# *Messingham Quarry Extension, Greetwell Hall Farm, Brigg Road, Messingham*

**Ecological Impact Assessment**

**April 2018**

**Prepared for:**

**Sibelco**

| REVISION SCHEDULE | | | | | |
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The report has been prepared and provided in accordance with the Code of Professional Conduct of the Chartered Institute of Ecology and Environmental Management.

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# 1 INTRODUCTION

## 1.1 Overview

This ecological impact assessment (EcIA) report has been prepared to form part of the Environmental Impact Assessment undertaken in respect of the proposed extension to Messingham Quarry, Brigg Road, Messingham (the proposed quarry extension). The approximate central grid reference for the proposed quarry extension application site (the application site) is SE 927 045.

The report assesses the impacts and resultant effects of the proposed quarry extension on ecology and nature conservation. It must be read in conjunction with the planning statement and the other environmental matters assessed in the Environmental Statement (ES) which together contain:

- figures showing the proposed quarry extension and its phasing;
- a full description of the proposed development; and
- a summary of other assessments undertaken in relation to the proposed quarry extension.

The EcIA takes account of the mitigation and compensation embedded in the scheme design, along with the proposed restoration scheme.

The EcIA was reviewed and minor amendments were made in April 2018 to support a second application. This second application is as previously proposed, save for minor amendment to the access layout. As part of the work to review and update the EcIA, an update walkover survey and desk study was completed in April 2018 to re-confirm the baseline conditions. This process confirmed that there had been no substantive changes in the habitat conditions or land management regimes associated with the site of the proposed quarry extension. On this basis it is considered that there would have been no change in the ecology and nature conservation value of the site over the intervening period (less than 3 years since the completion of the previous ecological surveys) that would alter the conclusions of the previous submission and the associated commitments to provide appropriate ecological mitigation and ecological enhancement at restoration.

## 1.2 Scope of Assessment

The objective of this EcIA is to identify, and where possible quantify, the likely significant effects of the implementation and restoration of the proposed quarry extension on ecology and nature conservation. With reference to the Chartered Institute of Ecology and Environmental Management *Guidelines for Ecological Impact Assessment* (CIEEM, 2016), the aims of this EcIA are to:

- identify relevant ecological features (nature conservation designations, ecosystems, habitats, species assemblages and/ or individual species) which may be impacted by the proposed quarry extension. Impacts may be either beneficial or adverse;
- provide an objective and transparent assessment of the likely ecological impacts and resultant likely significant effects of the proposed quarry extension as described in the planning statement and the ES and having regard to the mitigation and compensation embedded in the scheme design;
- facilitate objective and transparent determination of the consequences of the proposed quarry extension in terms of national and local policies relevant to nature conservation and biodiversity; and

- set out the steps which will be taken to adhere to relevant legal requirements relating to nature conservation designations and legally protected or controlled species.

The EcIA provided in this report firstly describes the legal and policy relevant to the baseline conditions and subsequent assessment. The methods used to identify and assess the potential significant effects of the proposed quarry extension during the site clearance and mineral working, and restoration phases are then described, followed by a description of the relevant baseline conditions and ecological features determined through application of these methods. Potential impacts on relevant ecological features arising from the proposed quarry extension are identified and their effect on the identified relevant ecological features are then assessed. This assessment takes account of the technical design and detail of the proposed quarry extension, as well as any commitments made by the applicant to provide appropriate mitigation or, where mitigation is not possible, habitat compensation made by the applicant. Locally relevant ecological enhancement opportunities are also identified and described to demonstrate how the proposed quarry extension can contribute to wider objectives for sustainable development.

There is potential for overlap with other assessments contributing to the ES, and relevant findings have been taken to account in this assessment. Reference is made to the appropriate ES Appendix, e.g. ES Appendix I: Hydrogeology, as required.

Professional judgment has been used throughout the assessment, particularly where the potential impacts and effectiveness of proposed mitigation are difficult to assess due to lack of information about the behaviour of the species concerned. Where uncertainties exist, the precautionary approach has been adopted and a “worst-case” scenario assumed for the purposes of assessing impact and any further mitigation recommended.

## 2 LEGISLATION AND PLANNING POLICY

The legislation and national and local planning policy relevant to habitats and species within the Zone of Influence (ZoI) (defined in section 3.2 below) of the proposed quarry extension are outlined in Tables 2.1 and 2.2 below. The source documents should be referred to for the wider context and the precise wording of these statutes/ policies.

Consideration has also been given to the *Lincolnshire Biodiversity Action Plan* (LBAP) (Lincolnshire Biodiversity Partnership, 2011) and the *North Lincolnshire Edge with Coversands National Character Area* (NCA) profile (Natural England, 2014) within this assessment, both to assist with the identification of relevant ecological features and to inform development of the proposed restoration scheme submitted with the ES.

**Table 2.1 Summary of Relevant Legislation**

| STATUTE | RELEVANT LEGAL REQUIREMENTS |
|---|---|
| The Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations) | Protection afforded to European Protected Species, i.e. bats and great crested newt (*Triturus cristatus*), listed on Schedule 2. It is an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in listed animals. In certain circumstances, licences can be granted to permit some actions prohibited under the Act.<br>Regulation 9A of the Conservation of Habitats and Species (Amendment) 2012 Regulations requires that competent authorities must take such steps in the exercise of their functions as they consider appropriate to secure the preservation, maintenance and re-establishment of a sufficient diversity and area of habitat for wild birds … as appropriate, and having regard to the requirements of Article 2 of the new Wild Birds Directive. This includes the use of planning and development control measures (Defra and Welsh Government, 2016, see also Table 2.2). |
| Wildlife and Countryside Act 1981 (as amended) (WCA) | Part 1 of the Act affords general protection to all species of wild bird, and specific protection to flora and fauna listed on Schedules 1 (birds protected by special penalties), 5 (other animals), and 8 (flora, fungi and lichens). With regard to the identified relevant ecological features, it is an offence (subject to exceptions) to:<br>• kill, injure, or take any wild bird;<br>• take, damage or destroy the nest of any wild bird while that nest is in use or being built;<br>• take or destroy an egg of any wild bird;<br>• disturb any wild bird listed on Schedule 1of the Act while it disturb the dependent young of such a bird (i.e. quail); and<br>• kill, injure or take any wild animal listed on Schedule 5 (i.e. bats, great crested newt, common lizard);<br>• damage, destroy or obstruct places used for shelter or protection by wild animals listed on Schedule 5 and covered by Part 4a of the Act (i.e. bats and great crested newt);<br>• intentionally disturb wild animals listed in Schedule 5, and covered by Part 4a of the Act, that are occupying |

| STATUTE | RELEVANT LEGAL REQUIREMENTS |
|---|---|
| | places of shelter and protection (i.e. bats and great crested newt).<br>In certain circumstances, licences can be granted to permit some actions prohibited under the Act. |
| Countryside and Rights of Way (CRoW) Act 2000 | Schedule 9 of the Act supplements provisions in the WCA for the designation of Sites of Special Scientific Interest (SSSIs). The Act increases powers for their protection and management of SSSIs; places a duty on public bodies to further the conservation and enhancement of SSSIs; increases penalties on conviction where the provisions are breached; and introduces a new offence whereby third parties can be convicted for damaging SSSIs. |
| Natural Environment and Rural Communities (NERC) Act 2006 | Section 41 (s41) includes a list of habitats and species to be used by decision-makers, including local authorities, to guide the implementation of their duties under section 40 of the Act to have regard to the conservation of biodiversity in England, when carrying out their normal functions. Relevant habitats and species are identified in Section 4 of this Technical Appendix. |
| Protection of Badgers Act 1992 | Not currently applicable to the baseline conditions, as no evidence of badger was found. Has a bearing on post-consent implementation and mitigation as there remains the risk that badgers may subsequently colonise the application site. Makes it an offence to kill or take a badger, to cruelly ill-treat a badger, or to interfere with a badger sett, including disturbing a badger while it is occupying a sett. In certain circumstances, licences can be granted to permit some actions prohibited under the Act. |
| The Hedgerow Regulations 1997 | Does not apply to acts of hedgerow removal covered by the process for granting planning permission. However, it retains value as part of the process for determining the relative value of specific hedgerows/ hedgerow networks and appropriate mitigation. |

**Table 2.2 Summary of Relevant National and Local Planning Policy and Associated Guidance**

| DOCUMENT | PLANNING POLICY | PURPOSE |
|---|---|---|
| National Planning Policy Framework (NPPF) | Section 11 | Relates specifically to "Conserving and Enhancing the Natural Environment". Paragraph 109 states that "*The planning system should contribute and enhance the natural and local environment by:*<br>• *Protecting and enhancing valued landscapes, geological conservation interests and soils;*<br>• *Recognising the wider benefits of ecosystem services; and*<br>• *Minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient* |

| DOCUMENT | PLANNING POLICY | PURPOSE |
| --- | --- | --- |
| | | *to current and future pressures; ...”*<br>Paragraph 113 adds to this and states: “*When determining planning applications, local planning authorities should aim to conserve and enhance biodiversity by applying the following principles:*<br>• *if significant harm resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused; …*<br>• *planning permission should be refused for development resulting in the loss or deterioration of irreplaceable habitats, including ancient woodland and the loss of aged or veteran trees found outside ancient woodland, unless the need for, and benefits of, the development in that location clearly outweigh the loss; …*” |
| North Lincolnshire Adopted Core Strategy 2011 (the Core Strategy) | CS5 | New development should incorporate appropriate landscaping and planting which enhances biodiversity and contribute to habitat linkages. |
| | CS16 | Protect, enhance and support a diverse multi-functional landscape, including through the protection of trees and hedgerows. |
| | CS17 | Promote effective stewardship of biodiversity resources by protecting national and international nature conservation designations, paying due regard to the presence of European and nationally protected species, protecting and maintaining features of biodiversity and geological interest, maintaining wildlife networks and green corridors, and ensuring ecological enhancement through good design. |
| | CS21 | Planning applications for mineral extraction should, where appropriate, contribute to the attainment of local biodiversity targets [e.g. as detailed in the LBAP and NRA profile] |
| The North Lincolnshire Local Plan 2003 (the Local Plan) | LC1 | Affords protection to international nature conservation designations. |
| | LC2 | Affords protection to national nature conservation designations. |
| | LC4 | Affords protection for sites of local nature conservation importance. |
| | LC5 | Prohibits development that would have an adverse impact on protected species, except where appropriate mitigation can be delivered. |
| | LC6 | Promotes ecological enhancement through the creation of new habitats, including restoration of former mineral workings to a nature conservation end use. |

| DOCUMENT | PLANNING POLICY | PURPOSE |
| --- | --- | --- |
| Natural England and Defra Standing Advice | - | The purpose of standing advice is 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. |
| Providing and protecting habitat for wild birds (Defra and Welsh Government, 2016) | - | Standing advice to local planning authorities on how they should maintain wild bird populations by supporting and protecting their habitats. This guidance has been prepared to support delivery of a legal obligation specified through amendment of the Habitats Regulations. It is important to acknowledge that this guidance requires competent authorities to ‘consider’ and ‘take steps’, but it does not require the complete protection of all bird habitats, the mitigation of all losses, and there are no national population targets have been set for wild birds. |

# 3 METHODS

## 3.1 Consultation Responses

Sibelco submitted a request for North Lincolnshire Council to adopt an EIA scoping opinion on 7th August 2015, and this was adopted and issued by the Council on 16th November 2015. The ecological survey work, which forms an important part of the basis for this EcIA, has been carried out in accordance with the relevant requirements of the EIA scoping opinion as demonstrated in the table below. This is in addition to the requirements of relevant legislation and survey guidance as detailed elsewhere in this EcIA.

**Table 3.1 Compliance with the adopted EIA Scoping Opinion**

| TOPIC | ADVICE GIVEN | ACTION TAKEN |
|---|---|---|
| Designations | Impacts on local designations need to be fully assessed. | Impact assessment is provided. |
| Flora | Potential for scarce flora of sandy soils to occur. | This has been taken into account by the surveys for the proposed quarry extension. |
| Invasive non-native flora | Need to consider potential presence e.g. Japanese knotweed (*Fallopia japonica*). | This has been taken into account by the surveys for the proposed quarry extension, no such species recorded. |
| Restoration and ecological enhancement | Initial advice given on expectations for restoration and enhancement.<br>Biodiversity enhancement should include creation of the most beneficial habitat features for the local area – lowland heathland/acid grassland. | Advice has been taken into account in the development of the proposed restoration scheme, see Figure MQ09. |
| Mitigation, compensation and net gain proposals | Information submitted should be sufficient to allow confirmation that these measures are feasible and can be delivered. | This has been taken into account in preparing this assessment. Mitigation would be specified and agreed in more detail in a Habitat Enhancement and Mitigation Plan (HEMP) prior to commencement of quarrying.<br>A restoration scheme has been prepared in support of the planning application ( see Figure MQ09. |
| Greetwell Hall Farm bat roost mitigation | Attention drawn to planning application PA/2010/1009, with statement that the proposed quarry extension should not compromise the enacted mitigation. | Taken into account, the proposed quarry extension is off-set from the roost mitigation measures installed, boundary habitats that constitute most of the foraging habitat will be retained. |
| Protected species | Requirement for comprehensive programme of habitat and protected species surveys | This is fully addressed by the commissioned surveys, as detailed in |

| | | |
|---|---|---|
| | covering birds, bats, badger, riparian mammals, amphibians, reptiles, invertebrates and flora.<br><br>Broad agreement with the scope of the ecology surveys put forward. | this assessment.<br><br>Advice on methods is consistent with the approach taken. |

## 3.2 Study Area and Zone of Influence

The study area was defined with reference to the potential Zone of Influence (ZoI) over which the proposed quarry extension may have potential to result in significant effects on relevant ecological receptors (nature conservation designations, habitats and species). In the context of the proposed quarry extension, the ZoI for most receptors is confined to the footprint of the proposed quarry extension and immediately surrounding land where indirect effects might arise e.g. from disturbance or alteration to local hydrological regimes. Other considerations that limit the potential ZoI are the relatively small size and short operational life of the proposed quarry extension, the excavation techniques to be employed (which do not require blasting and that are consistent with existing baseline activities on adjacent land), and the lack of any need to construct and operate extensive new infrastructure (roads, plant etc.). Other disciplines have contributed to the determination of the potential ZoI, particularly Hydrogeology (ES Appendix I) and Flood Risk Assessment (FRA) (ES Appendix H) have been undertaken to determine the maximum likely extent of the drainage and dewatering associated with the proposed quarry extension. The project description is provided in detail in the main ES.

Given the above, the extent of the field surveys was largely confined to within the boundary of the proposed quarry extension but also included directly adjacent land within the same landownership, or where it was otherwise visible from within the application site or from public rights of way. The survey team had no right of access onto third party land. The survey areas applied are defined further in the survey specific method statements provided in Section 3.5 of this report, and are considered sufficient and appropriate for the purpose of ecological impact assessment of the proposed quarry extension.

The study area covered by the desk studies extended beyond the application site, depending upon the potential ZoI of the ecological receptor being considered. In many cases the desk study area is larger than strictly necessary for the purposes of covering the ZoI, and also took into account data needed to inform survey scoping and the identification of potentially relevant receptors. The study area applied reflects standard good practice and the maximum distances within which statutory consultees would typically be expected to comment (e.g. 2 km for Sites of Special Scientific Interest (SSSI)). Accordingly, the desk study identified international statutory nature conservation designations within 10 km of the application boundary; national and local statutory nature conservation designations within 2 km of the application boundary; and, local non-statutory nature conservation designations, protected species, and Natural Environment and Rural Communities Act 2006 Section 41 (NERC Act S41) habitats and species within 1 km of the application boundary.

## 3.3 Scope of the Desk Study and Field Surveys

The purpose of the desk study and field surveys was to gather data to identify relevant ecological features in the ZoI of the proposed quarry extension. Such ecological features may encompass statutory and non-statutory nature conservation designations, and protected and/ or notable habitats, species assemblages and species.

