely data requirements for future decision-making regarding these material considerations.

3.1.2 Wider relevant biodiversity legislation, policy and guidance is detailed in **Appendix 11A**: Biodiversity and Nature Conservation Legislation and Policy (ES Volume II - **Application Document Ref. 6.3**).

3.1.3 The Wildlife and Countryside Act 1981 (as amended) affords:

- specific protection to a small number of aquatic macroinvertebrate species and their habitat under Schedule 5 of the Act;
- specific protection to flora is listed on Schedule 8 (flora, fungi and lichens); and
- the Act also contains measures for preventing the establishment of non-native species which may be detrimental to native wildlife, including prohibiting the planting and spread of plants listed in Schedule 9.

3.1.4 Certain aquatic macroinvertebrate, fish and aquatic plant species are also listed as 'Species of Principal Importance for Nature Conservation in England' pursuant to Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. Section 40 of the NERC Act requires that local planning authorities have regard to the conservation of biodiversity in England, when carrying out their normal functions.

3.1.5 The Government has published standing advice (Natural England and Department of Environment, Food and Rural Affairs (Defra), 2021) to guide decision-makers on the determination of proposals with potential to affect protected species. The guidance sets out responsibilities and minimum requirements for survey and mitigation.

3.1.6 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 transpose the requirements of The Water Framework Directive (WFD; EC Directive 2000/60/EC) into English law. Any proposed developments or activities that have the potential to affect the water environment require a WFD Assessment (WFDa). Compliance with the WFD means attainment of good ecological status, prevention of deterioration in status, and prevention of failure to achieve future attainment of good status where it is not already achieved within waterbodies. The aquatic macroinvertebrate and plant data presented in this report can be used to support subsequent WFDa of the Proposed Development, if required. The

WFDa for the Proposed Development is provided as **Appendix 12B**: WFD assessment (ES Volume II – **Application Document Ref. 6.3**).

4.0 RESULTS

4.1 Desk Study

Aquatic Nature Conservation Designations

4.1.1 LERC identified two freshwater nature conservation designations with direct habitat connectivity to the Proposed Development Site. The Keadby Boundary Drain LWS is designated for the botanical interest of both the drain habitat and the semi-improved neutral grassland on its banks. The LWS was last surveyed in 2010. Limited information on the botanical interest of the LWS is included on the citation, but it notes that: '*Aquatic vegetation is abundant throughout, including water-starwort, Nuttall's waterweed, and common and ivy-leaved duckweed, as well as the locally uncommon whorled water-milfoil, water-violet and needle spike-rush. Some of the many other wetland plants present are purple-loosestrife, water mint, water-plantain, water-cress, yellow iris, false fox-sedge, reed sweet-grass, reed canary-grass and common reed*.'

4.1.2 Stainforth and Keadby Canal LWS is designated for the botanical interest of the canal and its adjacent habitats. This LWS extents approximately 10km along the length of the canal and was last surveyed in 2010. Information on the botanical interest of the LWS is included on the citation as follows: '*The canal supports a rich aquatic flora that throughout its length includes common, fat and greater duckweed, spiked water-milfoil, fennel and perfoliate pondweed and the non-native curly and Nuttall's waterweed. Other widespread water plants are arrowhead, unbranched bur-reed, yellow water-lily, flowering-rush, amphibious bistort, yellow iris, gypsywort, water dock, reed sweet-grass, reed canary-grass and common reed. The canal banks are mostly vertical, but gently sloping wet edges created by anglers hold a variety of further species such as skullcap, marsh woundwort, angelica, water figwort, hemlock water-dropwort, common fleabane, yellow loosestrife and false fox-sedge*.'

Aquatic Macroinvertebrates

4.1.3 No records of rare or protected aquatic macroinvertebrate species were returned during the desk study within the study area. The Environment Agency has undertaken macroinvertebrate sampling within Keadby Warping Drain on two occasions within the last 10 years (2013 and 2016). This drain is 320m north of Proposed Development Site and is designated as a LWS for its aquatic flora and habitats. Four species were recorded during the surveys in 2013, while a total of 28 were recorded in 2016. These results indicate that the drain supports a typical assemblage of aquatic macroinvertebrates for the habitats present including a range of beetle, caddisfly, dragonfly and truefly taxa.

4.1.4 Only a single non-native species record was identified from Keadby Warping Drain; the amphipod *Crangonyx pseudogracilis/ floridanus*.

4.1.5 Records also indicate that in 2007, the Environment Agency recorded the presence of non-native Dreissenidae mussels within the Stainforth and Keadby Canal, approximately 500m downstream of the Potential Canal Water Abstraction Option that is the preferred cooling water source for the Proposed Development. The only British members of this group of mussels are the INNS zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena bugensis*). The species present in the canal was not determined.

Aquatic Plants

4.1.6 The desk study returned no aquatic plant records other than those included within the details of the nature conservation designations summarised above.

Fish

4.1.7 The results of the desk study are provided as **Annex C**. Twenty species of fish have been recorded during Environment Agency surveys on the River Trent. In addition, it is assumed that river and sea lamprey (*Lampetra fluviatilis* and *Petromyzon marinus* respectively) both occur, even though these species were not detected by these surveys. Lampreys are not easily detected using standard fish survey methods.

4.1.8 In addition to the two lamprey species, two other notable migratory fish species have also been recorded using the River Trent. These species are Atlantic salmon (*Salmo salar*) and European eel (*Anguilla anguilla*).

4.2 Field Survey Results

4.2.1 The aquatic macroinvertebrate species recorded are detailed in **Annex D**. No aquatic macroinvertebrate species were recorded that receive specific legal protection via Schedule 5 of the WCA, or that are listed on Section 41 of the NERC Act as being of principal importance for nature conservation in England. This does not remove the need to further assess the species recorded for their nature conservation importance. There are other criteria for nature conservation value, and legal protections do not always provide a true or current reflection of all species of nature conservation concern.

4.2.2 The aquatic plant species recorded are detailed in **Annex E**. This includes identification of plant species relevant to the identification of sites of importance for their aquatic plant interest (based on Table 11 and Criteria FW2 and FW3 of the LWS Guidelines for Lincolnshire (GLNP, 2013)). No aquatic plant species were recorded that receive specific legal protection via Schedule 8 of the WCA, or that are listed on Section 41 of the NERC Act as being of principal importance for nature conservation in England. However, as highlighted above, this does not remove the need to further assessment.

4.2.3 Further detail on the results obtained for each of the surveyed waterbodies is provided below.

Drain 1 (Glew Drain)

Aquatic Macroinvertebrates

4.2.4 A moderate/ high diversity of aquatic macroinvertebrates was recorded (45 taxa, 26 identified to species) and the community is considered fairly typical for the conditions present i.e. a small, heavily modified, slow flowing drain. The assemblage was dominated by a range of snail, crustacean, beetle and truefly taxa. The CCI score calculated was 14.8 indicating that the drain is of fairly high conservation value. The majority of the species present are of occasional to very common status. The exceptions to this were:

- white-lipped ramshorn snail (*Anisus leucostoma*). This is classified as being of local status within the CCI. More recent information on the status of this snail establishes that it remains widespread within its native range and it is not currently considered threatened (Seddon *et al*., 2014);
- the water beetle (*Rhantus suturalis*). This is classified as notable within the CCI. However, it is of favourable status and appears to be increasing in range (see Table 3).Therefore while it requires due regard it is not as notable as implied by the CCI; and
- the diving beetle (*Rhantus exsoletus*). This is classified as being of local status within the CCI. There is no more recent information to indicate that the status of this species has changed since the CCI was established.

4.2.5 Two non-native species were recorded. The amphipod (*Crangonyx pseudogracilis/ floridanus*) and the New Zealand mud snail (*Potamopyrgus antipodarum*). The New Zealand mud snail was first introduced to the UK in 1852 and is now naturalised, widespread and common in many areas (Seddon *et al*., 2014).

4.2.6 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 1.6), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (Biological Monitoring Working Party (BMWP): 97.3, ASPT: 4.2). Only a single pollution-sensitive taxon was recorded (the beetle *Gyrinus substriatus*), with the drain supporting a range of taxa defined as having a moderate tolerance to pollution.

Aquatic Plants

4.2.7 Drain 1 supported 23 aquatic plant species (excluding algae) which included a range of submerged, floating and emergent species. Of these, 16 are scoring species under the GLNP 2013 criteria. No rare or notable species were present, and the assemblage is considered fairly diverse for the habitat conditions present.

4.2.8 A single non-native plant species was recorded, Nuttall's waterweed (*Elodea nuttallii*) which was abundant along the length of the drain. This is a controlled

weed species listed under Schedule 9 of the WCA, as such it is an offence to cause it to spread in the wild.

Drain 2

Aquatic Macroinvertebrates

4.2.9 A moderate diversity of aquatic macroinvertebrates was recorded (37 taxa, 14 identified to species) and the community is considered fairly typical of a small, heavily shaded, slow flowing drain. The assemblage was dominated by a range of snail, crustacean, beetle and truefly taxa. The CCI score calculated was 7.3 indicating that the drain is of moderate conservation status. All of the species present are of common to very common conservation value. The only exception to this was the white-lipped ramshorn snail which, as highlighted above for Drain 1, remains widespread within its native range and it is not currently considered threatened.

4.2.10 The New Zealand mud snail was the only non-native species recorded.

4.2.11 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 76.1, ASPT: 4). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Aquatic Plants

4.2.12 Drain 2 supported six aquatic plant species, and only two of these are scoring species under the GLNP criteria. Species diversity was limited by the combination of heavy shading from trees and the dominance of common reed (*Phragmites australis*). Where this species was dominant, it excluded other flora and occurred as mono-specific stands. No rare or notable species were recorded, and the assemblage present is considered typical of the habitat conditions. No non-native plant species were recorded.

Drain 3

Aquatic Macroinvertebrates

4.2.13 A low/ moderate diversity of aquatic macroinvertebrates was recorded (22 taxa, nine identified to species) and the community is considered fairly typical of a small, slow flowing drain. The assemblage was dominated by a range of snail, beetle and truefly taxa. The CCI score calculated was 8.8 indicating that the drain is of moderate conservation value. All of the species present are of frequent to very common status. The only exception to this was the white-lipped ramshorn snail, which as highlighted above for Drain 1, remains widespread within its native range and it is not currently considered threatened. No non-native species were recorded.

4.2.14 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 49.3, ASPT: 4.1). No pollution-sensitive taxa were recorded, but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Aquatic Plants

4.2.15 Drain 3 supported nine aquatic plant species, and only four of these are scoring species under the GLNP 2013 criteria. Species diversity was limited by the shading of the channel by trees and the dominance of common reed. Where common reed was dominant, it excluded other flora and occurred as mono-specific stands. No rare or notable species were recorded, and the assemblage present is considered typical of the habitat conditions. No non-native plant species were present.

Drain 4

Aquatic Macroinvertebrates

4.2.16 A low diversity of aquatic macroinvertebrates was recorded (19 taxa, six identified to species) and the community is considered fairly typical of a small, slow flowing field drain. The assemblage was dominated by a range of snail, crustacean, caddisfly, beetle and truefly taxa. The CCI score was 9 indicating that the drain is of moderate conservation value. All of the species present are of very common status. The only exception to this was the white-lipped ramshorn snail, which as highlighted above for Drain 1, remains widespread within its native range and it is not currently considered threatened. No non-native species were recorded.

4.2.17 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 37.2, ASPT: 4.1). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Aquatic Plants

4.2.18 Drain 4 supported four aquatic plant species, of which three are scoring species under the GLNP criteria. The only species recorded were tall emergent species which dominated the channel. This in combination with the shallow water depth limited the species diversity present. No rare or notable species were recorded, and the assemblage present is considered typical of an arable field drain. No non-native plant species were recorded.

Stainforth and Keadby Canal

Aquatic Macroinvertebrates

4.2.19 The site sort identified that the canal supported a typical assemblage of aquatic macroinvertebrate found within canals including snails (Viviparidae, Lymnaeidae, Planorbidae), caddisflies (Limnephilidae) and mayflies (Baetidae).

4.2.20 The following INNS species were identified. None of these species recorded are listed on Schedule 9 of the WCA.

- zebra mussel (*Dreissena polymorpha*). Although this species is not listed on Schedule 9 of the WCA, it is highly invasive. It is unlike all other native mussel species in that it colonises and grows on hard substrates which can lead to a number of potential impacts including the clogging of water intake pipework and screens (GB Non-native Species Secretariat, 2020). The survey confirms this species to be well established within the canal. Large numbers of live animals were found during sampling, and there were also large numbers of old shells visible on the canal bed;
- demon shrimp (*Dikerogammarus haemobaphes*). This species was first recorded in the UK in 2012 and has spread rapidly. It is a highly efficient predator altering the diversity and abundance of other aquatic macroinvertebrates species;
- Caspian mud shrimp (*Corophium curvispinum*). This species was first recorded in Britain in 1935 and now widespread in the south-east and midlands of England (Dobson, 2012); and
- New Zealand mud snail.

Aquatic Plants

4.2.21 Eighteen aquatic plant species were present, of which eight of these are scoring species under the GLNP 2013 criteria. The dominant submerged plant species was Nuttall's waterweed, which formed dense beds over most of the visible channel. Nuttall's waterweed is a controlled weed species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). Other species were mostly either limited to the margins of the canal and/ or were present at low cover.

4.2.22 Filamentous green algae was also present at a relatively high cover within the canal. The presence of such algae may be indicative of poor water quality, particularly nutrient enrichment, when found at high abundances.

4.2.23 Although the survey was of limited extent and was not undertaken along the full extent of the LWS, the limited number of GLNP scoring plant species recorded in the area surrounding the preferred Canal Water Abstraction Option is not characteristic of the interest of the LWS as a whole. This relatively poor assemblage of scoring species is likely to be due to combination of factors include the dominance of Nuttall's waterweed, proximity to boat moorings and the canal lock on the River Trent, and the limited marginal habitat due to the dominance of vertical concrete banks.