Protected and notable habitats and species include those listed under Schedules 1, 5 and 8 of the WCA; Schedules 2 and 5 of the Habitats Regulations; species and habitats of principal importance for nature conservation in England listed under section 41 (s41) of the NERC Act; and other species that are Nationally Rare, Nationally Scarce or listed in national or local Red Data Lists and Biodiversity Action Plans.

Information was also collected on the presence/ absence of non-native controlled weed species listed under Schedule 9 of the WCA. While such species would not be considered sensitive ecological receptors, failure to consider such species might have an adverse effect on ecology and nature conservation.

### 3.4 Desk Study Methods

A desk study was undertaken to obtain recent (post-1990) records in support of the identification of relevant ecological features, and the scoping of the field surveys. The organisations contacted and data sources used during the desk study are summarised in Table 3.2.

The coverage of biological records varies in different areas and between different taxonomic groups, depending on the type and extent of previous surveys. Where they are available, historic records provide a useful indication of species or habitats that may be present in association with the application site and can help to put new survey data into local context. The records supplied provide a supplement to the detailed field surveys carried out specifically for the proposed quarry extension.

**Table 3.2 Desk Study Data Sources**

| DATA PROVIDER | DATA OBTAINED | DATE OF RESPONSE |
|---|---|---|
| Multi-Agency Geographic Information for the Countryside (MAGIC) website | Statutory nature conservation designations: SSSI, Special Protection Areas (SPA), Ramsar application sites, Special Areas of Conservation (SAC), National Nature Reserves (NNR), Local Nature Reserves (LNR), ancient woodland application sites, land in Environmental Stewardship | November 2014, rechecked 5th January 2015, and again 11th April 2018 |
| Lincolnshire Environmental Records Centre (LERC) | Non-statutory nature conservation designations, Lincolnshire Wildlife Trust Nature Reserves, records of protected and NERC Act S41 species, including birds and bats | 3rd December 2014, repeated 6th April 2018 |
| Lincolnshire Bird Club (LBC) | Bird records | 12th December 2014 |
| North Lincolnshire Council Online Planning Application Register | Bat survey report containing data collected in 2009 prior to the demolition of Greetwell Hall (Planning Application PA/2010/1009)<br>Results of ecological surveys undertaken in 2006 and 2007 for a previous quarry phase to the south of the application site (Planning Application MIN/2008/0532) | 5th January 2015 |

### 3.5 Field Survey Methods

A programme of ecological surveys was conducted for the proposed quarry extension between December 2014 and September 2015 in order to record relevant ecological features associated with the application site.

The site of the proposed quarry extension was re-visited in April 2018 to re-confirm the baseline habitat conditions and to determine if there had been any changes that would be likely to alter the suitability of habitats for protected species. This confirmed that there had been no substantive change in the site conditions. Given this, the approach and conclusions of the original Phase 1 Habitat survey and the scope of the follow-up habitat and species surveys, as described below, remain valid and require no further update.

Section 3.5.1 provides an overview of the survey work undertaken and the supporting rationale for these surveys. It should be read in association with the more detailed habitat and species survey methods provided from Section 3.5.2 onwards.

All surveys were undertaken by appropriately experienced ecologists from AECOM, unless stated in the relevant survey method statement.

### 3.5.1 *Scoping Survey*

Scoping was undertaken during an initial site meeting with the client in November 2014 and then in more detail during the Phase 1 Habitat and bat roost potential surveys undertaken on 30th January and 27th February 2015 respectively, and an invertebrate habitat appraisal undertaken on 8th April 2015. Illustrative photographs of the are provided as Annex A.

The results of the Phase 1 Habitat survey (Figure 1) describe the habitat context of the application site in detail and are supportive of the following rationale for which ecological surveys were not required. In summary, the habitat context of the application site is predominantly rank grassland of relatively recent origin, but also includes areas of secondary woodland, young plantation woodland, and minor drainage ditches.

A search was made for water bodies within the potential ZoI of the proposed quarry extension (where accessible or visible from land within the same ownership or public rights of way, or otherwise shown on available Ordnance Survey (OS) mapping and online aerial photography). While in some circumstances all water bodies within 500 metres of an application site may need to be considered for their potential to support great crested newts, Natural England advises that this species is unlikely to be affected at distances of greater than 250 metres from a breeding pond (Natural England, 2015). See Section 3.5.11 for further comment on the requirements for the survey of the identified water bodies for great crested newt.

Based on the findings of the various scoping surveys the following more detailed habitat and protected species surveys were confirmed as necessary:

- woodland National Vegetation Classification (NVC)
- breeding birds
- wintering birds
- bats
- badger (*Meles meles*)
- riparian mammals: water vole (*Arvicola amphibius*) and otter (*Lutra lutra*)
- reptiles
- great crested newt (*Triturus cristatus*)
- terrestrial invertebrates (selected habitats only)
- aquatic invertebrates (selected habitats only)

In scoping requirements for bird survey, due regard was given to the habitat context of the application site as explained in more detail in the method statements for the wintering and breeding bird surveys (Sections 3.5.4 to 3.5.5). In addition, as there are no internationally designated SPAs within 10km of the proposed quarry extension, these were not a consideration in scoping the surveys. Requirements for crepuscular (active in twilight) bird survey were considered and scoped out based on the predominant habitat conditions (rank species-poor grassland and dense secondary woodland). In addition, no crepuscular birds were observed during the numerous post-dusk, pre-dawn and early morning surveys undertaken at the application site for bats, great crested newt and birds. Such species would have been observed if present given the combined survey effort employed.

The updated walkover survey undertaken on 11th April 2018 confirmed that there had been no substantive change in the site conditions. As such, the conclusions of the original scoping survey, as described above, remain valid.

### 3.5.2 *Phase 1 Habitat Survey*

The survey was undertaken on 30th January 2015 in accordance with the standard method (JNCC, 2010). Whilst January is outside the optimal survey season for undertaking a Phase 1 Habitat survey this is not considered a limitation because (a) the habitats present could be representatively defined outside the recommended survey season, (b) the proposed quarry extension would primarily affect species-poor habitats of agricultural origin, and (c) additional floristic data was collected during subsequent visits e.g. the woodland NVC survey in April 2015, and top-up inspections of acid grassland and arable areas for notable flora in April, May and June 2015 in combination with the scheduled protected species surveys.

The survey covered all land within the application site as well as directly adjacent land where accessible or otherwise observable from the application site. The surveyor had no right of access onto third party land except where this was crossed by public byways or was otherwise within the control of the Applicant.

Target notes were made as appropriate to record notable features and have been incorporated into the main text of the report. The locations of any non-native, invasive plant species listed on Schedule 9 of the WCA were recorded, if found.

An update survey was completed on 11th April 2018 to re-confirm the habitat baseline.

### 3.5.3 *Woodland NVC Survey*

A woodland NVC survey was undertaken on 30th April 2015 to collect data on a small area of semi-mature secondary broad-leaved woodland located within the north-eastern corner of the application boundary. Weather conditions during the survey were optimal (clear sky, no rain, light wind), and the survey was undertaken at a time of year that is optimal for recording woodland flora.

The survey followed the method detailed in Hall *et al.* (2004). This involves:

- identification of homogenous stands of woodland vegetation for survey through an appraisal of the habitat area as a whole;
- laying out 5 x 5 metre survey quadrats in selected representative areas of each woodland vegetation type (typically five quadrats are surveyed per vegetation type);
- recording the ground flora species present in the survey quadrats and assigning a percentage cover value to each species; and
- recording the presence and percentage cover of tree and shrub species in the quadrats and a wider area 10 metre out from each quadrat.

The woodland vegetation recorded was classified to NVC type(s) using the botanical data gathered during the survey and the key given in Rodwell (1991).

### 3.5.4 *Wintering Bird Survey*

The application site was assessed during the scoping survey to be low risk for wintering birds based on the following considerations:

- the application site is predominantly rough grassland, with peripheral managed hedgerows and minor drains, secondary woodland and immature plantation. Because the grassland is unmanaged it was considered unlikely to have an attractant value for wintering waterfowl, and the limited scale and extent of the waterbodies present also meant that these would be unlikely to attract notable aggregations of wintering waterfowl;

- while the application site contains small areas of crops grown to provide cover for birds, the small size of these plots made it unlikely that they would be of any more than local (site scale) value to wintering birds and therefore they are not of critical functional importance to birds and would not reasonably be expected to support notable aggregations of bird species dependent on land within the application site;

- the pasture to the north of the application site is closely grazed by sheep and therefore unlikely to attract notable aggregations of wintering waterfowl and other birds. While a number of small ponds have also been created to the north of the application site under an Environmental Stewardship agreement, these ponds were considered unlikely to have a high attractant value to wintering birds given their small size and the surrounding sub-optimal land management;

- land to the south of the application site was in the process of being worked for minerals so was unlikely to be attractive to wintering birds in this context; and

- while there are extensive areas of woodland in the wider landscape to the north and west that will have a value for birds over the winter period, it is considered that the open habitats of the application site (the focus of the proposed quarry extension) would be unattractive to woodland specialist bird species. In addition, the woodland areas were considered unlikely to support sensitive dependent wintering bird species with potential to be affected by the proposed quarry extension.

Given the findings of the scoping survey, it was considered that wintering birds are not a relevant consideration, as there is no reasonable likelihood of the application site being of importance for wintering birds. However, in order to validate this assessment, it was considered appropriate to collect data on wintering birds through the application of proportionate survey effort as described below. The option remained to increase the survey effort if the initial results identified this would be appropriate, however the bird surveys only recorded limited wintering bird activity in association with the application site.

A three visit wintering bird survey was commissioned and was timed to coincide with those months when wintering birds would reasonably be expected to be making greatest use of the application site, if it had a specific value for such species. The survey dates and associated weather conditions are detailed in Table 3.3.

The survey area comprised the application site and adjacent land within the same ownership or where otherwise accessible using existing byways and/or visible from within the application boundary. At the time that the wintering bird survey was commissioned, the planning application boundary had not been defined, so the survey encompassed all potentially relevant land and not all of the derived data will be relevant to the planning application. The survey area covered was sufficient for the purposes of conducting an assessment of a phased development of the type and scale proposed.

Each survey visit was undertaken between dawn and late morning when birds where likely to be most active and apparent. The survey involved walking all of the field and habitat boundaries within the survey area. The route was walked slowly with the surveyor stopping periodically to scan the survey area with binoculars. Where practicable, any birds flushed to other parts of the survey area were noted and ignored on subsequent encounters, in order to minimise double-counting.

The location, movements and activities of birds present were recorded onto base-maps using standard British Trust for Ornithology (BTO) species and activity codes.

**Table 3.3 Wintering Bird Survey Dates and Associated Conditions**

| VISIT | DATE | CONDITIONS |
|---|---|---|
| 1 | 19th December 2014 | 7°C, force 3 to 4 westerly wind, cloudy |
| 2 | 13th February 2015 | 4°C, force 2 north/northeast wind, 100% cloud cover |
| 3 | 17th March 2015 | 1°C, no wind, initial low lying fog which lifted, cloud cover visible and clearing |

3.5.5 ***Breeding Bird Survey***

The survey involved a standardised timed method (Brown and Shepherd, 1993) but adapted to follow the Common Birds Census (Marchant, 1983) mapping technique. Three survey visits were undertaken to the application site during the main bird breeding season of April to mid-June. The survey dates and associated weather conditions are detailed in Table 3.4.

The survey area comprised the application site and adjacent land within the same ownership or where otherwise accessible using existing byways or otherwise visible from within the application site. For purposes of cross-comparison, the survey area was the same as that employed during the wintering bird survey and therefore not all of the derived data is relevant to the final application boundary as presented with the planning application. The survey area covered was sufficient for the purposes of conducting an assessment of a phased development of the type and scale proposed.

Each survey visit was undertaken over the period from dawn to no later than mid-morning to account for the time of day when birds are most vocal and territories are most easily defined. Cold, windy or wet days were avoided were possible because the activity, and thus detectability, of breeding birds would be much reduced.

The survey involved walking all of the field and habitat boundaries within the survey area. Birds were located by walking, listening and scanning by eye and with binoculars. Breeding was confirmed if nests or young were observed, and otherwise considered likely if birds were engaged in territorial and breeding activities such as singing, displaying, carrying nest material, repetitively alarm calling, disturbance displaying, carrying food, or in territorial dispute.

The location, movements and activities of birds present were recorded onto base-maps using standard British Trust for Ornithology (BTO) species and activity codes. Maps were produced of the breeding behaviour recorded during each visit, and these were combined to produce an estimate of the overall number of breeding territories for each species. This analysis followed the standard approach detailed in Marchant (1983). No attempt was made to assign territories to woodpigeon (*Columba palumbus*) and non-native game birds. The timing of the surveys (spring) meant that the survey was undertaken well outside of the peak breeding season of woodpigeon which is predominately late summer/early autumn. Therefore it was considered that assigning territories would have not been representative for this species. In addition, because woodpigeon is an extremely common and widespread species, it would not reasonably be considered a target species for survey. Assigning territories to non-native game birds was also not considered necessary or appropriate, particularly as the application site is closely associated with land managed as a game bird shoot involving annual or periodic captures and releases of captive birds. Such annual captures and releases make it impractical to determine or explain trends in the numbers of game birds using the application site.

**Table 3.4 Breeding Bird Survey Dates and Associated Conditions**

| VISIT | DATE | START TIME | CONDITIONS |
|---|---|---|---|
| 1 | 24th April 2015 | 05:30 | 7°C, no wind, dry, 30% cloud cover |
| 2 | 21st May 2015 | 05:20 | 4°C, no wind, dry, 20% cloud cover |
| 3 | 5th June 2015 | 04:50 | 12°C, no wind, dry, 70% cloud cover |

3.5.6 ***Bat Roost Potential Survey***

An inspection of all trees for their bat roost potential (BRP) was undertaken within the ZoI of the proposed quarry extension, except the woodland, was carried out on 30th January 2015 and encompassed the application site and adjacent boundary habitats. The trees within the woodland were inspected on 27th February 2015. The purpose of the survey was to identify any potential roost features for bats (rot holes, damaged limbs, woodpecker holes, peeled bark) or evidence indicating the presence of bats (scratching, droppings, feeding remains or dead bats).

The inspection was carried out with the aid of close-focussing binoculars and in accordance with standard bat survey method (at the time of survey this was Hundt, 2012, but the method applied remains consistent with the updated guidance in Collins, 2016). Four trees with BRP were identified and subjected to follow up surveys as described in Section 3.5.7.

Further details of the BRP survey approach and classification applied is provided as Annex B.

3.5.7 ***Bat Activity Survey***

Before commencement of bat surveys, the application site was appraised to determine whether it was a low, medium or high risk site for bats in accordance with the published guidance (at the time of survey this was Hundt (2012), but the method applied remains consistent with the updated guidance in Collins (2016)). The proposed quarry extension was appraised to be low to medium risk based on the following:

- the desk study data did not identify the presence of any high risk species roosting near the application site, this included consideration of the results of surveys undertaken for other nearby planning applications (see Table 3.2);
- habitat losses to the proposed quarry extension would be largely restricted to open habitats with low potential to be used by commuting and foraging bats, vegetation clearance and restoration would be phased, and operation of the quarry would be during daylight hours and would not require artificial lighting. All these factors combined make it unlikely that the proposed quarry extension would adversely affect the favourable nature conservation status of local bat populations, although potential impacts from the limited requirements for land take from more optimal bat habitats (woodland edge) still needed to be considered; and
- the application site is located in a landscape with extensive and well connected habitats of high suitability for bats. While proximity to such habitats increases the risk

of bats making use of habitats associated with the application site, it is also likely to reduce the potential consequences of the proposed quarry extension on bats because (a) bats are unlikely to be habitat limited in the local area and (b) the application site is unlikely to be of disproportionally high value for bats. This is particularly the case when the proposed quarry extension has only limited potential to directly or indirectly affect bat habitats and habitat usage.

The objective of the bat activity surveys undertaken in 2015 was to collect data to verify the assessed value of the application site for bats, determine which if any bat species use the application site, estimate the relative sizes of the populations of each species present, and identify any patterns in the bat usage of the application site i.e. which parts are more important to bats and which parts are less important.