Keadby Boundary Drain LWS

Aquatic Macroinvertebrates

4.2.24 A moderate diversity of aquatic macroinvertebrates was recorded (30 taxa, 17 identified to species) and the community is considered fairly typical of a small, heavily modified, slow flowing drain. The assemblage was dominated by a range of snail and beetle species. The CCI score calculated was 12.8 indicating that the drain is of fairly high conservation value. The majority of the species present are of frequent to very common status. The exceptions to this were:

- the water beetle (*Anacaena bipustulata*). This is classified as regionally notable within the CCI. However, it is of favourable status (see Table 3), therefore while it requires due regard, it is not as notable as implied by the CCI.
- White-lipped ramshorn snail. This is classified as being of local status within the CCI. More recent information on the status of this snail establishes that it remains widespread within its native range and it is not currently considered threatened (Seddon *et al*., 2014).

4.2.25 Two non-native species were recorded the amphipod *Crangonyx pseudogracilis/ floridanus* and the New Zealand mud snail.

4.2.26 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (WHPT: 70, ASPT: 3.7). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Aquatic Plants

4.2.27 The LWS supported 32 aquatic plant species (excluding algae), of which 20 are scoring species in the GLNP criteria. The assemblage is considered diverse for the habitat conditions and supported a range of submerged, floating and emergent species. Two notable species were recorded:

- Whorled water-milfoil is a species of calcareous freshwaters with good water clarity. It has declined substantially nationally and is of unfavourable status (Red Data List (RDL) Vulnerable). It was recorded as occasional during the survey and the LWS was judged to support a healthy viable population.
- Water-violet (*Hottonia palustris*) is of patchy distribution in Britain. It has declined substantially nationally and is of unfavourable status (RDL Vulnerable). It was recorded as occasional during the survey and the LWS was judged to support a healthy viable population.

4.2.28 A single non-native plant species, Nuttall's waterweed, was recorded and was abundant along the length of the drain. This is a controlled weed species listed

under Schedule 9 of the WCA, as such it is an offence to cause it to spread in the wild.

Table 3: Summary of the notable aquatic macroinvertebrate species recorded (Conservation Scores > 6)

Species	Waterbody	Habitat and distribution	Current Status
Rhantus suturalis	Drain 1	This species is found across the whole of England and is currently expanding its range into Scotland. It is commonly found in lowland stagnant waters including recently created habitats (Foster and Friday, 2011).	Previously regarded as Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection. It is judged to have increased in recent years (Hammond, 2017) and as such, a recent review assessed that this species is too widespread to qualify as Nationally Scarce (Notable in the CCI) (Foster, 2010).
Anacaena bipustulata	Keadby Boundary Drain LWS	This species is associated with slow-moving waterbodies with clay and silt substrates. It has been recorded within ponds, drains and canals (Hammond, 2017). It has a predominately south-eastern British distribution. With the most northerly British records coming from North Yorkshire (Hammond, 2017).	Previously regarded as Regionally Notable (Conservation Score 7) in the CCI system but with no statutory designation or protection. A recent review assessed that this species is not under threat or in decline (Foster, 2010) and there is evidence that it is either becoming more frequent or is otherwise better recorded now than in the past (Hammond, 2017).

5.0 CONCLUSIONS AND NATURE CONSERVATION EVALUATION

5.1 Overview

5.1.1 This section provides a final assessment of the aquatic macroinvertebrate, aquatic plant and fish species and assemblages recorded in association with the Proposed Development Site, to translate the preceding analysis to the geographic scale of nature conservation value used for EcIA.

5.2 Aquatic Macroinvertebrate Species Evaluation

5.2.1 The only relatively notable species recorded within any of the waterbodies were the beetles *Anacaena bipustulata* and *Rhantus suturalis* (recorded in Keadby Boundary Drain LWS and Drain 1 respectively, see Table 3). Although previously assessed as Regionally Notable, these species are either expanding in range or have been under recorded previously (or a combination of both factors). Neither are threatened and both can occur in a range of habitats and therefore the CCI is judged to inflate the significance of this species. There are also no grounds to expect that these species are restricted in range in the local area, and instead can reasonably be expected to occur wherever there are comparable drain habitats. On this basis these populations are not considered to be of more than local value.

5.3 Aquatic Plant Species Evaluation

5.3.1 Two notable plant species were recorded; water-violet and whorled water-milfoil, both of which were recorded within Keadby Boundary Drain LWS. No notable plant species were recorded from waterbodies within the Proposed Development Site.

5.3.2 Whorled water-milfoil has declined substantially nationally due to eutrophication of its habitats and is now primarily concentrated in the drainage systems of North Lincolnshire and the fenland of south Lincolnshire and Cambridgeshire (BSBI, 2020). These strongholds are important for the maintenance of the species nationally. Given the unfavourable status of the species (RDL Vulnerable) it is likely to be considered a key part of the nature conservation interest of Keadby Boundary Drain LWS and as such it is assessed to be of county value.

5.3.3 Water-violet is of patchy distribution in Britain, with its distribution concentrated in areas where there are, or were historically, extensive networks of suitable shallow freshwater habitat. As such, it was formerly widespread in the drainage ditches of North Lincolnshire. The species has declined markedly as a result of eutrophication of freshwater habitats, and its distribution is now much reduced (BSBI, 2020). Given the unfavourable status of the species (RDL Vulnerable) it is likely to be considered a key part of the nature conservation interest of Keadby Boundary Drain LWS and as such it is assessed to be of county value.

5.4 Aquatic Macroinvertebrate and Plant Assemblage Evaluation

5.4.1 The aquatic macroinvertebrate and plant assemblage for each of the waterbodies have been considered together. This is because if the waterbody does not meet the GLNP (2013) criteria for the identification for either group, there is an alternate criterion that allows the data assemblage to be assessed in combination (criterion FW3 of GLNP, 2013).

Drain 1 (Glew Drain) and Keadby Boundary Drain LWS

5.4.2 Both Drain 1 and Keadby Boundary Drain LWS meet GLNP (2013) criteria for the identification of freshwater habitats of county value for ecology and nature conservation. Both Drain 1 and Keadby Boundary Drain LWS meets the criterion for their aquatic plant flora (criterion FW2) and the alternate criterion that allows the aquatic macroinvertebrate assemblage to be assessed in combination with aquatic plant data (criterion FW3).

5.4.3 This data re-confirms the previous third-party LWS assessment in 2010 that Keadby Boundary Drain is of county value, but also indicates that this value also extends to Drain 1 which is not currently included as part of the LWS. These two waterbodies should therefore be considered to be of county nature conservation value.

5.4.4 The aquatic macroinvertebrate communities are largely comparable between the LWS and Drain 1. The small differences observed between them are likely to be the result of slight differences in micro-habitats and/ or sampling effort. Mobile species (for example the beetles *Anacaena bipustulata* and *Rhantus suturalis*), will likely move between these areas using suitable niches as they become available.

5.4.5 However, the two waterbodies differed in terms of their botanical interest. Although both waterbodies meet the relevant LWS criterion, Keadby Boundary Drain LWS was found to support a markedly more diverse aquatic plant assemblage (nine more species and four additional GLNP scoring species). This included two notable species (whorled water-milfoil and water-violet, which are assessed as being of county value), both of which were absent from Drain 1.