Based on the published guidance (Hundt, 2012) for low to medium risk situations, the following survey effort was applied to assess the application site and is described in greater detail below:

- walked transect survey – two dusk and one dusk/pre-dawn surveys were undertaken in the active season for bats (May to September);
- static monitoring survey – three survey periods (a minimum of 5 days per survey period) in the active season for bats (May to September); and
- dawn re-entry survey of all trees of BRP – survey effort applied to each relevant tree varied, depending on the BRP assigned to the trees concerned

Walked transect survey

Evening bat detector surveys were undertaken on one occasion per season (spring, summer, autumn) over the period May to September 2015. Two of the surveys were dusk surveys and one was a dusk/dawn survey. Survey visits were scheduled for dates when appropriate weather conditions were expected (survey dates are given with the survey results in Annex C). Appropriate conditions were those with an absence of rain and/or strong winds and with evening temperatures above 7°C.

The survey involved walking a transect route (as shown on Figures 2 to 5) that provided representative coverage of the application site and habitats of potential value to bats. The transect route was walked at a steady speed and bat activity was detected/recorded using a handheld heterodyne/frequency division bat detector (e.g. Bat box III) connected to a recording device. Several stop points were incorporated along the transect route (as shown on Figures 2 to 5), where the surveyors stopped for periods of 3 to 5 minutes. All bat activity detected during the survey was recorded and mapped on a suitably scaled plan.

Each dusk survey commenced half an hour before sunset and was completed within three hours of sunset to coincide with peak activity periods as bats emerge and disperse from their roosts. Pre-dawn surveys commenced two hours before sunrise and finished at sunrise to coincide with peak activity as bats return to their roosts.

Static monitoring survey

Static monitoring was undertaken at three discrete locations as shown on Figure 6. The locations were selected to collect data on bat activity associated with potential foraging and commuting habitats that would suffer severance, or that would otherwise be altered, as a consequence of the proposed quarry extension.

Data were collected using SM2 and SM2+ static bat detectors. The static detectors were set to start recording half an hour before the published sunset time and to stop recording half an hour after the published sunrise time.

As there is potential for bat activity levels and habitat use to vary across the survey season of May to September it is good practice to spread survey effort out over the active season. As such, data were collected over periods of at least five full nights to coincide with spring, summer and late summer/early autumn. Typically the static detectors were left to run longer than required to compensate for any nights when conditions were unsuitable for bats e.g. too cold or wet. The survey dates and associated conditions are summarized in Table 3.5. The first five days were used except in spring where the night of the 19th May was removed and replaced with a more optimal dataset from the 20th due to unfavourably low temperatures on the 19th May.

The bat sound recordings made during the surveys were later analysed to identify the bat species involved and the number of passes made by each species. The number of passes is not directly correlated with the number of individual bats involved and many of the passes recorded are likely to be a result of repeat activity by relatively few bats. However, the data can be used as an indicator of the relative significance of specific locations for bats.

**Table 3.5 Dates of the 2015 Static Monitoring Surveys for Bats and the Associated Conditions**

| VISIT | SEASON | DATES | AIR TEMPERATURE |
|---|---|---|---|
| 1 | Spring | $15^{th}$ to $18^{th}$, and $20^{th}$ May | 4.6 to 13.8°C |
| 2 | Early-summer | $9^{th}$ to $13^{th}$ July | 9.2 to19.8°C |
| 3 | Late summer/ early autumn | $14^{th}$ to $18^{th}$ August | 8.5 to 26.2°C |

Dawn Re-entry Survey

A small area of mature secondary woodland occurs within and immediately adjacent to the excavation area of Phase1 of the proposed quarry extension. The BRP survey identified four trees within the woodland (Figures 2 to 5) with features of bat roost potential. These trees were surveyed to determine the presence/likely absence of bat roosts. The survey dates and times are detailed in Table 3.6.

The number of times that each of the trees was surveyed depended on the relative BRP of the tree, as determined by the preceding BRP survey. This survey identified one tree (Tree 1) of low BRP, one tree of moderate BRP (Tree 3) and two trees of high BRP (Trees 2 and 4). In accordance with published guidance (at the time of survey this was Hundt, 2012, but the method applied remains consistent with the updated guidance in Collins, 2016), trees of low BRP were surveyed once; and trees of moderate to high BRP were surveyed three times. The only exception was when new information became available during the course of the survey work undertaken that allowed certain trees to be scoped out of requirements for further survey. This was the case with Tree 4 which was observed to be occupied by nesting/roosting jackdaws (*Corvus monedula*) on the second survey visit. On this basis it was considered unsuitable for roosting bats and was scoped out of the final survey.

Features can be surveyed for roosts either by undertaking observations to coincide with the dusk period for bat emergence from roosts, or the dawn period for bat re-entry into roosts. In this case, dawn surveys were undertaken. As all of the trees were located in dense secondary woodland, it was considered that conditions at dusk would have been too dark to allow observation of any bats emerging from the trees. In contrast, light levels and bat re-entry behaviour at dawn are more favourable for direct observation, so surveys were scheduled for dawn.

The dawn re-entry surveys commenced 90 minutes before sunrise and continued until 15 minutes after sunrise. Any bats observed were recorded. Batbox Duet bat detectors with Edirol solid state recording devices were used by all surveyors during the surveys. The recording devices were set to record continuously for the duration of each survey to enable later analysis of recordings in BatSound and to ensure that no bat calls were missed. Surveys were completed during suitable weather conditions (dry, temperatures above 7°C, no to light wind).

**Table 3.6 Dates and Times of the Bat Re-Entry Surveys of Woodland Trees**

| VISIT | DATE | SUNRISE TIME | WEATHER | TREES SURVEYED (SEE FIGURES 2 TO 5 FOR LOCATIONS) |
|---|---|---|---|---|
| 1 | $3^{rd}$ July 2015 | 04:39 | 12°C, full moon, dry | T1 to T4 |
| 2 | $31^{st}$ July 2015 | 05:16 | 11°C, dry but misty at time of survey | T2 to T4 |

| | | | | |
|---|---|---|---|---|
| 3 | 4th Sept 2015 | 06:17 | 10°C, overcast but dry | T2 and T3 (T4 was not surveyed as it was a confirmed jackdaw nest / roost) |

3.5.8 ***Badger Survey***

A badger survey was undertaken during the Phase 1 Habitat survey on 30th January 2015, with additional top-up data gathered when undertaking other surveys for the proposed quarry extension. This species was reconsidered during the update walkover survey completed on 11th April 2018.

The badger survey was based on the standard approach detailed in Harris *et al*. (1989). This involved searching for field signs associated with badger including setts, runs, foraging activity, latrines and footprints. Other signs searched for included scratching posts near any setts and hairs caught on fences.

Any setts found would be categorised as either main, annex, subsidiary or outlier. This classification allows a measure of importance to be assigned to setts. For example, a disused outlier sett would not be considered as important as a main breeding sett if development were to disturb them.

3.5.9 ***Water Vole and Otter Survey***

A water vole survey was undertaken along the full length of the three drains that would be lost or impacted by the proposed quarry extension (Waterbodies 6, 14 and 30, Figure 7). The survey took place on the 14th May 2015 and was completed in accordance with current guidance (Strachan *et al*. 2011).

During the survey of waterbodies 6, 14 and 30, searches were also made for signs of otter. While the application site is low risk for this species, due to the relatively small size of the watercourses and their isolation from larger rivers, there was low potential for otter to make transitory use of the watercourses.

Survey conditions were considered to be optimal and the survey was undertaken following a run of several days of good weather, thus ensuring that water levels were low, and that field signs would be more obvious than they would be after a period of heavy rainfall.

The presence or absence of water vole and otter was determined by a thorough search of both banks for the following field signs:

- sounds of water vole entering the water
- water vole and otter feeding remains
- water vole latrines and otter spraints
- water vole burrow entrances (above and below water)
- water vole ‘gardens/ lawns’ around tunnel entrances
- pathways in the vegetation and to the water’s edge
- footprints in mud

3.5.10 ***Reptile Survey***

Artificial reptile refuges made from roofing felt were placed in suitable reptile habitats identified during the preceding Phase 1 Habitat survey. A total of 169 reptile refuges were set out

(Figure 8) at an approximate density of seven refuges per hectare in accordance with recommendations made in Foster (1999). The refuges were checked during suitable weather conditions in line with good practice guidelines (English Nature, 2004; Gent & Gibson, 1998). On each survey visit, transects were also walked through suitable habitats associated with the survey locations to afford the opportunity to observe any reptiles present but not using the refuges.

Reptile surveys are most effective when the air temperature is between 9 and 18ºC, and therefore all surveys were undertaken on days with suitable weather conditions. The survey dates and conditions are detailed in Table 3.7.

A recent review of survey approaches (Sewell *et al*. 2013) concludes that a minimum of six survey visits are required to derive a population estimate using artificial refuge-based techniques for the common species of reptile. This survey exceeds these minimum requirements and therefore allows the estimation of population size.

**Table 3.7 Reptile Survey Dates and Associated Conditions**

| VISIT | DATE | WEATHER CONDITIONS |
|---|---|---|
| Refuges installed | 10th March 2015 | Not relevant |
| 1 | 23rd April 2015 | Temperature 10.2$^{o}$C, cloud cover 90%, wind speed force 1 |
| 2 | 27th April 2015 | Temperature 10$^{o}$C, cloud cover 0%, wind speed force 2 |
| 3 | 11th May 2015 | Temperature 17.9$^{o}$C, cloud cover 90%, wind speed force 1 |
| 4 | 22nd May 2015 | Temperature 14$^{o}$C, cloud cover 100%, no wind |
| 5 | 27th May 2015 | Temperature 10$^{o}$C, cloud cover 90%, wind speed force 1 |
| 6 | 9th June 2015 | Temperature 11$^{o}$C, cloud cover 30%, wind speed force 1 |
| 7 | 1st Sept 2015 | Temperature 13$^{o}$C, cloud cover 70%, wind speed force 2 |
| 8 | 22nd Sept 2015 | Temperature 12$^{o}$C, cloud cover 25%, wind speed force 1 |

### 3.5.11 *Great Crested Newt Survey*

Identification of Relevant Ponds and Assessment of their Suitability for Great Crested Newt

Waterbodies within 500 metres of the application site were identified through examination of Ordnance Survey (OS) maps and aerial photography, and through Scoping / Phase 1 Habitat survey. As a result of this process 30 waterbodies were identified for survey within the potential ZoI, most of which were located off-site. These are shown on Figure 7. There were no existing survey data for these ponds and all were surveyed to determine the presence/ likely absence of great crested newts, as well as to collect data on any other amphibians present.

All of the potentially relevant waterbodies within the ZoI were inspected during the Phase 1 Habitat survey on the 30th January 2015 to determine initial survey requirements. Requirements for survey were subject to ongoing review during the course of the scheduled surveys as and when additional information became available. Waterbodies that were scoped out, and the reasons for this, were:

- waterbodies 6, 13, 15, 16 and the large lakes to the northeast of the application site – these waterbodies were confirmed through direct observation to support populations of fish. Waterbodies supporting populations of fish are unlikely to support breeding great crested newt, as great crested newt eggs and larvae are highly vulnerable to predation from fish (English Nature, 2001);

- waterbodies 12 and 18 – these ponds are 350 metres from the application site, and are separated from it by land currently being worked for minerals extraction. Because of the lack of habitat connectivity, there is no reasonable likelihood of any great crested newt populations present being able to access terrestrial habitats within the application site. These ponds were surveyed for great crested newt in 2007 for the current quarry, and this species was not found;

- waterbody 14 – this ditch contains negligible water as a result of overspill from a connected impounded ditch (Waterbody 6/15). Insufficient water was available at the time of survey and throughout the summer to support breeding by great crested newt, and it was considered likely (and later confirmed) to dry up during the summer months;

- waterbody 17 – 420 metres from the application site and outside the extent of agreed land access. Given the relative distance from the application site there was no requirement for survey. The location of the pond is nearly at the maximum limit of the area within which requirements for great crested newt survey should be considered, and the pond is well beyond the 250 metre distance within which Natural England considers it likely that great crested newts would occur and be potentially adversely affected (Natural England, 2015). The pond is surrounded by optimal terrestrial habitat (woodland) which reduces the likelihood of migration into the distant terrestrial habitats associated with the application site, and if such migrations are taking place it would have been reasonable to expect a greater incidence of great crested newts in the other ponds present between the application site and Waterbody 17. This was not the case, and no great crested newts were recorded from intervening waterbodies (see survey results); and.

- waterbody 30 – minor ditch that contained insufficient water at the time of survey to support breeding by great crested newt, and it was considered likely (and later confirmed) to dry up during the summer months.

The ponds identified as requiring survey were appraised further to quantify their relative suitability for great crested newts. This information was collected in case it was required for the purposes of a future European Protected Species Mitigation Licence (EPSML) application. The appraisal was undertaken using the Habitat Suitability Index (HSI) method (Oldham *et al*. 2000). The HSI is a numerical index, between 0 and 1, that allows ponds to be rated for their relative suitability for great crested newt. In the HSI, 0 indicates unsuitable habitat and 1 represents optimal habitat.

The calculation of a HSI requires that the following ten habitat variables are recorded and assigned a numerical value:

- location within Britain

- pond area

- pond drying (based on both local knowledge and field evidence)

- water quality

- percentage perimeter shaded

- presence or absence of waterfowl
- presence or absence of fish
- number of ponds situated within 1km
- suitability of terrestrial habitat
- percentage of macrophyte cover

HSI is not intended to be used as a tool for the determination of which ponds should and should not be subject to survey for great crested newt. The only way to robustly determine presence / likely absence of great crested newt is to undertake a field survey using a method approved by Natural England for this purpose. However, should great crested newts be present within the zone of influence of a proposed quarry extension, then HSI data is required to support (where relevant) an application for a EPSML application to Natural England.

Survey Method

The surveys were undertaken in accordance with the best practice guidelines for great crested newt survey (English Nature, 2001), an approach that allows population data to be collected for other species of amphibian in addition to great crested newt.

Four survey visits were undertaken to each potentially suitable pond to determine the presence/ absence of great crested newts. Where certain ponds dried up over the course of the survey period then further surveys of these ponds could be abandoned. Great crested newts require continuity of standing water into late summer to provide sufficient time for larvae to develop into adults, at which point they are no longer dependent on the presence of water for their immediate survival, from around August onwards.

Where great crested newts were recorded over the course of the first four survey visits, then a further two survey visits were undertaken to the relevant ponds to enable a population size class assessment to be completed (English Nature, 2001).

All survey visits were undertaken during suitable periods of weather, with air temperatures falling no lower than 5$^{o}$C (see Table 3.8 for details of the survey dates and associated weather conditions).

All species of amphibian observed were recorded, and where possible all great crested newts were sexed to allow a determination of the ratio of males to females.

The standard survey method requires that on each survey visit three of a possible four survey methods be used, these methods being bottle trapping, torching, netting and egg searches. This approach was taken at all ponds, except Waterbodies 2, 7, 8, 9 and 10 where bottle trapping and netting was not possible due to insufficient depth of water. As such, only torching and egg searching was employed at these ponds. This is not considered a limitation as Waterbody 2 had good visibility and therefore torching was the most effective survey method, while the other ponds subsequently dried up and it is considered unlikely that these shallow woodland ponds would support standing water long enough in any given year to provide breeding habitat for great crested newt. In accordance with the standard survey method, egg searching was stopped once great crested newt breeding was confirmed.

Bottle traps were set out at dusk and checked the following morning. Torching was undertaken after nightfall. Egg searching was undertaken prior to torching or when the bottle traps were collected in the morning, as this was when light levels were best.