5.4.6 Neither of these drains is considered to be of greater than county value at this time. The desk study undertaken for the PEA (**Appendix 11C** (ES Volume II - **Application Document Ref. 6.3**)) identified a large number of similarly designated drains and other waterbodies in the local area (within a 1km radius of the Proposed Development Site), of which the drains associated with the Proposed Development Site represent only a very small proportion. In addition, similar drains are widespread in the Humberhead Levels National Character Area (NCA) (Natural England, 2012). While the extent of the drain network is not automatically an indicator of comparable aquatic value, it seems likely that other drains supporting a similar assemblage of species will occur more widely in the NCA beyond the boundaries of North Lincolnshire.

Drains 2, 3 and 4

5.4.7 The remaining drains (Drain 2, 3 and 4) do not support aquatic macroinvertebrate and plant assemblages that meet the criteria established for the identification of sites of waterbodies of county value, either in isolation or in combination of the data. Similar arable field drains supporting a similar composition of species are likely to be very common in the wider landscape. On this basis, these waterbodies are considered to be of local value only for their aquatic macroinvertebrate and plant assemblages. However, as these drains are hydrologically linked to Drain 1 and Keadby Boundary Drain LWS, they may have a value in terms of the contribution they make to supporting the nature conservation interest of these higher value waterbodies.

5.5 Fish Species Evaluation

5.5.1 River and sea lamprey are features of interest of the Humber Estuary SSSI, Special Area of Conservation (SAC) and Ramsar site. Accordingly, the populations of these species are of international value. The River Trent at Keadby is of key functional importance for these two lamprey species as it is the route by which they access and leave the wider River Trent catchment.

5.5.2 The populations of Atlantic salmon and European eel associated with the River Trent are considered to be of regional value, given this is the main river catchment within the region.

5.5.3 All of the other fish species recorded make use of the River Trent either as part of the wider habitat resource of the Humber Estuary, or incidentally e.g. occasional use by species more typically associated with freshwater habitats located upstream of the tidal limit at Keadby. All of these species widespread and relatively common, and accordingly each species is considered to be of local nature conservation value.

5.6 Invasive Non-native Species

5.6.1 One species listed on Schedule 9 of the Wildlife and Countryside Act was recorded from the Proposed Development Site, this being Nuttall's waterweed. This species was recorded from Drain 1, Keadby Boundary Drain LWS and Stainforth and Keadby Canal. The Act makes it illegal to cause the spread of this species in the wild. Measures to prevent this should therefore be identified in the EcIA of the Proposed Development.

5.6.2 Although not listed on Schedule 9 of the WCA, the presence of zebra mussel (combined with the dominance Nuttall's waterweed) within the Stainforth and Keadby Canal may lead to issues relating to the clogging of water supply pipework and intake screens for the Proposed Development in the event that the preferred Canal Water Abstraction option is selected as this could affect the operation of the Proposed Development, as well as increase the frequency and cost of essential maintenance and repairs. Given this, the implications arising from the presence of zebra mussel should be considered further during detailed

design to mitigate the potential risk to the effective operation of the Proposed Development.

5.6.3 The life cycle of the zebra mussel consists of a microscopic planktonic fee-swimming veliger (larval stage), a settling juvenile stage and a settled (sessile) adult stage. It is the larval stage that is most likely to be drawn into water supply pipework and lead to settling of juveniles and adults within pipes and on screens. Zebra mussels generally spawn when water temperatures exceed 12^{o}C, however the species has a very varied reproductive cycle and spawning can be restricted in duration (as short as six weeks) or can occur throughout the year (Maguire & Sykes, 2004).

5.6.4 Once spawning is completed, the veligers will then remain in the plankton for eight to 240 days before settling onto surfaces where they metamorphose into juveniles and then develop into the adult form. Zebra mussels will settle on a wide range of substrates, including rocks, pipes and screens. There is also evidence that this species can successfully colonise soft muddy substrates. Densities of adults can be extremely high with densities of 2,500 to 36,990 mussels per square metre recorded in Ireland (Maguire & Sykes, 2004). This is the primary reason why they have such an adverse impact on infrastructure, as this high biomass inevitably leads to clogging of pipework or impedance of screens, and associated damage.

5.6.5 The other non-native species recorded are also not listed on the Schedule 9 of the WCA but are considered a significant design constraint. It is possible that species such as the demon shrimp may further compound the blocking of pipework, as they are known to occur at high densities but if steps are taken to overcome the issues relating to the zebra mussel and Nuttall's waterweed, this is likely to mitigate the potential risk posed by this species.

5.6.6 It is important to highlight that given the number of INNS recorded within Stainforth and Keadby Canal, this demonstrates that there are a number of existing pathways (but particularly boat traffic) that have facilitated the spread and establishment of these aquatic INNS in the local area. Given this, there is likely to be an ongoing risk of other INNS becoming established which may further impact operation of the preferred Canal Water Abstraction Option on the Stainforth and Keadby Canal. Such INNS might include high risk species such as quagga mussel (*Dreissena bugensis rostrigormis*) and floating pennywort (*Hydrocotyle ranunculoides*), both of which can also block pipework). Therefore, it is recommended that the detail design also consider this risk so that the Proposed Development is resilient to potential additional INNS risks.

5.6.7 The final Construction Environmental Management Plan (CEMP will set out any necessary measures to minimize the risk of off-site spread of the identified INNS during construction; a Framework CEMP is provided as **Application Document Ref. 7.1**. The recorded INNS are not likely to pose a specific risk to the River Trent through construction and operation of the Proposed Development, given the existing hydrological connectivity between the canal and the river (there are

no current barriers to prevent INNS dispersal, and dispersal can therefore be assumed). However, there would be a risk of spread of these species to waterbodies elsewhere in the landscape e.g. through movements of plant and machinery during and after the construction period. INNS may also be relevant during decommissioning and this should be reappraised at that time based on current survey information and with reference to legal requirements at that time.

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FIGURE 11G.1 – WATERBODY LOCATIONS

Keadby Boundary Drain LWS

Drain 1

Drain 5

Drain 3

Drain 4

Drain 2

Glew Drain

Keadby Common Drain

North Soak Drain

Stainforth and Keadby Canal Corridor (LWS)

Keadby Common

Keadby Common

N

1:4,000 @ A3

50 25 0 50 100 150 200 m

Filename: K:\07 CAD & GIS\02_Maps\PEA Preliminary Environmental Assessment\ES Version\K_ES_PEA_Fig_11G.1_Waterbody_Locations_A3_20210507_R01.mxd

Revision:02 Drawn: TD Checked: JW Approved: CW Date: 13/05/2021

AECOM

PROJECT

The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

CLIENT

Keadby Generation Limited

CONSULTANT

AECOM Limited
2 City Walk
Leeds
LS11 9AR
T: 0113 391 6800
www.aecom.com

LEGEND

- The Order Limits
- Running Water
- Local Wildlife Site (LWS)

NOTES

ISSUE PURPOSE

AQUATIC MACROINVERTEBRATE AND AQUATIC PLANT SURVEY

PROJECT NUMBER

60625943

SHEET TITLE

Waterbody Locations

SHEET NUMBER

Figure 11G.1

ANNEX A PROPORTION OF SEDIMENT-SENSITIVE INVERTEBRATES METHODOLOGY

A.1.1 The Proportion of Sediment-sensitive Invertebrates (PSI) index allows an assessment of the extent to which a waterbody is composed of, or covered by, fine sediments. This follows the method stated in Extence *et al.*, 2013. Under this system, individual species of aquatic macroinvertebrates are assigned a Fine Sediment Sensitivity Rating (FSSR) as detailed in Table A1, and abundance rating based on LIFE scores as detailed in Table A2. The PSI score for the aquatic macroinvertebrate sample is then derived from the individual species scores and abundances, as detailed in Table A3. The PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, with low scores corresponding to waterbodies with high fine sediment cover.

Table A1: Fine Sediment Sensitivity Rating (FSSR) groups used to derive PSI scores

FSSR group	Description
A	Highly sensitive
B	Moderately insensitive
C	Moderately insensitive
D	Highly insensitive

Table A2: Abundance categories used to derive PSI scores

FSSR group	Abundance			
	1-9	10-99	100-999	>999
A	2	3	4	5
B	2	3	4	5
C	1	2	3	4
D	1	2	3	4

Table A3: Interpretation of PSI scores

PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented

ANNEX B WHALLEY, HAWKES, PAISLEY & TRIGG (WHPT) METRIC

B.1.1 There are approximately 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data, individual species are not identified, but instead only the major types (taxa), mostly at the family taxonomic level. A key piece of information is the number of different taxa at a site. A fall in the number of taxa indicates ecological damage, including pollution (organic, toxic and physical pollution such as siltation, and damage to habitats or the river channel).

B.1.2 The WHPT scoring system (WFD-UKTAG, 2014) is based upon the sensitivity of macroinvertebrate families to organic pollution. It replaces the Biological Monitoring Working Party (BMWP) system (Hawkes, 1997) previously used in the UK.

B.1.3 The WHPT system assigns a numerical value to about 100 different taxa (known as the WHPT-scoring taxa) according to their sensitivity to organic pollution. In addition to the presence of macroinvertebrate taxa at a sampling site, as in the BMWP scoring system, the WHPT system also uses another type of information, this being the abundances of different scoring taxa.

B.1.4 Taxa abundances are classified in four categories (Class 1: 1 to 10 individuals, Class 2: 11 to 100 individuals, Class 3: 101 to 1,000 individuals, and Class 4: > 1,000 individuals). A score (Pressure Sensitivity Scores (PSs) is then assigned to each taxa, depending of the taxa sensitivity and abundances recorded.

B.1.5 The total WHPT score for a sample corresponds to the sum of PSs of scoring taxa recorded. The Average Score Per Taxon (ASPT) values are calculated as the Sum PSs divided by the number of scoring taxa (NTAXA). As such, three metrics are calculated:

- WHPT score;
- NTAXA; and
- ASPT.

B.1.6 Some animals are more susceptible to organic pollution than others, and the presence of sensitive species indicates good water quality. This fact is taken into account by the WHPT metrics.

B.1.7 The most useful way of summarising the biological data was found to be one that combined the number of taxa and the ASPT. The best quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution. Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are sensitive to pollution. Organic pollution sometimes encourages an increased abundance of the few taxa that can tolerate it. However, maximum achievable values will vary between geological regions. For example, pristine lowland streams in East Anglia will always score lower than

pristine Welsh mountain streams because they are unable to support many of the high-scoring taxa associated with fast flowing habitat. WHPT scores and ASPT for different types waterbody are dependent on the quality and diversity of habitat, natural water chemistry (associated with geology, distance from source etc.), altitude, gradient, time of year the sample was taken and other factors.

Table B1: A guide to interpreting WHPT and ASPT Score

ASPT	Interpretation
<3.0	Very poor, heavily polluted
3.0-4.3	Poor, polluted or impacted
4.3-4.8	Moderate, moderately impacted
4.8-5.4	Good, clean but slightly impacted
>5.4	Very good, unpolluted, unimpacted

ANNEX C SUMMARY OF THE FISH SPECIES RECORDED IN THE VICINITY OF THE PROPOSED DEVELOPMENT

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
Atlantic salmon (*Salmo salar*)	S41 Salmon and Freshwater Fisheries Act 1975 (as amended)	Single record of single individual (2010)	X	X	✓	X	Salmon migrate through tidal watercourses to reach their freshwater spawning grounds between **April and September.** Spawning habitats are in the upper catchment, where there are clean stony or gravelly substrates. Spawning is between October and January. Juveniles mature in the upper catchment before migrating back to the sea **between April and May.**	No – not likely to use canals and the lock gate is a barrier to access
Bleak (*Alburnus alburnus*)	Subject to general legal	Four records from 2008 and 2010	X	✓	X	X	Mainly found in freshwater but will forage or make incidental use of tidal watercourses. Spawns in freshwater	Unlikely – prefers running water, so the canal is not

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
	protection only (welfare) Common and widespread	Peak Count: 1					between April and July in very shallow gravel or vegetation. Species of flowing waters which requires good water quality and suitable flow. Habitat complexity is also important for this species to provide suitable food and refuge resources.	likely to have enough flow
Brown / sea trout (*Salmo trutta*)	Subject to general legal protection only (welfare) Common and Widespread	Single record of single individual (2013)	X	✓ (brown trout)	✓ (sea trout)	X	Sea trout migrate through tidal watercourses from the sea to reach their freshwater spawning grounds between **April and September**. Spawns in the upper catchment where there are suitable stony or gravelly substrates. Spawning occurs in October. Juveniles mature in the upper catchment before migrating back to the sea in **April and May.**	Possible – brown trout could occur in canals provided there is access to suitable breeding habitat No – sea trout not likely to use

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
							Brown trout is the same species as sea trout but is non-migratory. Although most will occur higher in the catchment they may forage and make incidental use of tidal watercourses.	canals and the lock gate is a barrier to access
Chub (*Leuciscus cephalus*)	Subject to general legal protection only (welfare) Common and widespread	Present once in 2009 Peak Count: 3	X	✓	X	X	Mainly found in freshwater but will forage or make incidental use of tidal watercourses. Spawns in freshwater between April and June, within well-flushed gravels. Habitat complexity is important for this species to provide suitable food and refuge resources. Although it does not require good water quality, they thrive in better conditions.	Yes - uses canals
Common bream (*Abramis brama*)	Subject to general legal	A common species	X	✓	X	X	Predominantly found in freshwater but will forage or make incidental use of tidal watercourses. Spawns in	Yes - uses canals

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
	protection only (welfare) Common and widespread	recorded in most years Peak Count: 35					freshwater within submerged vegetation May through July. Water quality is not a primary concern for this species, and they are able to survive in habitats with relatively low oxygen levels.	
Common goby (*Pomatoschistus microps*)	Subject to general legal protection only (welfare) Common and widespread	Occasional records Peak Count: 18	✓	X	X	X	This species is predominately found in marine and brackish water. Spawns in marine environments, but tidal systems are used as nursery sites by juveniles.	No – marine species not present in freshwater habitats