**Table 3.8 Great Crested Newt Survey Schedule**

| VISIT | DATE | MINIMUM TEMPERATURE | WATERBODIES SURVEYED | PONDS DRY AND SCOPED OUT OF SUBSEQUENT SURVEY |
|---|---|---|---|---|
| 1 | 13th April 2015<br>14th April 2015 | 14°C<br>10°C | 1, 2, 3, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29<br>4, 5, 7, 8, 9, 10, 11 | - |
| 2 | 28th April 2015<br>29th April 2015 | 7°C<br>7°C | 1, 2, 5, 11, 27, 28, 29<br>3, 4, 7, 8, 9, 10, 19, 20, 21, 22, 23, 24 | 10 |
| 3 | 13th May 2015<br>14th May 2015 | 7°C<br>11°C | 3, 4, 7, 8, 9, 19, 20, 21, 22, 23, 24, 25<br>1, 2, 5, 11, 26, 27, 28, 29 | 7, 8, 9 |
| 4 | 26th May 2015<br>27th May 2015 | 10°C<br>10°C | 1, 2, 5, 11, 26, 27, 28, 29<br>3, 4, 19, 20, 21, 22, 23, 24, 25 | - |
| 5 | 11th June 2015 | 10°C | 4 and 23 (ponds confirmed as supporting great crested newt) | - |
| 6 | 16th June 2015 | 14°C | 4 and 23 (ponds confirmed as supporting great crested newt) | - |

3.5.12 ***Terrestrial Invertebrate Habitat Appraisal***

The habitat appraisal survey was undertaken by a specialist sub-consultant on behalf of AECOM (Richard Wilson Ecology) on 8th April 2015. Favourable survey conditions were encountered, as it was a mild and warming spring day (12° C to 16° C), cloud cover was about 6 octets but clearing, and there was light air to light breeze conditions (force 1 to 2) from the north-east.

Notes were made on adjacent habitats abutting the application site but these were only visually appraised from within the application site.

All habitats within the application site were surveyed, with notes made on the habitats present (type, extent and context) and land management, which are of relevance to determining the likely presence of notable species of terrestrial invertebrate and therefore to scoping the requirement for further survey. Limited collecting was undertaken during the walkover, with the specimens collected either identified in the field or retained for subsequent microscopic determination in representative habitats. Collecting was focussed on those groups most likely to include species of nature conservation interest, typically Diptera (flies), Coleoptera (beetle) and Aculeate Hymenoptera (solitary bees, wasps and allies). Specific methods employed to collect invertebrates were restricted to sweeping the edges of paths, tracks and vegetation with a light-weight butterfly-net and direct observation.

3.5.13 ***Terrestrial Invertebrate Survey***

The terrestrial invertebrate survey and subsequent sample identification was undertaken by a specialist sub-consultant on behalf of AECOM (Richard Wilson Ecology) on the dates detailed in Table 3.9.

**Table 3.9 Schedule of Terrestrial Invertebrate Survey Dates and Associated Weather Conditions**

| DATE | WEATHER |
|---|---|
| 1st July 2015 | Cloud: 0/8; Temperature: 27.0° C, rising to 27.0° C; Wind Speed: Light air to Gentle breeze; Hot and humid. |
| 5th August 2015 | Cloud: 6/8 to 8/8; Temperature: 20.0° C; Wind Speed: Gentle to Moderate breeze. |
| 3rd September 2015 | Cloud: 7/8 (high); Temperature: 14.0° C; Wind Speed: Light air to Gentle breeze. |

The purpose of the survey was not to provide an exhaustive list of invertebrate taxa present within the application site, but to enable an accurate and robust appraisal of the relative nature conservation value of the habitats present for invertebrates. To achieve this, the surveys broadly adhered to the methods described in Drake *et al*. (2007) and involved the application of a variety of manual techniques, including:

- sweep netting of vegetation
- aerial netting for flying invertebrates using a light-weight butterfly net
- vacuum sampling (using a commercially available modified garden blow-vac)
- direct observation

In addition, two static traps (a yellow water trap and a ‘four-bottle’ aerial trap) were installed within the woodland area at the locations given in Table 3.10. Each trap had a small amount of commercially available concentrated screenwash / diluted monopropylene glycol poured into the receptacle to act as a preservative. Each location was selected based on the presence of deadwood. The purpose of the traps was primarily to collect Diptera (flies) and Coleoptera (beetles), especially saproxylic invertebrate species that may emerge from adjacent deadwood.

Specimens collected were either identified in the field or retained for subsequent microscopic determination. Surveys paid particular attention to those groups most likely to include species of nature conservation interest, typically Diptera, aculeate Hymenoptera, Araneae (spiders), Coleoptera and Hemiptera (bugs). However, a wide range of invertebrate orders were recorded as detailed in the survey results.

**Table 3.10 Locations of the Static Traps set in the Woodland**

| TRAP TYPE | GRID REFERENCE | COMMENT |
|---|---|---|
| Water trap | SE 9300 0492 | Located in a split crack willow (*Salix x fragilis*) within a damp area of the woodland, about 2 metres above ground level. |

| TRAP TYPE | GRID REFERENCE | COMMENT |
|---|---|---|
| Aerial trap | SE 9293 0492 | Hung from a dying pedunculate oak (*Quercus robur*) tree in a drier area of the wood. |

There is currently no standard frame of reference to evaluate the nature conservation value of invertebrate assemblages for the purposes of Ecological Impact Assessment (EcIA). The various methods available have been designed for specific purposes such as condition monitoring of statutory nature conservation designations (Drake *et al*., 2007); or assigning a measure of 'rarity' based on formal nature conservation status e.g. Red Data Book (RDB) and Nationally Scarce status (Colin Plant Associates (CPA), undated). Each have their advantages and disadvantages, so for the purposes of evaluating the results of the survey, more than one approach was used to draw a conclusion, and this was moderated by professional judgement where appropriate. A summary of methods used is given below.

The assemblages recorded have been assessed using the Invertebrate Species-habitat Information System (ISIS) (Drake *et al*., 2007). ISIS was initially designed to inform condition monitoring of statutory nature conservation designations, but has subsequently been adopted to assess the potential nature conservation status of sites studied for the purposes of EcIA. Whilst this has some justification, caution has to be applied as strictly speaking, survey effort would normally require standardisation (e.g. timed sweeps). Nevertheless, ISIS can at least inform which invertebrate communities (assemblages) recorded are of particular importance within a site, for example those associated with wood decay, floristically rich habitats or both. There is a benefit as attention is given to assemblages rather than solely relying on national status, though the latter, especially in terms of a proportion of the total species recorded can also be indicative of value. There are two 'assemblage types' recognised by ISIS:

- Species Assemblage Types (SATs) which are of greater significance as they include stenotopic species (i.e. those with a restricted habitat requirement) and are considered to have an intrinsic nature conservation value. These species are generally only recorded on sites that are of nature conservation value; and
- Broad Assemblage Types (BATs), which are arguably more reliable and characterised by species that are more widespread.

Another assessment method that has been used is the Index of Ecological Continuity (IEC). The IEC is a measure of the continuity of woodland cover at a site inferred from the saproxylic beetle fauna assemblage present i.e. beetle species that show a strong affinity for old woodland. Alexander (2004) has used the IEC to define thresholds of nature conservation importance as follows:

- IEC scores > 80 = international importance
- IEC scores > 25 = national importance
- IEC scores > 15 = regional importance

The final assessment method used is the CPA (undated) method. This relies on the number of species recorded within the samples that have a formal nature conservation status, whilst recognising that professional judgement is also needed as species status can change over time.

### 3.5.14 *Aquatic Macroinvertebrate Survey*

The macroinvertebrate (aquatic invertebrates visible with the naked eye) survey of selected waterbodies was undertaken on 22nd September 2015, and was timed to coincide with an optimal season for undertaking such work.

The surveys targeted waterbodies that would be lost to, or that might be indirectly affected by, the proposed quarry extension (Table 3.11 and Figure 7) as advised by the client based on the results of hydrological assessment. This included consideration of the ponds in the woodland (Waterbodies 7 to 9), but these were subsequently scoped out as they were dry at the time of survey. Two survey samples were taken from Waterbody 6 because this is a long drain and the habitats present varied along its length.

**Table 3.11 Aquatic Invertebrate Sample Site Locations**

| WATERBODY | GRID REFERENCE |
|---|---|
| 6 | SE 92899 04827 |
| 14 | SE 92890 04720 |
| 16 – Sample site 1 | SE 92519 04699 |
| 16 – Sample site 2 | SE 92631 04712 |
| 30 | SE 92520 04619 |

Macroinvertebrate sampling was undertaken by two suitably experienced aquatic ecologists to assess the biological quality of the waterbodies. Biological samples were taken using a standard Freshwater Biological Association (FBA) pattern pond net (mesh size: 1 mm). The sampling methods applied accorded with standard guidance (Environment Agency, 2012) and involved three-minute ‘kick sampling’ and ‘sweep netting’ techniques, followed by a one-minute hand search of larger substrates. Consideration was also given to the National Pond Survey (NPS) method for sampling macroinvertebrates in ponds (Biggs *et al*., 1998).

This method allows characterisation of the invertebrate communities and establishes the biological quality of freshwater habitats. It does not generate a comprehensive list of every taxon present. Instead, the survey recorded species and conditions that could be identified at the time of the survey and other species that may be present at other times of year, sporadically and/or in low numbers, may not have been recorded. For example, where juvenile or damaged specimens were collected, species level identification may not have been possible in some cases. To attempt to detect all species that occur, including those at low abundance, or occurring sporadically, would be impractical, would generate unnecessary information and is not necessary for representative characterisation of waterbodies.

The samples were then preserved in isopropyl alcohol 70% v/v for laboratory processing. Detailed sorting of the entire samples was carried-out in the laboratory by a trained and experienced aquatic biologist, to gain comparable lists of macroinvertebrate taxa (in line with Environment Agency, 2012 guidance). Macroinvertebrates were identified to mixed-taxon level (where practicable) using stereo-microscopes (under low power) and appropriate identification keys. In line with Environment Agency analytical guidance protocols (Environment Agency, 2014) the following groups were excluded from species level identification, and were only determined to the taxonomic levels indicated:

- Diptera (family);
- Coleoptera larvae (family);
- Oligochaeta (order);
- Nematoda (order);
- Sphaeriidae (genus); and
- Hydracarina (order).

Immature or damaged specimens were determined to the lowest reliable level of identification possible.

The invertebrate data were analysed using the following indexes:

- Biological Monitoring Working Party (BMWP) scores and Average Score Per Taxon (ASPT) values (Hawkes, 1997) - these are derived based on the sensitivity of particular macroinvertebrate taxa (families) to organic pollution, further explanation of BMWP scores and ASPT is provided as Appendix D; and
- Community Conservation Index (CCI) method (Chadd & Extence, 2004) – to assess the conversation value of the macroinvertebrate populations present and identify and unusual or rare species.

The conservation value of the different invertebrate species and communities recorded was assessed using the Community Conservation Index (CCI). The CCI classifies many groups of freshwater invertebrates according to their scarcity and nature conservation value in England (Chadd & Extence, 2004). Species scores range from 1 to 10, with 1 being ‘very common’ and 10 being ‘endangered’ (see Table 3.12). These classifications relate closely to the categories used in relevant Red Data Books (RDB) and Lists (e.g. Shirt, 1987; Foster, 2010; and Bratton, 1991).

The overall index provides an indication of the conservation value of the community sampled based on a combination of the rarity of the different species present and overall community richness, as explained Table 3.13 below.

**Table 3.12: Conservation Scores from the Community Conservation Index**

| CONSERVATION SCORE | CONSERVATION VALUE (EQUIVALENT RDB STATUS) |
|---|---|
| 10 | RDB1 (Endangered) |
| 9 | RDB2 (Vulnerable) |
| 8 | RDB3 (Rare) |
| 7 | Notable (but not RDB status) |
| 6 | Regionally notable |
| 5 | Local |
| 4 | Occasional - species not in categories 5 to 10, which occur in up to 10% of all samples from similar habitats |

| CONSERVATION SCORE | CONSERVATION VALUE (EQUIVALENT RDB STATUS) |
|---|---|
| 3 | Frequent - species not in categories 5 to 10, which occur in up to >10-25% of all samples from similar habitats |
| 2 | Common - species not in categories 5 to 10, which occur in up to >25-50% of all samples from similar habitats |
| 1 | Very common - species not in categories 5 to 10, which occur in up to >50-100% of all samples from similar habitats |

**Table 3.13: Guidance on Interpretation of CCI scores (from Chadd & Extence, 2006)**

| CCI SCORE | DESCRIPTION | INTERPRETATION |
|---|---|---|
| 0 – 5 | Sites supporting only common species and/or a community of low taxon richness | Low conservation value |
| 5 – 10 | Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness | Moderate conservation value |
| 10 – 15 | Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness | Fairly high conservation value |
| 15 – 20 | Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness | High conservation value |
| > 20 | Sites supporting several rarities, including species of national importance, or at least one extreme rarity and/or a community of high taxon richness | Very high conservation value |

## 3.6 Evaluation of Ecological Receptors

In order to keep EcIA manageable and focussed on relevant ecological features only, there is a need to determine the scale at which specific ecological features are of value. The approach taken when valuing ecological features is described below.

### 3.6.1 *The value of sites and habitats*

An approach to evaluation of nature conservation value of a given site and its associated habitats was first presented in Ratcliffe (1977). The criteria used for evaluation of the importance of sites for nature conservation include:

- size (area or extent)
- rarity
- diversity
- fragility
- potential value
- position within an ecological/geographical unit
- typicality
- recorded history
- naturalness

- intrinsic appeal

In the UK these criteria were developed, and in most instances quantified, for the selection of sites of national importance for nature conservation designated as SSSI. A similar approach has been taken to identify the most important sites at a county or district level, although criteria may be applied qualitatively. These sites are designated by a local committee of relevant groups, including representatives from local planning authorities. This is done using the guidance of the Ratcliffe Criteria, but with allowance for the appropriate geographical level. In assigning a geographic value to relevant sites and habitats, consideration is given to their published value (designations) or relative distribution, abundance, and trends in status (stable, increasing or declining). The categories of geographic value used for this assessment are detailed in Table 3.14.

### 3.6.2 *The value of species*

The importance of the presence of species of relevant plants and animals is assessed with reference to the geographic scales of value given in Table 3.13. In assigning a geographic value to species consideration is given to their relative distribution, abundance, and whether or not their populations are stable, increasing or in decline.

The status of species that are rare or threatened is outlined nationally in various Red Data Books and Lists, and also in the NERC Act s41 list of species of principal importance for nature conservation in England. The local status of species is detailed in the LBAP. There are national criteria for rarity and level of threat to populations for different groups of species. Species may be widespread or common nationally, but of scarce occurrence in the county or district. Conversely, a species may be common in a county or district context, but considered rare nationally. In addition, some species, termed legally protected species such as bats, badger and reptiles are given statutory protection that protects them from harm or forms of disturbance.

The assignment of value to a specific resource requires that the assessor make use of relevant published evaluation criteria (where available). Where published evaluation criteria do not exist it has been necessary to apply best judgment, supported by a reasoned case. The categories of geographic value used for this assessment are detailed in Table 3.14.

**Table 3.14 Scale of Ecology and Nature Conservation Value**

| CIEEM SCALE OF VALUE | CRITERIA | EXAMPLE |
|---|---|---|
| International | High importance and rarity, international scale and limited potential for substitution | • Internationally designations (e.g. SACs)<br>• Sustainable area of a habitat listed in Annex I of the Habitats Directive, or smaller areas of such habitat where they are essential to maintain the viability of a larger whole<br>• Sustainable population of a species listed in Annex IV of the Habitats Directive and Annex 1 of the Birds Directive |
| National (England) | High importance and rarity, national scale, or regional scale with limited potential for | • Nationally designations (e.g. SSSIs)<br>• Regionally important sites with |

| CIEEM SCALE OF VALUE | CRITERIA | EXAMPLE |
|---|---|---|
| | substitution | limited substitution possibilities<br>• Sustainable area of a priority habitat identified in Section 41 of the NERC Act<br>• Sustainable population of a species listed on Schedules 1, 5 and 8 of the WCA, of a species identified in Section 41 of the NERC Act, of a UK Red Data Book species, or of a nationally rare species (15 or fewer 10km-squares in the UK) |
| County (Lincolnshire) / District (North Lincolnshire) | High or medium importance and rarity local or regional scale and limited potential for substitution | • Regionally important sites with potential for substitution<br>• Locally designated sites (e.g. SINCs)<br>• Sustainable area of a priority habitat identified in the LBAP and/ or NRA profile<br>• Sustainable population of a priority species identified in the LBAP, or a nationally scarce species (16-100 10km squares in the UK) |
| Local | Low or medium importance and rarity, local scale | • Undesignated sites that are good examples of a more widespread habitat, or species-poor examples of a habitat of note (as described above), or of earth heritage interest<br>• Population of a species that is of low importance and rarity but of some value locally |

# 4 RESULTS

## 4.1 Nature Conservation Designations

### 4.1.1 *Statutory Nature Conservation Designations*

There are no international or local statutory nature conservation designations in the desk study area.