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
Dace (*Leuciscus leuciscus*)	Subject to general legal protection only (welfare) Common and widespread	Recorded twice (2008 and 2009) Peak Count: 2	X	✓	X	X	Predominantly found in freshwater but will forage or make incidental use of tidal watercourses. Feeds on invertebrates and thrive in areas with good water quality and varied habitats, to supply a diverse and abundant food source. Spawns upstream in freshwater within shallow gravels between February and May.	Yes - uses canals
European eel (*Anguilla Anguilla*)	S41 The Eels (England and Wales) Regulations 2009	Recorded twice (2008 and 2010) Peak Count: 2	✓	X	✓	X	Eels migrate through tidal watercourses to reach their marine spawning grounds between **August and October**. Larva enter freshwater and migrate upstream between **April and October**, initially to inhabit small, well vegetated tributaries higher in the catchment. As they mature, they	Yes - uses canals

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
	Widespread but in decline						occur in both estuarine and river systems so are also likely resident within the tidal River Trent. Eels can withstand moderate pollution, but good water quality is preferable.	
Flounder (*Platichthys flesus*)	Subject to general legal protection only (welfare) Common and widespread	A common species recorded and caught in most years Peak Count: 59	✓	X	X	X	Typically a marine/ estuarine species, but flounder is tolerant of freshwater and regularly occurs in lower river reaches where they feed on benthic invertebrates and small fish. Spawns in marine environments but tidal systems are used as nursery sites by juveniles.	No – will move into freshwater systems but highly unlikely to be present in a canal system
Herring (*Clupea harengus*)	Subject to general legal protection only (welfare)	Single record of single individual (2015)	X	✓	X	X	This species is predominately found in marine environments. It is likely only to forage and make incidental use of tidal watercourses.	No – marine species not present in freshwater habitats

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
	S41						This species spawn in marine environments.	
Perch (*Perca fluviatilis*)	Subject to general legal protection only (welfare) Common and widespread	Recorded during four surveys Peak Count: 2	X	✓	X	X	Perch is predatory fish inhabiting both rivers and brackish areas and will forage or make incidental use of tidal watercourses. They require good water quality and habitat complexity to provide suitable food and refuge resources. The species spawns upstream in freshwater between April and June, usually in shallow areas on a hard surface.	Yes - uses canals

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
Pike (*Esox Lucius*)	Subject to general legal protection only (welfare) Common and Widespread	Records from 2012 and 2013 Peak Count: 1	X	✓	X	X	Found in a variety of clean (unpolluted) aquatic habitats but has limited tolerance of salinity. Where present in these habitats they are limited to more dilute reaches. Requires freshwater to spawn, moving to vegetated shallows or backwaters between late February to early May. Given the above, only likely to make incidental use of tidal watercourses.	Yes – uses in canals
River lamprey (*Lampetra fluviatilis*)	Reason for designation of the Humber Estuary SSSI and SAC S41	Not recorded but assumed present	X	X	✓	X	River lamprey migrate through tidal watercourses to reach their freshwater spawning grounds between **October to December**. Spawning occurs in the upper catchment where there are suitable stony or gravelly substrates. Spawning is undertaken between March and May. Juveniles mature in	No – canals are not suitable habitat and the lock gate is a barrier to access

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
							the upper catchment before migrating down to estuarine systems over **October to December** to parasitise fish.	
Roach (*Rutilus rutilus*)	Subject to general legal protection only (welfare) Common and widespread	A common species recorded in most years Peak Count: 9	X	✓	X	X	Predominantly found in freshwater but will forage or make incidental use of tidal watercourses. Spawns in freshwater between April and June and requires submerged vegetation. Found in a range of standing and flowing waters but requires good water quality and habitat complexity. This includes areas of deep water that are important for roach during the winter.	Yes - uses canals
Rudd	Subject to general legal	Present once in 2009	X	✓	X	X	Usually associated with standing waters but can be found in slow flowing rivers. So not likely to occur	Yes - uses canals

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
(*Scardinius erythrophthalmus*)	protection only (welfare) Common and widespread	Peak Count: 1					regularly in the River Trent. Found mainly in freshwater but will forage or make incidental use of tidal watercourses. Spawns in freshwater between April and June and requires submerged vegetation. Requires good water quality and habitat complexity to provide suitable food and refuge resources.	
Sand goby (*Pomatoschistus minutus*)	Subject to general legal protection only (welfare) Common and widespread	A common species recorded in most years Peak Count: 60	✓	X	X	X	Predominately found in marine and brackish waters. Spawns in marine environments, but tidal rivers can be used as nursery sites by juveniles.	No – marine species not present in canals

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
Sea bass (*Dicentrarchus labrax*)	Subject to general legal protection only (welfare) Common and widespread	Occasional records Peak Count: 1	X	✓	X	X	Found predominately in marine environments. It is likely only to forage and make incidental use of tidal watercourses. Spawns in marine environments.	No – marine species not present in freshwater habitats
Sea lamprey (*Petromyzon marinus*)	Reason for designation of the Humber Estuary SSSI and SAC S41	Not recorded but assumed present	X	X	✓	X	Sea lamprey migrate through tidal watercourses from the sea to reach their freshwater spawning grounds between **April and June**. Spawning occurs in the upper catchment where there are suitable stony or gravelly substrates. Spawning is undertaken between June and July. Juveniles mature in the upper catchment before migrating to the sea to parasitise fish (**July and September**)	No – canals are not suitable habitat and the lock gate is a barrier to access

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
Silver bream (*Abramis bjoerkna*)	Subject to general legal protection only (welfare) Locally common	Occasional records Peak Count: 13	X	✓	X	X	This species predominantly occur in freshwater but will forage or make incidental use of tidal watercourses. This species is normally found within standing waters or slow-flowing rivers. They require reasonable water quality and good habitat complexity to provide suitable food and refuge resources. This includes areas of deep water that are important during the winter. They spawn upstream in freshwater on submerged vegetation between May and July.	Yes – uses canals
Smelt (*Osmerus eperlanus*)	Subject to general legal protection only (welfare)	A fairly common species	X	X	✓	✓	This species is found in coastal waters and estuaries. Although still abundant in several European rivers,	No – suitable spawning habitat not present and barriers (locks)

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
	S41	recorded in most years Peak Count: 100					most of the UK population is restricted in or close to. estuaries. British Smelt however do occasionally spawn in lower rivers reaches (**February – April**) although this is normally undertaken in freshwater within clean gravels or macrophytes (Natural England, 2003). After spawning the adults return to the sea and young fish move down into estuaries after hatching. Reasons for declines are thought to be associated with four main factors pollution, overfishing, habitat loss and barriers blocking access to spawning grounds.	will obstruct access to the canal
Sprat (*Sprattus sprattus*)	Subject to general legal	Single record of single	X	✓	X	X	Mainly found in marine environments. It is only likely to	No – marine species not

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
	protection only (welfare)	individual (2014)					forage and make incidental use of tidal watercourses. Spawns in marine environments.	present in freshwater habitats
Three-spined stickleback (*Gasterosteus aculeatus*)	Subject to general legal protection only (welfare) Common and widespread	A common species recorded in most years Peak Count: 8	✓	X	X	✓	Found in a variety of different waterbodies from ponds, ditches and small streams to estuaries. Does not require good water quality and often thrives in polluted areas where there is often a lack of predators and competition. Spawning occurs between March and July within purpose-built nests.	Yes - uses canals

Definitions of habitat use:

Resident or potentially resident species - spend at least one stage of their lifecycle associated with the tidal River Trent at Keadby.