Two national statutory nature conservation designations are present in the desk study area as detailed in Table 4.1 and shown on Figure 9.

**Table 4.1 Statutory Nature Conservation Designations**

| DESIGNATION | NATURE CONSERVATION VALUE | DISTANCE FROM THE APPLICATION SITE | REASON FOR DESIGNATION |
|---|---|---|---|
| Manton and Twigmoor SSSI | National | 340 metres northeast | The SSSI comprises three separate sections and contains important areas of heathland, grassland and wetland on cover-sand deposits of wind-blown origin, which overlie a west-facing scarp of Oolitic limestone. These habitats, once extensive in the area, are now limited due to agricultural forestry and industrial development. |
| Messingham Sand Quarry SSSI | National | 720 metres southwest | Supports a mosaic of habitats in an area initially worked to exploit the cover-sand deposits, but recently managed to create open water, wetland and woodland, with some re-establishment of natural heathland vegetation. The SSSI is particularly important for its insect fauna, and also supports a diverse breeding bird community. The SSSI is managed as a Lincolnshire Wildlife Trust Nature Reserve. |

### 4.1.2 *Non-Statutory Nature Conservation Designations*

LERC identified 12 non-statutory nature conservation designations for the desk study area, these are detailed in Table 4.2 and shown on Figure 9. No new designations were identified when updating the desk study in April 2018.

**Table 4.2 Non-statutory Nature Conservation Designations**

| DESIGNATION | NATURE CONSERVATION VALUE | DISTANCE FROM THE APPLICATION SITE | REASON FOR DESIGNATION |
|---|---|---|---|

| DESIGNATION | NATURE CONSERVATION VALUE | DISTANCE FROM THE APPLICATION SITE | REASON FOR DESIGNATION |
|---|---|---|---|
| Greetwell North Local Wildlife Site (LWS) | County | The application site includes part of the LWS | Contains a large and diverse area of habitats that forms a habitat linkage between the central and southern sections of Manton and Twigmoor SSSI. The most important habitats present are the dry acidic grassland and wet woodland. The LWS is considered of value for its flora, invertebrates and breeding birds. |
| Broom Plantation LWS | County | <10 metres west of the application site | Open woodland and favourably managed acid grassland habitats. |
| Black Hoe Plantation | County | <10 metres northwest of the application site | Woodland and acid grassland habitats. |
| Twigmoor Warren Local Geological site (LGS) | County | 440 metres north | Of geological interest for its coversand deposits. Part of the LGS falls within Manton and Twigmoor SSSI, but geology is not part of the designated interest of the SSSI. |
| Messingham Sand Pit Extension LGS | County | 710 metres south | Of geological interest for its coversand deposits showing dune topography. |
| Greetwell South LWS | County | 810 metres southeast | Unimproved acid grassland and associated habitats. |
| Greetwell Road, West Verge LWS | County | 1.2 km southeast | Unimproved acid grassland. |
| Greetwell Road, West Verge LWS | County | 1.2 km southeast | Unimproved acid grassland and scrub habitats. |
| Messingham Northwest LWS | County | 1.2 km southwest | Semi-improved grassland habitats located within Messingham Sand Quarry Nature Reserve but outwith the SSSI of the same name. |
| Messingham Grassland LWS | County | 1.2 km southwest | Semi-improved neutral grassland and unimproved acid grassland. |
| Holme Lane Verge LWS | County | 1.5 km northwest | Neutral grassland. |
| Staniwells Plantation Site of Nature Conservation Interest (SNCI) | Possibly county, but awaits assessment against current LWS criteria | 1.5 km southeast | Plantation with an old limestone quarry. |

## 4.2 Habitats

### 4.2.1 *Phase 1 Habitat Types*

The habitats associated with the application site, as identified through Phase 1 Habitat survey and reconfirmed on 11th April 2018, are described below. The Phase 1 Habitat map is provided as Figure 1 and includes the locations of the target notes referred to in the following habitat descriptions. The target notes are provided in full in Annex E, while representative photographs are provided as Annex A.

The application site is located in a predominantly rural landscape. The current Messingham Quarry is to the immediate south of the application site and Brigg Road. Other land to the south comprises agricultural fields (many restored following quarrying) under arable cultivation. To the immediate north of the application site are two fields of improved pasture which are closely grazed by sheep. Within the fields, numerous small waterbodies have been created to benefit wading birds under an Environmental Stewardship agreement. Elsewhere to the immediate north, east and west of the application site there are extensive areas of woodland, scrub, acid grassland and wetland habitats that are covered by a range of nature conservation designations as detailed in Section 4.1 of this report and shown on Figure 9.

The habitats associated with the application site, in descending order of area occupied are:

- Neutral semi-improved grassland
- Arable
- Broad-leaved semi-natural woodland
- Broad-leaved plantation woodland
- Bracken
- Ponds
- Drains and ditches
- Hedgerows and scattered trees
- Acid semi-improved grassland
- Continuous scrub

These habitats are described in more detail below.

<u>Neutral semi-improved grassland</u>

The grassland areas have developed over land previously managed for the production of arable crops. As such, the grassland is species-poor and of recent origin (Photograph 1, Annex A). The grassland has not been recently managed and as a consequence is tussocky and there is a build-up of thatch.

The grassland is dominated by a limited suite of grasses and is herb poor. Typical flora includes: creeping bent (*Agrostis stolonifera*), common bent (*Agrostis capillaris*), Yorkshire-fog (*Holcus lanatus*), red fescue (*Festuca rubra*), white clover (*Trifolium repens*), cat's-ear (*Hypochaeris radicata*) and creeping buttercup (*Ranunculus repens*).

Adjacent to the arable plots (see below) were areas of Timothy (*Phleum pratense*) sown to provide cover and food for farmland birds under an Environmental Stewardship agreement.

Arable

This comprises small plots of maize (*Zea mays*) sown to provide cover for game birds. No scarce arable flora were recorded in association with these plots, instead only common species such as common stork's-bill (*Erodium cicutarium*), groundsel (*Senecio vulgaris*), dove's-foot crane's-bill (*Geranium molle*), small nettle (*Urtica urens*), field pansy (*Viola arvensis*) and annual meadow-grass (*Poa annua*) were observed.

Broad-leaved semi-natural woodland

The main area of semi-natural woodland is at Target Note 4 (Photographs 2 to 5, Annex A). This is birch (*Betula* spp.)/ pedunculate oak (*Quercus robur*) woodland of relatively recent secondary origin. Historic 1:2,500 OS maps from 1972, strongly suggest that at this time the woodland area comprises heath/ rough grassland with scattered scrub. Therefore the woodland must have established after this date. The 1975-1980 shows a similar context, but with scrub the dominant habitat and some localised establishment of trees. Based on available maps and inference based on the size of the trees observed, the woodland is considered to be of 30 to 40 years of age.

Within the woodland at Target Note 4 are areas of drainage impeded ground containing seasonal pools of standing water that dry up over the course of the summer. This woodland was subject to an NVC survey and is described in more detail in Section 4.2.2.

There is a small woodland copse surrounding a pond at Target Note 2 (Photograph 6, Annex A). This woodland has a mature canopy of dense crack willow (*Salix x fragilis*) over predominantly bare ground, although there are some local patches of common nettle (*Urtica dioica*) and cow parsley (*Anthriscus sylvestris*).

Broad-leaved plantation woodland

This is a young plantation (less than 10 years of age) over species-poor tussocky neutral grassland. It supports a diverse mix of native tree species, including hawthorn (*Crataegus monogyna*), silver birch (*Betula pendula*), hazel (*Corylus avellana*) and pedunculate oak. Blackthorn (*Prunus spinosa*) and brambles (*Rubus fruticosus* agg.) are frequent along the margin where there is scattered scrub in association with the boundary ditch.

Bracken

This area is dominated by dense bracken (*Pteridium aquilinum*), within which there are clearings of grassland dominated by Yorkshire-fog and common nettle, with occasional scattered bushes of hawthorn. Other flora present at low frequency includes red fescue, ground-ivy (*Glechoma hederacea*), wood sage (*Teucrium scorodonia*), rosebay willowherb (*Chamerion angustifolium*), hairy bitter-cress (*Cardamine hirsuta*), white dead-nettle (*Lamium album*) and lesser burdock (*Arctium minus*).

Ponds

Two ponds (Waterbodies 9 and 11) occur within the application site, but there are a larger number in the surrounding landscape (Figure 7).

On-site at Target Note 2 there is a permanent pond (Waterbody 11, Photograph 6, Annex A). This pond has heavily shaded and steep bare earth banks and is relatively deep. The water was turbid and no aquatic vegetation was observed.

The on-site woodland at Target Note 4 contains a series of hydrologically connected seasonal pools (Waterbody 9) that hold water over the wetter winter and spring months, but that dry-up completely during the summer leaving bare mud (Photograph 2, Annex A). Where light penetrates the woodland canopy these pools support common water-starwort (*Callitriche* *stagnalis*), soft rush (*Juncus effusus*), water forget-me-not (*Myosotis scorpioides*), gypsywort (*Lycopus europaeus*) and common duckweed (*Lemna minor*).

Drains and ditches

The drains and ditches associated with the application site are Waterbodies 6, 14, 16 and 30 (Figure 7).

Waterbody 6 is an impounded canalised drain located upstream of a concrete dam (Photograph 7, Annex A). The channel is approximately 3 metres wide, is over 1 metre deep, and has moderate flow (20 cm/sec). Water clarity was good. At the time of the September 2015 macrophyte survey the drain was moderately/ heavily shaded by adjacent and overhanging trees and shrubs. Broad-leaved pondweed (*Potamogeton natans*) covered 20% of the water's surface, with common reed (*Phragmites australis*) and soft rush present in the margins, and there was 40% cover of green filamentous algae beneath the water's surface. The drain also supports a population of a stonewort (*Nitella flexilis* agg.).

Waterbody 14 is part of the same drain as Drain 6, however, as it is located downstream of the dam it only receives limited overspill and is consequently very shallow (Photograph 8, Annex A). The channel is 1 metres wide, the water was less than 5 cm, and had slow flow (10 cm/sec). The water was clear and the drain bed substrate was predominantly clays and silts with extensive leaf litter within channel. The drain was heavily shaded by bankside vegetation of scrub and great willowherb (*Epilobium hirsutum*), while common reed provided 80% cover within the channel.

Waterbody 16 is an over-deepened field boundary ditch overhung by trees and a hedgerow (Photograph 9, Annex A). The channel is approximately 1.5 to 2.5 metres wide, the water was 25 to 30 cm deep, and the flow was slow (<5 cm/sec). The water was clear and the substrate was predominantly clays and silts. The macrophyte cover was approximately 40% and comprised common duckweed and broad-leaved pondweed. The margins supported stands of common reed (*Phragmites australis*), great willowherb, soft rush and bulrush (*Typha latifolia*).

Waterbody 30 is a minor field ditch (Photograph 10, Annex A). The channel was approximately 1 metre wide and overhung by scrub. The water level was less than 5 cm deep and the associated flow was very slow (<5 cm/sec). The water was clear and the substrate was predominantly clays and silts. The channel was choked with vegetation that was dominated by brambles, common reed, meadowsweet (*Filipendula ulmaria*), great willowherb and soft rush.

Hedgerows and scattered trees

There are seven hedgerows associated with the application site (Table 4.3 and Figure 1), all of which, with the exception of Hedgerow 2, are located on the boundaries of the application site.

All of the hedgerows are species-poor, and therefore outside the remit of the Hedgerow Regulations, and hawthorn dominated. Mature standard trees are infrequent within the hedgerows and are predominantly pedunculate oak.

**Table 4.3 Hedgerows associated with the application site**

| HEDGEROW NUMBER | SPECIES-RICH OR POOR? | DESCRIPTION |
|---|---|---|
| 1 | Poor | Intact hedgerow dominated by hawthorn, with some dog-rose (*Rosa canina*) and willow (*Salix* sp.). The non-native Oregon-grape (*Mahonia aquifolium*) is also present in the bottom of the hedgerow. |

| HEDGEROW NUMBER | SPECIES-RICH OR POOR? | DESCRIPTION |
|---|---|---|
| 2 | Poor | Short intact section of hawthorn hedgerow. |
| 3 | Poor | Defunct hedgerow (>10% gaps) of hawthorn, with hazel, grey willow (*Salix cinerea*) and one pedunculate oak standard. |
| 4 | Poor | Intact hedgerow of hawthorn with one pedunculate oak standard. |
| 5 | Poor | Heavily managed hedgerow of hawthorn. |
| 6 | Poor | Hedgerow gappy due to cutting back of shrubs to allow access for ditch maintenance. Dominated by hawthorn with grey willow, dog-rose and pedunculate oak. |
| 7 | Poor | Defunct hedgerow (>10% gaps) of hawthorn, grey willow, hazel with standards of pedunculate oak. |

<u>Acid semi-improved grassland</u>

Semi-improved acid grassland occurs as narrow verges along the boundary with the Greetwell North LWS (Target Note 7, grassland approximately 8 metres wide) and along the existing farm track (Target Note 8, grassland approximately 2 metres wide). These verges are grazed by rabbits, and the sandy ground has been disturbed in places by rabbit digging. There is also some relict acid grassland in the clearing at Target Note 5, but this is relatively species-poor due to unfavourable management. This latter area of grassland provides a habitat linkage between the more species-rich grassland verges.

The flora of all three of the target noted areas is grass dominated, including species such as sheep's fescue (*Festuca ovina*), red fescue and Yorkshire-fog. These grasses are supplemented by herbs, particularly at Target Notes 7 and 8 where these include ephemerals and other species typical of short nutrient-poor turf. These herbs include: yarrow (*Achillea millefolium*), field mouse-ear (*Cerastium arvense*), common stork's-bill, field wood-rush (*Luzula campestris*), white clover, field pansy, little mouse-ear (*Cerastium semidecandrum*), dove's-foot crane's-bill, parsley-piert (*Aphanes arvensis*), sheep's sorrel (*Rumex acetosella*), common cudweed (*Filago vulgaris*), sand spurrey (*Spergularia rubra*) and sand sedge (*Carex arenaria*).

These grasslands were too small in area to merit NVC survey, but based on the species listed above and the more detailed target notes provided as Annex E, the grassland is considered typical of the 'U1 *Festuca ovina-Rumex acetosella* grassland community, Typical sub-community'. This is a widespread grassland type on warm free-draining substrates.

<u>Continuous scrub</u>

This comprises a dense stand of broom (*Cytisus scoparius*) on the western boundary of the application site.

### 4.2.2 *Woodland National Vegetation Classification*

The results of the NVC survey (Table 4.4) of the woodland at Target Note 4 (Figure 1) show a community with a tree layer dominated by birches, silver birch on the drier ground and downy birch (*Betula pubescens*) in lower lying wetter areas, with local contributions from other tree species, particularly pedunculate oak.

The shrub layer reflects the main canopy, with saplings of all the trees species present, but is otherwise typified by a sparse cover of hawthorn and elder (*Sambucus nigra*).

The ground layer is not particularly species-rich and no plant species were present that are indicators of a long continuity of woodland cover. Indeed the presence, at low cover, of a number of ruderal and grass species support the view that woodland is of relatively recent secondary origin (along with the relative ages of the trees present). Common nettle and Yorkshire-fog are frequent in the ground layer, particularly in drier areas. In wetter areas, bare mud predominates but with local gypsywort (not present in the survey quadrats), marsh bedstraw (*Galium palustre*), willowherbs (*Epilobium* sp.) and creeping buttercup.