Occasional visitors – do not depend on the tidal River Trent to complete their lifecycle and instead is normally found in other habitats e.g. freshwater, marine or estuarine systems. Any use of tidal systems is likely only incidental and time-limited such as occasional foraging.

Migratory species - spend a brief part of their lifecycle in tidal watercourses. These species will migrate through the tidal River Trent to reach either spawning upstream or feeding grounds downstream of Keadby. As such the Trent is not optimal for this species either in

Species	Conservation status and relevant legislation	Records within the River Trent	Use of the tidal River Trent at Keadby				Supplementary Ecological Information (after Everard, 2013; Maitland 2003a,b)	Likely to use the Stainforth and Keadby Canal?
			Resident	Occasional visitor	Migratory	Spawning		
terms of reproduction or maturing. Any use of this habitat during this time will be time-limited and will only include certain activities such as foraging. Spawning species – those that specifically use tidal reaches, such as the tidal River Trent, for spawning.								

ANNEX D AQUATIC MACROINVERTEBRATE SURVEY DATA

Family	Species	WHPT score (presence only)	Conservation Score	FSSR Score	Drain 1	Drain 2	Drain 3	Drain 4	Keadby Boundary Drain LWS
Flatworms								2	
Planariidae	*Polycelis nigra / tenuis*	4.9	1	D		1			
Snails									
Lymnaeidae	Lymnaeidae (juvenile / damaged)	3.3		D	134	1	2		
Lymnaeidae	*Stagnicola sp.*	3.3	-	D			1		
Lymnaeidae	*Stagnicola palustris*	3.3	2	D					4
Lymnaeidae	*Lymnaea stagnalis*	3.3	1	D					2
Lymnaeidae	*Radix sp.*	3.3	-	D	1	10			
Lymnaeidae	*Radix auricularia*	3.3	2	D		8			
Lymnaeidae	*Radix balthica*	3.3	1	D	17	3			
Valvatidae	*Valvata piscinalis*	3.2	1	C					100
Hydrobiidae	*Potamopyrgus antipodarum*	4.2	1	C	116	5			20
Bithyniidae	*Bithynia tentaculata*	3.7	1	D	594		1	10	70
Physidae	Physidae (juvenile / damaged)	2.4		D	7				
Physidae	*Physa fontinalis*	2.4	1	D	11				

Family	Species	WHPT score (presence only)	Conservation Score	FSSR Score	Drain 1	Drain 2	Drain 3	Drain 4	Keadby Boundary Drain LWS
Zonitoides	*Zonitoides nitidus*	-	4		1				
Succineidae	-	-				1		1	2
Planorbidae	*Planorbis planorbis*	3.1	1	D	233	20			20
Planorbidae	*Anisus sp.*	3.1	-	D	10			20	
Planorbidae	*Anisus vortex*	3.1	1	D	30				10
Planorbidae	*Anisus leucostoma*	3.1	5	D	55	5	30	5	5
Planorbidae	*Armiger crista*	3.1	2	C	21				
Limpets and mussels									
Sphaeriidae	Sphaeriidae (juvenile / damaged)	3.9	-	D			10	5	
Sphaeriidae	*Pisidium sp.*	3.9	-	D	4	20	140	25	150
Worms									
Oligochaeta		2.7	-	D		5			20
Leeches									
Glossiphoniidae	*Glossiphonia complanata*	3.2	1	C					3
Erpobdellidae	*Erbodella octoculata*	3.1	1	C					2
Hirudinidae	*Haemopis sanguisuga*	-0.8	4	D	3				
Mites									

Family	Species	WHPT score (presence only)	Conservation Score	FSSR Score	Drain 1	Drain 2	Drain 3	Drain 4	Keadby Boundary Drain LWS
Hydracarina		-			4	2	1		
Oribatei		-					1	2	
Crustaceans									
Crangonyctidae	*Crangonyx sp. (floridanus/pseudogracilis)*	3.9	-		1				150
Asellidae	*Asellus sp.*	2.8	-	D		1		3	
Asellidae	*Asellus aquaticus*	2.8	1	D	1	30	10	3	80
Mayflies									
Baetidae	Baetidae (juvenile / damaged)	5.5		A					1
True bugs									
Gerridae	*Gerris lacustris*		1		1	1			1
Veliidae	Veliidae (nymph / damaged)	4.5				1			
Corixidae	Corixidae (nymph / damaged)	3.8		D	5				
Corixidae	*Hesperocorixa sahlbergi*	3.8	2	D	1				
Notonectidae	Notonectidae (nymph / damaged)	3.4			10				

Family	Species	WHPT score (presence only)	Conservation Score	FSSR Score	Drain 1	Drain 2	Drain 3	Drain 4	Keadby Boundary Drain LWS
Notonectidae	*Notonecta glauca*	3.4	1		1				
Beetles									
Haliplidae	Haliplidae (larvae / damaged)	3.6		D					2
Haliplidae	*Haliplus confinis*	3.6	2	D					3
Haliplidae	*Haliplus immaculatus*	3.6	4	D	2				
Haliplidae	*Haliplus lineaticollis*	3.6	1	C	11	1	1		
Haliplidae	*Haliplus ruficollis group*	3.6			10				5
Gyrinidae	*Gyrinus substriatus*	8.2	1		3				
Dytiscidae	Dytiscidae (larvae / damaged)	4.5		D		20	10	5	1
Dytiscidae	*Hydroporus sp.*	4.5	-	D	1	4			
Dytiscidae	*Hydroporus palustris*	4.5	1			4			
Dytiscidae	*Hydroporus planus*	4.5	2	D		2			
Dytiscidae	*Hydroporus tesselatus*	4.5	2	D	1				
Dytiscidae	*Graptodytes pictus*	4.5	3	D	4				
Dytiscidae	*Rhantus exsoletus*	4.5	5	D	1				
Dytiscidae	*Rhantus suturalis*	4.5	7	D	1				

Family	Species	WHPT score (presence only)	Conservation Score	FSSR Score	Drain 1	Drain 2	Drain 3	Drain 4	Keadby Boundary Drain LWS
Hydrophilidae	Hydrophilidae (larvae / damaged)	6.2	-	D	9	7			
Hydrophilidae	*Helophorus sp.*	6.2	-	D		2			
Hydrophilidae	*Helophorus brevipalpis*	6.2	1	D	1				
Hydrophilidae	*Hydrobius fuscipes*	6.2	1	D			2		
Hydrophilidae	*Anacaena bipustulata*	6.2	7	D					1
Hydrophilidae	*Anacaena limbata*	6.2	1	D	5	2	8	3	
Hydrophilidae	*Anacaena lutescens*	6.2	3	D			1		
Hydrophilidae	*Laccobius bipunctatus*	6.2	2	D	1				
Hydraenidae	*Hydraena sp.*	8.9	-	B	1				
Curculionidae	Curculionidae	-	-		6				
Alderflies									
Sialidae	Sialidae (juvenile / damaged)	4.3	-	D					
Sialidae	*Sialis lutaria*	4.3	1	D					26
Caddisflies									
Limnephilidae	Limnephilidae (juvenile / damaged)	6.2	-	B		1	2	4	1
Limnephilidae	*Limnephilus lunatus*	6.9	1	C		5	1	1	