Based on the flora recorded the woodland tends towards the NVC W4 *Betula pubescens-Molinia caerula* woodland community, *Dryopteris dilatata-Rubus fruticosus* sub-community, with an affinity / transition towards a species-poor W2 *Salix cinerea-Betula pubescens-Phragmites australis* woodland community, *Alnus glutinosa-Filipendula ulmaria* sub-community in the wetter areas. Confidence in the typification of the woodland community is limited by the relatively small size of the woodland plot surveyed, its relatively recent origin, and the limited time available for a mature woodland ground flora community to establish. The W2 and W4 woodland communities are both widespread nationally.

**Table 4.4 NVC Survey Results**

| SPECIES | QUADRAT AND GRID REFERENCE | | | | |
|---|---|---|---|---|---|
| | Q1<br>SE 9301 048 1 | Q2<br>SE 9297 0482 | Q3<br>SE 9298 0484 | Q4<br>SE 9297 0485 | Q5<br>SE 9299 0486 |
| | DOMIN SCORE | | | | |
| **Canopy** | | | | | |
| Silver birch* | 8 | 7 | 8 | 7 | 8 |
| Downy birch * | | 7 | 7 | 7 | 6 |
| Pedunculate oak | 5 | | 1 | 2 | 2 |
| Goat willow (*Salix caprea)** | | 1 | | | |
| Grey willow* | | | | 2 | |
| **Shrub layer** | | | | | |
| Sycamore (*Acer pseudoplatanus)* | | | 1 | | |
| Silver birch | | 2 | | | |
| Downy birch | | | 2 | | |
| Hawthorn | 4 | 3 | 3 | 3 | |
| Pedunculate oak | 2 | 1 | 1 | | |
| Goat willow | | 2 | | | |

| SPECIES | QUADRAT AND GRID REFERENCE | | | | |
|---|---|---|---|---|---|
| | Q1 SE 9301 048 1 | Q2 SE 9297 0482 | Q3 SE 9298 0484 | Q4 SE 9297 0485 | Q5 SE 9299 0486 |
| | DOMIN SCORE | | | | |
| Grey willow | 1 | | 3 | 2 | |
| Elder | 4 | 3 | 2 | 1 | |
| **Ground layer** | | | | | |
| Creeping bent | | | | 4 | |
| Bare ground | 3 | 4 | 4 | 5 | 3 |
| Bryophytes | 3 | 3 | 2 | 4 | |
| Spear thistle (*Cirsium vulgare)* | | 1 | | | |
| Spring beauty (*Claytonia perfoliata*) | 1 | | | | |
| Cock's-foot (*Dactylis glomerata)* | 1 | 1 | | | |
| Broad buckler-fern (*Dryopteris dilatata)** | | 2 | 4 | 4 | |
| Willowherb seedlings (*Epilobium sp.)* | | 1 | | 1 | |
| Fumitory seedlings (*Fumaria sp.)* | | | 1 | | 1 |
| Cleavers (*Galium aparine)* | 1 | 1 | 2 | 1 | 2 |
| Marsh bedstraw (*Galium palustre)** | | | | 1 | |
| Ground-ivy (*Glechoma hederacea)* | 4 | | | | |
| Yorkshire-fog | 9 | 8 | 4 | 7 | |
| Soft-rush | | 4 | | 1 | |
| Three-nerved sandwort (*Moehringia trinerva)** | 1 | | 1 | | |
| Annual meadow-grass | 1 | | | | |
| Rough meadow-grass (*Poa trivialis)* | | | | | 1 |

| SPECIES | QUADRAT AND GRID REFERENCE | | | | |
|---|---|---|---|---|---|
| | Q1 SE 9301 048 1 | Q2 SE 9297 0482 | Q3 SE 9298 0484 | Q4 SE 9297 0485 | Q5 SE 9299 0486 |
| | DOMIN SCORE | | | | |
| Creeping buttercup | 1 | 4 | | 4 | 1 |
| Brambles | 1 | 2 | 5 | 2 | 2 |
| Broad-leaved dock (*Rumex obtusifolius)* | | 1 | | | |
| Water figwort (*Scrophularia auriculata)** | | | | 1 | |
| Common ragwort (*Senecio jacobaea)* | | 1 | | | |
| Bittersweet (*Solanum dulcamara)* | | | 2 | 1 | |
| Chickweed (*Stellaria media)* | | | | 1 | |
| Tree seedlings | 1 | | | 1 | 1 |
| Common nettle | 4 | 3 | 8 | 4 | 9 |
| **Additional flora not present in quadrats:** cuckoo-flower (*Cardamine pratensis)**, enchanter's-nightshade (*Circaea lutetiana)**, Borrer's male-fern (*Dryopteris borreri)**, great willowherb, hemp-nettle (*Galeopsis sp.),* honeysuckle (*Lonicera periclymenum)**, gypsywort, rowan (*Sorbus aucuparia*), hedge woundwort (*Stachys sylvatica*) and wood sage | | | | | |
| **Domin scale** 1: rare, 2: sparse, 3: frequent (but all <4%), 4: 4-10%, 5: 11-25%, 6: 26-33%, 7: 34-50%, 8: 51-75%, 9: 76-90%, 91-100%<br><br>Taxa used for the identification of woodland LWS are marked with an *, see Section 4.2.3 | | | | | |

4.2.3 ***NERC Act S41 and Other Notable Habitats***

Of the habitats recorded the following need to be considered for their potential to represent examples of NERC Act S41 habitats defined in Maddock (2011):

- Woodland at Target Note 4 – This woodland is not considered to be part of the Wet Woodland S41 habitat type. While small areas tend towards W2 wet woodland these are located in a wider area of predominantly dry woodland, including the W4a type. The woodland is considered to fall within the Lowland Mixed Deciduous Woodland S41 habitat type, and this is supported by the habitat inventory on the MAGIC website.

- Acid grassland – The acid grassland within the application site meets the definition for the S41 Lowland Acid Grassland habitat. While the habitat extent within the application site is relatively limited it connects to similar habitats on adjacent land.

- Hedgerows – The intact hedgerows meet the definition of the S41 Hedgerows habitat, as they are all greater than 20 metres long and support one or more native tree and shrub species. Ditches and verges within 2 metres of the centre of these hedgerows are considered a functional part of the S41 habitat and this encompasses some of the acid grassland resource.

- Ponds – None of the ponds within the application site meet criteria for recognition as the S41 Ponds habitat based on available data. The ponds in the woodland do not hold permanent water and Waterbody 11 is a heavily shaded duck pond. Off-application site Waterbodies 4 and 23 are covered by the habitat definition as they support populations of great crested newt; however these ponds are not closely associated with the application site.

All of the above habitats are also covered by the LBAP. No additional LBAP habitats occur in association with the application site.

The habitats recorded have also been screened against LWS selection criteria (Greater Lincolnshire Nature Partnership, 2013) to determine their relative quality and value in a county context. Clearly, all of the habitats (the W4 and W5 woodland, and bracken) within the Greetwell North LWS contribute to the integrity of the LWS but to better understand their relative value it is also potentially informative to consider them on their individual merits also. It is important to acknowledge that this assessment has not been made with reference to data collected from surveys undertaken for the purposes of identifying LWS, and therefore any associated limitations to the assessment made are clearly stated.

Following review of the LWS criteria the following conclusions are reached:

- Woodland at Target Note 4 – based on available data the woodland narrowly falls short of criteria for the recognition of wet woodland LWS (12 of the minimum 15 species required found during the NVC survey, see Table 4.4). Regardless it is connected to and is integral to a wider area of woodland that has been designated as a LWS.

- Acid grassland – based on the available data, the acid grassland at Target Notes 7 and 8 meets minimum criteria for LWS selection. This is because the relevant areas are linear habitat parcels that are more than 50 metres long and that support the required number of qualifying plant species. The grassland at Target Note 7 is also likely to meet supplementary criteria relating to habitats of wildlife value that occur adjacent to a designated LWS (in this case Greetwell North LWS).

No other habitats of likely LWS quality were identified by the survey.

### 4.2.4 *Ecology and Nature Conservation Value*

For the purposes of transparent assessment, the habitats listed below are considered further below to determine their relative value and their relevance to the EcIA. All of the habitats recorded are of local ecology and nature conservation value only and not need to be considered further; this is because they are species-poor examples of habitats that are common in the wider landscape.

- Woodland at Target Note 4. This is assessed as being of county ecology and nature conservation value as it is integral to Greetwell North LWS, supports an area of semi-mature wet woodland that if retained or enhanced would likely accrue further biodiversity value, and because it supports an invertebrate assemblage of county value (see Section 4.3.9) that is dependent on the woodland and its immediately adjacent acid grassland habitat.

- Acid grassland at Target Notes 7 and 8, and including the habitat linkage provided by the grassland at Target Note 5. This is assessed as being of county ecology and nature conservation value because it meets acid grassland criteria for the selection of LWS based on the flora recorded (see also Section 4.3.1), and is supportive and provides a habitat buffer to the comparable and complementary adjacent habitats present in Greetwell North LWS. It also supports a dependent invertebrate assemblage of county value (see Section 4.3.9), and is also important for the reptile population associated with the application site (Section 4.3.6).

- Hedgerows. While most native hedgerows are covered by S41 of the NERC Act, hedgerows remain widespread nationally and in the county. Accordingly S41 status does not automatically mean that all hedgerows are of high nature conservation value. The hedgerows present are of limited extent and fragmented, and represent only a relatively small proportion of the hedgerow resource present in the wider landscape. Therefore they are considered to be of local value only

- Drains habitat associated with Waterbodies 6 and 16. The value of these drains relates to the presence of notable aquatic invertebrate species. See Section 4.3.10 for the assessment of ecology and nature conservation value.

- Ponds. There are no permanent ponds in the potential ZoI of the proposed quarry extension (as determined with reference to the hydrogeology assessment, ES Appendix I). So there is no requirement to assess the nature conservation value of the ponds recorded.

## 4.3 Species

### 4.3.1 ***Flora***

<u>Desk Study</u>

The Environment Team at North Lincolnshire County Council drew attention, via the scoping opinion, to the potential for the application site to support notable flora. Specific mention was made of:

- Dense silk-bent (*Apera interrupta*) – while this species was originally considered Nationally Scarce (Stewart *et al*. 1994) it should be noted that current expert botanical opinion (Stace & Crawley, 2015) now considers this species to be a non-native neophyte and as such it would not be considered a species in need of nature conservation action.

- Common cudweed – listed as Near Threatened in the England Red Data list (Stroh *et al*. 2014) based on a declining national population trend but not rarity. This species is widespread but locally distributed in Lincolnshire, reflecting the distribution of suitable substrates.

- Sand spurrey – Not threatened in England (Stroh *et al*. 2014) but this is a species that is uncommon in Lincolnshire and concentrated in areas with suitable sandy substrates.

In addition, LERC identified records of the following additional species:

- Annual knawel (*Scleranthus annuus*) – Endangered in England (Stroh *et al*. 2014) and rare in Lincolnshire, there are records for Messingham Sand Quarry SSSI.

- Pillwort (*Pilularia globulifera*) - Vulnerable in England (Stroh *et al*. 2014) and rare in Lincolnshire, there are records for Messingham Sand Quarry SSSI. There are no suitable waterbodies within the application site for this species.

Field Survey

Of the notable flora species identified as potentially present by the desk study, only common sand spurrey and cudweed occur in association with the application site, being present in acid grassland at Target Notes 7 and 8 (Figure 1 and Appendix E). There are small (population sizes in the low 10's), but viable, populations of both species reflecting the limited extent of the acid grassland.

Another species present in the acid grassland habitat, and in comparable numbers, is the Near Threatened (Stroh *et al*. 2014) field mouse-ear. This species is locally distributed in Lincolnshire, but is locally frequent on light soils in North Lincolnshire.

None of the other species recorded from the application site are considered notable.

Ecology and Nature Conservation Value

The small, localised populations of common cudweed, sand spurrey and field mouse-ear are considered to be of county ecology and nature conservation value in view of their unfavourable status and local distribution in the county. National value is not considered appropriate given these species are still widespread, albeit declining nationally, and because the populations within the application site are relatively small. These species can be expected to be present more widely in the local area in association with comparable habitats in the various nature conservation designations. County value is also justified given these species contribute to an acid grassland assemblage of county ecology and nature conservation value (see Section 4.2.4).

All other flora species associated with the application site are of local ecology and nature conservation value, although some contribute to an acid grassland community of county ecology and nature conservation value.

### 4.3.2 *Birds*

Desk Study

A large number of bird records were returned for the study area. Most of the records provided by LERC were made at Messingham Sand Quarry SSSI, as were many of the records provided by Lincolnshire Bird Club.

The following WCA Schedule 1 bird species occur in the local area and may be relevant to the application site, due to the presence of suitable breeding habitat (as determined through Phase 1 Habitat survey):

- Common quail (*Coturnix coturnix*) – potential to breed in area of maize cover crop.

- Red kite (*Milvus milvus*) – potential to breed in woodland areas.

A wide range of other bird species have been recorded, including species listed on S41 of the NERC Act. The value of the application site for birds is considered better determined through field survey than with reference to desk study records which are not necessarily those of regularly occurring species, or species for which there is suitable habitat associated with the application site. Accordingly, wintering and breeding bird surveys were undertaken to investigate this further.

Wintering Bird Survey

The results of the wintering bird survey are shown on Figures 10 to 12 and detailed in Annex F.

The survey data demonstrate that the application site is of relatively low value for wintering birds, with very low levels of activity recorded for a limited suite of predominantly common and widespread bird species.

In all survey months, bird activity within the application boundary was primarily of small passerine species associated with woodland habitats and field boundary hedgerows, although there were also regular occurrences of skylark (*Alauda arvensis*) in the grass fields towards the end of winter when this species is re-establishing breeding territories. Woodpigeon (*Columba palumbos*) was another regularly occurring species. Small numbers of wigeon (*Anas penelope*) and mallard (*Anas platyrhynchos*) occurred in association with the duck pond. All other bird activity reflected more incidental use of the application site by birds present in the wider landscape, and such activity is considered typical of lowland areas supporting comparable habitats.

Bird activity in the adjacent fields to the north was comparable in composition and abundance to that present within the application site, despite the presence of several small ponds that might have attracted bird activity.

Breeding Bird Survey

The results of the breeding bird survey are shown on Figures 13 to 14. Bird activity associated with the application site is summarised in Table 4.5. As the proposed quarry extension will include habitat buffers around the working area of the quarry, it is unlikely that birds associated with adjacent off-site land would be affected and therefore this data is not summarised, except where these species may be relevant to determination e.g. nearby breeding activity by bird species listed on Schedule 1 of the WCA.

Twenty-one bird species were recorded breeding or probably breeding in association with the application site. These breeding bird species are categorised in Table 4.5 in accordance with their relative nature conservation concern (Red, Amber, Green, with Red List species of highest concern and Green List species not considered threatened) as given in Eaton *et al*. (2015).

Three Red List bird species were recorded from the application site in small numbers. Skylark and lapwing (*Vanellus vanellus*) were present in the grassland fields, while a single song thrush (*Turdus philomelos*) territory was recorded from the woodland (Figure 13). All of these species are also listed on S41 of the NERC Act.

Seven Amber List bird species were recorded from the application site in small numbers, of which willow warbler (*Phylloscopus trochilus*) in wooded habitats, and meadow pipit (*Anthus pratensis*) in grassland habitats, were the most abundant breeding species (5 and 4 pairs respectively) (see also Figure 13).

Ten Green List bird species were recorded, predominately from habitats on the boundary of the application site, but a few small passerine species also made use of the trees and scrub associated with the banks of Waterbodies 14 and 30 (Figure 14).

No evidence of breeding by Schedule 1 bird species was confirmed during the survey. However, a single quail was heard calling later in the year and may have bred in association with the maize crops sown to benefit game birds. The presence of this species in any given year is likely to be opportunistic and will depend on a range of factors, but particularly the availability of suitable arable land under favourable land management. As the current presence of arable crops is linked to an Environmental Stewardship agreement of limited duration, there is no guarantee that the application site will remain suitable for this species over the short to medium term (< 5 years).

**Table 4.5 Breeding Bird Territories Associated with the Application Site**

| SPECIES | STATUS | ESTIMATED NUMBER OF TERRITORIES | HABITAT USE |
|---|---|---|---|
| Lapwing | Red List, NERC Act S41 | 1 | Grass field |
| Skylark | Red List, NERC Act S41 | 3 | Grass fields |
| Song thrush | Red List, NERC Act S41 | 1 | Woodland within boundary of Greetwell North LWS |
| Dunnock (*Prunella modularis*) | Amber List, NERC S41 (research only) | 3 | Woodland within boundary of Greetwell North LWS, and hedgerows |
| Mistle thrush (*Turdus viscivorus*) | Amber List | 2 | Woodland within boundary of Greetwell North LWS |
| Mallard | Amber List | 1 | Waterbody 14 |
| Meadow pipit | Amber List | 4 | Grass fields |
| Quail | Amber list | Unknown – 1 calling male | Maize crop sown under Environmental Stewardship agreement |
| Reed bunting (*Emberiza schoeniculus*) | Amber List | 1 | Waterbody 16 |
| Whitethroat (*Sylvia communis*) | Amber List | 2 | Hedgerow, and scrub by Waterbody 14 |
| Willow warbler | Amber List | 5 | Scrub, particularly by waterbodies |
| Blackbird (*Turdus merula*) | Green List | 5 | Hedgerows and woodland |
| Blackcap (*Sylvia atricapilla*) | Green List | 1 | Hedgerow |
| Blue tit (*Cyanistes caeruleus*) | Green List | 6 | Hedgerows and woodland |
| Chiffchaff (*Phylloscopus collybita*) | Green List | 2 | Willow woodland |
| Chaffinch (*Fringilla coelebs*) | Green List | 6 | Hedgerows and woodland |
| Great tit (*Parus major*) | Green List | 4 | Woodland |

| SPECIES | STATUS | ESTIMATED NUMBER OF TERRITORIES | HABITAT USE |
|---|---|---|---|
| Jay (*Garrulus glandarius*) | Green List | 1 | Woodland |
| Moorhen (*Gallinula chloropus*) | Green List | 1 | Duck pond |
| Robin (*Erithacus rubecula*) | Green List | 5 | Hedgerows and woodland |
| Wren (*Troglodytes troglodytes*) | Green List | 1 | Woodand |

<u>Ecology and Nature Conservation Value</u>

Based on the survey data, the application site is assessed as being of local ecology and nature conservation value for wintering birds. This is because of the very low levels of activity recorded, and which relates to a limited suite of predominantly common and widespread bird species.

The breeding bird assemblage is also assessed to be of local ecology and nature conservation value, but quail is considered further below. The limited number of bird species recorded, and the small population sizes are the reason for the assigned value. While there are a limited number of Red and Amber List bird species of conservation concern present, the numbers of territories are very small and typical of comparable habitats that are widespread in the local landscape. The bird species using the woodland at Target Note 4, contribute to and are likely typical of (given the comparable habitat context) the bird interest of Greetwell North LWS, but are considered unlikely to be critical for the maintenance of this interest given the abundance of the habitats they are using and the small numbers of territories recorded.

Quail merits further consideration, given this species is Amber Listed. Quail also benefits from strict legal protection through the provisions of Schedule 1 of the WCA. While legal status is not automatically applicable to considerations of value, in this case it does reflect the relative status of this species in the UK.

The quail activity may be linked to the cover crops sown to benefit game birds, and the presence and maintenance of this is tied to an Environmental Stewardship agreement of limited duration. On this basis, in the absence of the Environmental Stewardship agreement, the application site may not be attractive to this species and therefore the application site may be best considered as a transitory and opportunistic location rather than as suitable for the long-term needs of the breeding population of the species. The UK population is estimated at 540 pairs (Musgrove *et al*. 2013) based on records of calling males. Therefore if the application site supports one pair, this is less than 1% of the national population and therefore it is not of national nature conservation value. No current data could be sourced for the county breeding population, but the occasional use of the application site by one pair is unlikely to be critical for maintenance of the county population. Given lack of confidence in the maintenance of suitable habitat for this species over the medium term (greater than 5 years), it is considered that local value is most appropriate.

### 4.3.3 *Bats*

<u>Desk Study</u>

LERC returned recent records for Messingham Sand Quarry SSSI, and Manton and Twigmoor SSSI. The bat species recorded include common and soprano pipistrelle (*Pipistrellus pipistrellus* and *P. pygmaeus*), Daubenton's (*Myotis daubentonii*), Natterer's bat (*Myotis nattereri*) and brown long-eared (*Plecotus auritus*).

The ecology survey reports submitted with the Greetwell Hall planning application (PA/2010/1009) recorded the presence of common pipistrelle in association with the application site. This included records of roosts within Greetwell Hall (now demolished). Mitigation for the loss of the Greetwell Hall roost was installed to the east of the application site (see below) and may now support this species.

Roost Potential, Including Emergence Survey Results for Relevant Trees

Four trees with BRP were identified in association with the application site, three from woodland within the application site boundary (Trees 1 to 3) and one woodland tree just to the north of the application site boundary in the potential ZoI (Tree 4). The locations of these trees are shown on Figures 2 to 5. The trees with BRP are described below in Table 4.6.

All of the other trees present within the application site and on its boundary were inspected. No features with BRP were identified in association with these trees. As such, there is no requirement to consider or describe these trees further.

The trees with BRP were subject to follow-up dawn re-entry surveys as explained in the Methods section. No bat activity was recorded in association with these trees and as such there is no reasonable likelihood of these trees supporting bat roosts.

In addition to trees with BRP, several artificial bat roosting features were identified during the Phase 1 Habitat survey. These features had been installed as part of the agreed mitigation strategy for the demolition of Greetwell Hall and its associated farm buildings. These features comprised bat boxes erected on the woodland edge 50 metres to the east of the application boundary and 120 metres from the proposed maximum extent of the quarry face (Target Note 9, Figure 1; Photograph 11, Annex A), and a small wooden bat 'barn' supporting a range of bat box types on its external and internal walls, including boxes suitable for use all year round (Target Note 10, Figure 1; Photograph 12, Annex A), located 60 metres to the east of the application boundary and 160 metres from the proposed maximum extent of the quarry face. The bat activity surveys would have recorded any bat activity arising from the presence of roosts in association with these features, and therefore they did not require emergence surveys as the roost locations would not be directly or indirectly affected by the proposed quarry extension.

**Table 4.6 Trees with Bat Roost Potential**

| TREE NUMBER | TREE SPECIES | LOCATION AND DIMENSIONS | DESCRIPTION OF BAT ROOST POTENTIAL | BRP |
|---|---|---|---|---|
| 1 | Silver birch | Location: SE 93026 04813<br>Diameter at breast height: 0.3 m | One rot hole 1.7 metres from ground level with a SE facing upwards pointing cavity. Depth of cavity could not be confirmed during the ground based assessment. | Low |
| 2 | Silver birch | Location: SE 92992 04861<br>Diameter at breast height: 0.2 m | One rot hole 5 metres from ground level with a 10x30 cm opening. Scratching on top edge of hole (possibly indicating bird/squirrel use) and birds nest at bottom of hole. Cavity extends up | High |

| TREE NUMBER | TREE SPECIES | LOCATION AND DIMENSIONS | DESCRIPTION OF BAT ROOST POTENTIAL | BRP |
|---|---|---|---|---|
| | | | into trunk. | |
| 3 | Silver birch | Location: SE 92994 04867<br>Diameter at breast height: 0.4 m | One rot hole 7 metres from ground level with a 5x20 cm opening. Cavity upward facing and extending at least 5 cm. | Moderate |
| 4 | Silver birch | Location: SE 92958 04885<br>Diameter at breast height: 0.25 m | One rot hole 7 metres from ground level with a 5x20 cm opening. Cavity upward facing and extending at least 10cm. | High |

Bat Activity Surveys

The results of the transect surveys are provided as Annex C, while the results of the static monitoring are provided as Table 4.7. Together, the two datasets indicate that the application site supports only limited bat activity, reflecting the open nature of the application site which is derived from farmland.

The available data identifies the presence of six bat species in association with the application site. These are: common pipistrelle, soprano pipistrelle, noctule (*Nyctalus noctula*), Leisler's (*Nyctalus leisleri*), brown long-eared and an unidentified *Myotis* species (possibly including Natterer's bat). It was not always possible to distinguish between the calls of noctule and Leisler's bat, and in such cases the records are aggregated. It is rarely possible to identify the calls of *Myotis* bats to species level, as the calls of all species are very similar, so such bats were recorded in aggregate, although some records were considered likely to be Natterer's bat. Some bat calls could not be identified to genus / species because the quality of the recorded sound files did not allow determination, however based on other nearby bat activity these are considered likely to represent additional activity by pipistrelle and *Myotis* bats.

Most of the bat activity recorded was attributable to the two species of pipistrelle bat, with *Myotis* bat activity also relatively frequent. All of the other species recorded were present at much lower levels of activity.

The transect surveys recorded bat activity that was closely correlated with the distribution of woodland and other areas with trees, and is therefore largely restricted to east / west movements along the application boundary. There were also some north / south movements of bats through the application site, primarily along the alignment of Waterbody 14 and its associated hedgerow, scrub and scattered trees. Bat activity peaked in the summer months.

The static detector surveys recorded low levels of bat activity, with bat activity indices (BAI) for all locations and seasons in the order of 0.1 passes per minute (Table 4.7). The number of passes recorded cannot be used to determine the actual numbers of bats present. Many of the passes recorded are likely to represent repeat activity by the same individual bats while they foraged in association with optimal habitat. If this is the case, the number of individuals present from each species is likely to be relatively small.

**Table 4.7 Summarised Results of the 2015 Static Monitoring Survey – Species and Relative Frequency of Activity**

| MONTH | NUMBER OF PASSES PER BAT SPECIES (OVER 5 FULL NIGHTS) | MEAN |
|---|---|---|

| | COMMON PIPISTRELLE | SOPRANO PIPISTRELLE | PIPISTRELLE SP. | MYOTIS SP. | MYOTIS/ BROWN LONG-EARED | NOCTULE | NOCTULE/ LEISLER'S | LEISLER'S | BROWN LONG-EARED | UNKNOWN | TOTAL BAT PASSES | NIGHTLY BAT ACTIVITY INDEX (BAT PASSES PER MINUTE) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location 1 (Figure 6)** | | | | | | | | | | | | |
| Spring | 54 | 52 | 0 | 17 | 14 | 6 | 0 | 0 | 3 | 6 | **152** | 0.064 |
| Early-summer | 85 | 36 | 2 | 17 | 0 | 7 | 1 | 1 | 14 | 16 | **179** | 0.081 |
| Late summer | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0.000 |
| **Location 2 (Figure 6)** | | | | | | | | | | | | |
| Spring | 36 | 42 | 3 | 5 | 0 | 3 | 0 | 0 | 0 | 10 | **99** | 0.042 |
| Early-summer | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0.000 |
| Late summer | 21 | 58 | 3 | 11 | 5 | 2 | 0 | 0 | 3 | 0 | **103** | 0.047 |
| **Location 3 (Figure 6)** | | | | | | | | | | | | |
| Spring | 62 | 145 | 7 | 51 | 0 | 2 | 1 | 0 | 0 | 18 | **286** | 0.118 |
| Early-summer | 34 | 6 | 0 | 39 | 0 | 17 | 1 | 0 | 0 | 52 | **149** | 0.068 |
| Late summer | 54 | 49 | 0 | 14 | 0 | 12 | 0 | 0 | 6 | 10 | **145** | 0.065 |

<u>Ecology and Nature Conservation Value</u>

The recorded bat population does not meet any criteria for national or higher ecology and nature conservation value. In the absence of any bat roosts in the potential ZoI of the proposed quarry extension, there are no criteria for the selection of sites of county value for bats (Greater Lincolnshire Biodiversity Partnership, 2013). The value of the foraging / commuting habitat associated with the application site for bats has been assessed (Table 4.8) based on the numbers present and their relative nature conservation value with reference to Wray *et al*. (2010). Overall, the application site is considered to be of district value to foraging and commuting bats.

**Table 4.8 Assessment of the Relative Nature Conservation Value of the Bat Species Recorded from the Application site**

| BAT SPECIES | STATUS IN ENGLAND I.E. COMMON, RARER, RAREST (STATUS IN COUNTY FROM LBAP) | ESTIMATE OF POPULATION SIZE AND NUMBER OF NEARBY ROOSTS, HABITAT SUITABILITY | VALUE |
|---|---|---|---|
| Brown long-eared | Common (county common) | Small numbers, no known on-site/ immediately adjacent roosts, habitat of moderate suitability due to large field sizes, optimal habitats peripheral to the application site with limited habitat connections across the application site. | District |
| Common pipistrelle | Common (county common) | | District |
| Leisler's | Rarer (county rare but thought under-recorded) | | District |
| Myotis sp. | Rarer (county common/ uncommon) | | District |
| Noctule | Rarer (county uncommon) | | District |
| Soprano pipistrelle | Common (county common) | | District |

4.3.4 ***Badger***

No desk study records of badger were returned for the study area.

No setts or other evidence of badger was found within the application site or from accessible adjacent land within 50 metres of the application site, this was still the case in April 2018. On this basis, this species is not considered further in this report.

Adjacent land to the west and south of the application site was not surveyed, however taking account of intervening tracks / roads and the habitat stand-offs that would be incorporated around the working area of the proposed quarry extension, these areas are not relevant as any badger setts present would be outside the zone of influence of the proposed quarry extension.

4.3.5 ***Riparian Mammals***

There are records of otter using lakes to the northeast and southwest of the application site, and records of water vole from Messingham Sand Quarry SSSI.

No evidence of water vole or otter was found within the application site or from connected minor watercourses within 50 metres of the application site. This is supported by previous studies for the quarry to the south of the application site (planning application reference MIN/2008/0532), which found no evidence of water vole in association with the shared watercourse.

Riparian mammals are not relevant and no further consideration is given to them in this assessment.

### 4.3.6 *Reptiles*

Desk Study

LERC returned records of common lizard (*Zootoca vivipara*) and grass snake (*Natrix helvetica*) for Messingham Sand Quarry SSSI.

Field Survey

Areas containing optimal habitat for reptiles were identified during the Phase 1 Habitat survey and targeted for reptile survey. The locations of these optimal habitats coincide with the locations of the artificial reptile refuges shown on Figure 8. These areas are associated with the application site boundary and internal field boundaries. The main body of the fields within the application site were considered sub-optimal for reptiles due to their previous agricultural management, and the presence of a uniform rank grassland sward. Therefore they were scoped out of the survey. This decision was further validated during ecological clerk of works supervision of the archaeological ground investigations undertaken over the period 3$^{rd}$ to 5$^{th}$ August 2015. No reptiles were found in these fields during pre-works inspections, or during supervision of vegetation strimming and the subsequent topsoil strip.

The only reptile species recorded using the application site during the reptile survey (and other ecological walkover surveys) was common lizard, a species listed on S41 of the NERC Act. The results of the reptile survey are summarized below as Table 4.9.

Common lizard was found to be widely distributed in suitable habitats around the magins of the application site, and in other suitable habitats at Target Notes 1 and 8 (Figure 8). There was a particularly strong association with the northern application site boundary adjacent to Waterbody 16 and the internal field boundary along Waterbody 14. There were also regular records in association with the ditch bank and immature plantation at Target Note 1, and occasional records in association with the bracken / woodland edge habitat at Target Note 6 and the area of scrub by Hedgerow 5. Given all of the occupied habitats are connected by other areas of suitable habitat the application site should be considered to support a single common lizard metapopulation.

A maximum count of 12 adult common lizards was recorded from the application site, equating to a 'good' population based on the population size classes defined in Froglife (1999). Juvenile common lizards were observed on several occasions, confirming the presence of a breeding population.