Family	Species	WHPT score (presence only)	Conservation Score	FSSR Score	Drain 1	Drain 2	Drain 3	Drain 4	Keadby Boundary Drain LWS
Limnephilidae	*Limnephilus auricula*	6.9	3	C					1
Leptoceridae	*Athripsodes aterrimus*	6.7	1	D	1				
Trueflies						4	1	2	
Chironomidae	Chironomidae (damaged / pupea)	1.1	-			30		5	1
Chironomidae	*Tanypodinae*	1.1	-			30			45
Chironomidae	*Orthocladiinae*	1.1	-		1	322	70	2	10
Chironomidae	*Chironomini*	1.1	-		2	733	10	8	10
Chironomidae	*Tanytarsini*	1.1	-			176	10		15
Limoniidae		5.9	-	B	2			1	
Psychodidae		4.4	-	D		1			
Empididae		7.1	-	-		4			
Ceratopogonidae		5.5	-	-	2		2		
Stratiomyidae		3.6	-	C	2	1	2		
Culicidae		2.0	-	-		1			
Muscidae		3.9	-	-	2				
Sciomyzidae		3.4	-	-		2			
Other Taxa									

Family	Species	WHPT score (presence only)	Conservation Score	FSSR Score	Drain 1	Drain 2	Drain 3	Drain 4	Keadby Boundary Drain LWS
Lepidoptera		-	-	-		1			
Collembola		-	-	-					1
Total number of taxa		-	-	-	45	37	22	19	30
Total Number of species		-	-	-	26	14	9	6	17
CCI Score		-	-	-	14.8	7.3	8.8	9.0	12.8
CCI Score required to meet GLNP (2013) criteria for LWS quality based on aquatic macroinvertebrate data alone		-	-	-	15				
PSI Score (species)		-	-	-	1.6	0.0	0.0	0.0	0.0
NTAXA (WHPT)		-	-	-	23.0	19.0	12.0	9.0	19.0
Number of non-scoring families (WHPT)		-	-	-	3.0	2.0	1.0	1.0	1.0
Total number of families		-	-	-	26.0	21.0	14.0	11.0	20.0
WHPT score		-	-	-	97.3	76.1	49.3	37.2	70.0
ASPT (WHPT)		-	-	-	4.2	4.0	4.1	4.1	3.7

ANNEX E AQUATIC PLANT DATA

Common name	Latin name	Drain 1	Drain 2	Drain 3	Drain 4	Stainforth and Keadby Canal	Keadby Boundary Drain LWS
GLNP (2013) scoring freshwater flora		DAFOR D = Dominant (greater than 75% total cover) A = Abundant (51 to 75% total cover) F = Frequent (26 to 50% total cover) O = Occasional (11 to 25% total cover R = Rare (1 to 10% total cover) L (used where species were noted as Local (patchy) in distribution)					
Common water-plantain	*Alisma plantago-aquatica*	R					R
Water-starwort species	*Callitriche agg.*						LA
Blunt-fruited water-starwort	*Callitriche obtusangula**	A					F
Various leaved water-starwort	*Callitriche platycarpa**	F					
Greater pond sedge	*Carex riperia*	A					O
Common hornwort	*Ceratophyllum demersum*					O	
Floating sweet grass	*Glyceria fluitans*	F					A
Greater sweet-grass	*Glyceria maxima*				LA	R	A
Water-violet	*Hottonia palustris*						O
Yellow iris	*Iris pseudacorus*	F		O			O
Fat Duckweed	*Lemna gibba*						LO

Common name	Latin name	Drain 1	Drain 2	Drain 3	Drain 4	Stainforth and Keadby Canal	Keadby Boundary Drain LWS
Common duckweed	*Lemna minor*	A					R
Ivy-leaved duckweed	*Lemna trisulca*	O					R
Purple loosestrife	*Lythrum salicaria*	R					O
Water mint	*Mentha aquatica*						R
Tufted water forgot-me-not	*Myosotis laxa*	O	R				
Spiked water millfoil	*Myriophyllum spicatum*					O	
Whorled water-milfoil	*Myriophyllum verticillatum*						O
Watercress	*Nasturtium officinale*	F					
Watercress species	*Nasturtium officinale agg.*						R
Yellow water-lily	*Nuphar lutea*					R	
Reed canary-grass	*Phalaris arundinacea*	A		F	A		LA
Common reed	*Phragmites australis*	F	D	D	A	O	LA
Curled pondweed	*Potamogeton crispus*	F					A
Fennel pondweed	*Potamogeton pectinatus*						O
Perfoliate pondweed	*Potamogeton perfoliatus*					O	
Water Figwort	*Scrophularia auriculata*					R	
Branched bur-reed	*Sparganium erectum*						O

Common name	Latin name	Drain 1	Drain 2	Drain 3	Drain 4	Stainforth and Keadby Canal	Keadby Boundary Drain LWS
Marsh woundwort	*Stachys palustris*					R	
Bulrush	*Typha latifolia*	O		O			LO
Water speedwell	*Veronica anagallis-aquatica*	O					
Other emergent and aquatic flora		**DAFOR**					
Sweet Flag	*Acorus Calamus*					R	
Creeping bent	*Agrostis stolonifera*	A					O
Wild angelica	*Angelica sylvestris*		F	A			
Hedge bindweed	*Calystegia sepium*						LO
False-fox sedge	*Carex otrubae*	F		R			R
Nuttall's waterweed	*Elodea nuttallii*	A				D	O
Greater Willowherb	*Epilobium hirsutum*		O	A	F	R	R
Hoary willowherb	*Epilobium parviflorum*	R					
Field horsetail	*Equisetum arvense*			F			
Meadowsweet	*Filipendula ulmaria*		F			R	O
Soft rush	*Juncus effusus*						LO
Hard rush	*Juncus inflexus*						LO
Blunt-flowered rush	*Juncus subnodulosus*						LF
Yellow loosestrife	*Lysimachia vulgaris*						R

Common name	Latin name	Drain 1	Drain 2	Drain 3	Drain 4	Stainforth and Keadby Canal	Keadby Boundary Drain LWS
Peppermint	*Mentha piperita*					R	
Hemlock water dropwort	*Oenanthe crocata*					R	
Amphibious bistort	*Persicaria amphibia*	O				R	O
Celery-leaved buttercup	*Ranunculus sceleratus*	O	R				
Clustered dock	*Rumex conglomeratus*						O
Bittersweet	*Solanum dulcamara*			O		R	
Greater duckweed	*Spirodela polyrhiza*	O				A	
Negative Indicators (Algae)							
Green filamentous algae	-					F	O
An algae	*Enteromorpha intestinalis*						R
Total - all species excluding algae		23	6	9	4	18	32
Total - scoring species only		16	2	4	3	8	20
Number of scoring species required to meet GNLP (2013) criteria for LWS quality based on botanical diversity alone		10					
* Water-starwort species are treated as an aggregate for scoring purposes so there is only one point scored regardless of the number of species recorded in this genus							