**Table 4.9 Summary Results of the Reptile Survey**

| VISIT | RESULTS |
|---|---|
| 1 | 2 adult common lizards (refuges 63, 118) |
| 2 | 1 adult common lizard (refuge 118) |
| 3 | 12 adult common lizard (refuges 9, 34, 35 63, 78, 79, 112, 131, 134, 140, 143) |
| 4 | 8 adult common lizard (refuges 10, 35, 48, 63, 70, 78, 133,139) |
| 5 | 6 adult and 3 juvenile common lizards (refuges 9, 60, 61, 75, 78, 107, 113, 133, 140, 145) |
| 6 | 2 adult common lizards (refuges 9, 154) |
| 7 | 2 adult common lizards (refuges 120, 121) |
| 8 | 1 adult and 1 juvenile common lizard (refuges 51 and 55) |

Ecology and Nature Conservation Value

Given the extent of the common lizard population and the interconnectivity of the habitats that it is using, it is considered appropriate to assess the status of this species as a single metapopulation.

The survey area does not meet criteria for the identification of sites of national importance for reptiles. As such, the survey area must be of less than national value for reptiles. Greater Lincolnshire Nature Partnership (2013) does not include any specific criteria for the recognition of sites of importance for their common lizard populations, despite the LBAP acknowledging that this species is in decline in the county.

Based on the presence of a viable and breeding 'good' population of common lizard, a species that remains widespread in Lincolnshire but that is listed on S41 of the NERC Act, it is considered that the population associated with the application site is of district ecology and nature conservation value.

### 4.3.7 *Great Crested Newt*

Desk Study

The only great crested newt records returned by the 2018 desk study were those records collected by AECOM from the application site in 2015 (as detailed below).

Field Survey

The results of the great crested newt survey are summarised in Table 4.10. The results of the HSI survey, along with a full breakdown of the great crested newt survey data is provided in Annex G. These data are presented in the formats specified by Natural England in its great crested newt licence application forms, to facilitate a future licence application if required.

Great crested newt was recorded from two ponds (Ponds 4 and 23), both of which are located outside the application site in the sheep-grazed pasture to the north. As maximum counts of less than 10 adult great crested newts were obtained for each pond (10 great crested newts for both ponds in combination), this equates to a 'small' population size class (as defined in English Nature, 2001). Great crested newt eggs were found in Pond 4 confirming that this pond is used for breeding.

It is relevant that Pond 4 is a long established field pond, whereas Pond 23 is of recent origin having been created under an Environmental Stewardship agreement for the benefit of breeding waders. This is likely to explain the greater number of great crested newts recorded from Pond 4, which is considered the main population. Great crested newt can only have colonised Pond 23 recently, because the pond is of recent origin. It would be reasonable to expect there to be interchange of great crested newts between Ponds 4 and 23, because the ponds are so close to each other, such that an ongoing increase in use of Pond 23 would be expected over time as the aquatic habitats develop further. It also seems likely that over time, great crested newts would eventually colonise some of the other recently created ponds in the same field, as they will provide similarly suitable breeding habitat for this species as they become established.

**Note** that it is considered that substantive spread of great crested newt is unlikely to have occurred by the time of this update in April 2018, as there has been insufficient time available for this to occur (there have been just two additional breeding seasons completed since the last survey), and would regardless would still be restricted to ponds outside the land required for the quarry extension.

Of the other amphibian species recorded, the most frequent was smooth newt (*Lissotriton vulgaris*). This species was recorded from 12 ponds, all of which are located outside the application boundary and supported relatively low numbers of smooth newts, with a maximum single pond count of 15 (Table 4.10). Common frog (*Rana temporaria*) and common toad (*Bufo bufo*) were also recorded, and their population sizes may have been under-estimated, as the peak in their breeding activity is typically in advance of the great crested newt survey season. In addition to the ponds subject to great crested newt survey, common frog and common toad were also observed in association with Waterbodies 6 and 15 (drains supporting fish and therefore unsuitable for great crested newt) where adults and spawn were recorded. Common toad is listed on S41 of the NERC Act.

**Table 4.10 Summary of Great Crested Newt Survey Results**

| WATERBODY | MAXIMUM COUNT OF ADULT GREAT CRESTED NEWT | BREEDING CONFIRMED? | OTHER AMPHIBIAN SPECIES PRESENT (WITH MAXIMUM COUNT) |
|---|---|---|---|
| *Waterbodies within the application boundary* | | | |
| 9 | None | - | None |
| 11 | None | - | Frog tadpoles<br>Common toad (1 plus tadpoles) |
| *Waterbodies outside the application boundary* | | | |
| 1 | None | - | None |
| 2 | None | - | None |
| 3 | None | - | Smooth newt (2) |
| 4 | 6 males, 3 females | Yes | Smooth newt (13) |
| 5 | None | - | None |
| 7 | None | - | None |
| 8 | None | - | None |
| 10 | None | - | Smooth newt (1) |
| 19 | None | - | Smooth newt (10) |
| 20 | None | - | Smooth newt (7) |
| 21 | None | - | Smooth newt (1) |
| 22 | None | - | None |
| 23 | 1 male | No | Smooth newt (8)<br>Common frog (1) |
| 24 | None | - | None |
| 25 | None | - | None |
| 26 | None | - | Smooth newt (15) |
| 27 | None | - | Smooth newt (5) |

| WATERBODY | MAXIMUM COUNT OF ADULT GREAT CRESTED NEWT | BREEDING CONFIRMED? | OTHER AMPHIBIAN SPECIES PRESENT (WITH MAXIMUM COUNT) |
|---|---|---|---|
| 28 | None | - | None |

Ecology and Nature Conservation Value

Great crested newts were only recorded from two closely associated off-site ponds, and are considered to relate to a single metapopulation of the species. It is considered unlikely that this species will occur within the application site, based on the relative distance of the breeding ponds from the application boundary. This is considered further in the ecological impact assessment (Section 5.5.8). Common toad uses Pond 11 within the application boundary (this pond will be retained), but this represents only one of a large number of waterbodies suitable for this species in the local area.

Great crested newts and common toad are widespread and considered relatively abundant in Lincolnshire (e.g. Schofield, 2013). In this light, the populations of these species are not considered to merit county or higher ecology and nature conservation value. It is considered that district value is most appropriate for great crested newt, in recognition of the species listing on S41 of the NERC Act and its inclusion in the LBAP. Recent pond creation has the potential to improve the status of this species in the local area over the short to medium term (within 10 years). The common toad population is considered to be of local value only, this species is able to exploit a greater range of freshwaters that great crested newt, and consequently is less habitat limited and more widespread as a consequence.

4.3.8 ***Terrestrial Invertebrate Habitat Appraisal***

The dominant species-poor neutral grassland community present within the application site is considered suitable only for widespread and relatively ubiquitous invertebrate species typically associated with arable and pasture field margins. Likewise, the banks of the north-south drains (Waterbodies 14 and 30, Figure 7) are also of limited interest, being structurally homogenous and offering little botanical variation. The immature plantation (Target Note 1, Figure 1) is also of limited nature conservation value for invertebrates owing to the lack of deadwood (either standing or lying). The grassland, over which these trees are growing, is species-poor, similarly structurally homogenous and the sward is dense, offering no bare areas of ground. These habitats are not of sufficient potential nature conservation interest to require further invertebrate survey.

The waterbody (Waterbody 11) and associated mature crack willows (Target Note 2, Figure 1) were considered of greater potential interest owing to the increased structural variation provided by the tree cover, the associated deadwood resource, and the associated foraging habitat when the trees are in flower. The combination of deadwood (of benefit to saproxylic invertebrates) and early spring nectar resource within this specific location, which is in close proximity and ecologically connected to woodland within Greetwell North LWS, meant that further survey may have been appropriate if this habitat was likely to be affected by the proposed quarry extension. However, this habitat is to be retained and hydrological investigations predict no impact on the pond. Accordingly further surveys were scoped out as they were not material to impact assessment of the proposed quarry extension.

The acid grassland on some of the field margins (particularly Target Note 7) provides an ecotone between the woodland and hedgerows, and the species-poor neutral grassland within the fields. This acid grassland can be considered a poor example of the acid grassland communities present within Greetwell North LWS, based on the description given on the citation for the LWS. Nevertheless, in combination with the woodland, scrub and bramble, there is a mosaic of potential foraging and breeding habitat available for a wide range of invertebrate faunas that are likely to be present within the more extensive heaths and unimproved acid grasslands of the LWS. Further surveys of these areas were undertaken to inform on-site mitigation and enhancement (see Section 4.3.9).

The woodland (Target Notes 4 and 6, Figure 1) provides a range of habitats (lying and standing deadwood in dry and wet environments, foraging habitat e.g. bramble scrub, and open and enclosed areas, including mosaics with acid grassland and bracken communities). This structural heterogeneity is potentially important for terrestrial invertebrates, especially given this part of the application site lies within the boundary of Greetwell North LWS. Given this, further surveys were undertaken to appraise the nature conservation value of this area (see Section 4.3.9).

### 4.3.9 *Terrestrial Invertebrate Survey*

Desk Study

The citation for Greetwell North LWS states that the LWS supports a 'diverse fauna of common moths, butterflies, dragonflies and damselflies'. Messingham Sand Quarry SSSI is also known to support notable invertebrates. Numerous records of butterflies and moths were returned by the desk study, particularly records made at Messingham Sand Quarry SSSI. Given this desk study information, comparable habitats within the application site may be of similar terrestrial invertebrate interest.

Species Recorded by the Field Survey

A wide variety of invertebrate groups were recorded as summarised in Table 4.11 (and detailed in full in Annex H), including those recommended to be studied by Drake *et al.* (2007). The large number of flies identified is largely a result of the primary collecting methods applied, i.e. active sweeping of vegetation / aerial species, which favoured collection of this group. It is not in itself an indication that the application site is specifically important for fly species. Vacuum sampling, water and aerial traps increased the number of beetles, bugs and spiders collected and identified.

A total of eight species (3% of the total recorded) are, or have previously been, considered notable as explained in Table 4.12.

Small heath butterfly (*Coenonympha pamphilus*) and cinnabar moth (*Tyria jacobaea*) were also recorded from the acid grassland community on the southern edge of the woodland. These are listed on S41 of the NERC Act as this is based predominantly on the species lists in the now withdrawn UK Biodiversity Action Plan (UK BAP). However, it should be acknowledged that these species were included on the UK BAP to encourage further research only, and not because they require specific nature conservation action. Accordingly, no further detailed consideration has been given to these two species.

**Table 4.11 Summary of the Main Taxonomic Groups of Terrestrial Invertebrate Identified**

| TAXONOMIC GROUP | NUMBER OF SPECIES |
|---|---|
| Hemiptera (Bugs) | 25 |
| Coleoptera (Beetles) | 57 |
| Diptera (Flies) | 147 |
| Hymenoptera (Bees, wasps, ants etc) | 16 |
| Araneae (Spiders) | 16 |

**Table 4.12 Review of Potential Notable Invertebrate Species Recorded from the Application Site**

| SPECIES | LOCATION | ECOLOGY |
|---|---|---|
| *Alaobia hybrida* (Coleoptera, Staphylinidae) | Woodland | A very rare Red Data Book rove beetle with scattered records from southern England to mid-Scotland. The male collected from the aerial traps represents the fourth confirmed record in Britain since 1913 and only the eighth ever Booth, 1998; Welch, 1999; Boyce, 2008; Denton, 2003). The specimen is a first for VC 54 (North Lincolnshire). |
| *Hippodamia variegata* (Coleoptera, Coccinellidae) Adonis ladybird | Grassland | Previously considered nationally notable but it has recently increased its range, including within Lincolnshire, and it no longer justifies this nature conservation status. |
| *Conopalpus testaceus* (Coleoptera, Melandryidae) | Woodland | Sieved from deadwood. Previously considered nationally notable, it is considered to be under-recorded and has recently been down-graded to Least Concern by Alexander et al. (2014). |
| *Mordellistena neuwaldeggiana* (Coleoptera: Mordellidae) | Woodland | Considered to be Nationally Scarce (Alexander et al. 2014). It breeds in decaying branch-wood and has been reared from hornbeam and field maple in the early stages of decay (Alexander, 2002). Adults are attracted to nectar sources such as hogweed flowers. Collected in the aerial interception trap in the woodland. |
| *Keroplatys testaceus* (Diptera, Keroplatidae) | Woodland | A Nationally Scarce fungus gnat associated with old, broad-leaved woodland and has a requirement for damp rotten wood, usually with bracket fungi in shaded conditions. The larvae live under the bark within a mucous web, frequently underneath fungi, which has been interpreted as a potential food source as they may be spore-feeders (Falk and Chandler, 2005). |
| *Dichetophora finlandica* (Diptera, Sciomyzidae) | Woodland | This Red Data Book 3 (Rare) snail-killing fly is known from the region, i.e. south-east Yorkshire and north Lincolnshire; however, the majority of records are for the fens and heaths of East Anglia and the East Midlands (Falk, 1991). The fly's larvae probably feed on aquatic pulmonate snails and on the continent it has been recorded from vegetation within wet woodlands, marshes and edge of watercourses (Rozkošný, 1984). A single individual was collected in the water-trap located in the woodland. |
| *Fannia speciosa* | Woodland | A Nationally Scarce lesser housefly considered to be |

| SPECIES | LOCATION | ECOLOGY |
| --- | --- | --- |
| (Diptera, Fanniidae) | | associated with mature semi-natural woodland. D'Assis Fonseca (1968) only knew of it from a few locations in southern and south-western England. A single specimen was collected by sweeping within the woodland. |
| *Achaearanea riparia* (Arachnida, Theridiidae) | Grassland | A nationally notable spider, predominantly known from southern England (Spider Recording Scheme, 2015). It is associated with heathland and woodland rides where it constructs its specialised web, connecting overhanging vegetation (e.g. grass stems) to the ground to capture invertebrates such as ants that live of the soil surface. A single male was vacuum sampled from the acid grassland on the edge of the woodland at Target Note 7. This represents the first record for VC 54 (North Lincolnshire) |

Terrestrial Invertebrate Community Analysis

A total of 38 stenotopic species (i.e. those with a restricted habitat requirement), 14% of the total invertebrate fauna, were recorded within the targeted woodland and acid grassland habitats (Table 4.13). Of these, 15 species (*c*. 40%) have an association with wood decay habitats (sapwood, heartwood and fungi associated with deadwood).

These stenotopic species include three beetle species relevant to the IEC method. These were recorded within the woodland (*Orchesia undulata*, *Conopalpus testaceus* and *Mordellistena neuwaldeggiana*) and had a combined index score of nine. Based on this score, the woodland is of less than regional importance for its deadwood (saproxylic) beetle fauna.

A second significant group, comprising 20 species (*c*. 52% of the stenotopic species recorded), were recorded in association with the flower-rich resource and short swards/ bare ground on the woodland edge. These can be considered species reliant on the acid grassland and open bracken communities.

Species habitat dependencies can be investigated further based on the BAT approach (Table 4.14). Based on rarity scores, the analysis presented in Table 4.13 shows that the acid grassland and edge habitats and the wood decay habitats are particularly important for terrestrial invertebrates. Just over 100 species are reliant on these habitats (40% of the species recorded). A further 35 species, all associated with the woodland, make an important contribution to the invertebrate fauna of the application site. Therefore, more than half (53%) of the invertebrates recorded are reliant to some extent on the woodland and acid grassland habitats present within the application site.

Whilst Tables 4.13 and 4.14 are useful, a degree of caution needs to be applied in using them to evaluate nature conservation value as there will inevitably be some bias (detracting or enhancing) to the rarity scores within the analysis. Furthermore, approaching (as in this instance), meeting or exceeding the threshold for 'favourable condition' is not necessarily solely indicative that the assemblages are of national significance, as other factors need to be taken in to account. Nevertheless, the ISIS approach does provide a useful guide when assessing the significance of the habitats surveyed and studied within the application site.

Based on rarity and the thresholds published in Drake *et al*. (2007), none of the invertebrate assemblages recorded achieved the rarity score threshold considered to represent 'favourable status' if the application site was being monitored as if it were a SSSI.

Ecology and Nature Conservation Value

For the purposes of assessment, the grassland and woodland habitats are considered integral to each other in terms of maintenance of the invertebrate species assemblage recorded. This is because the invertebrate species assemblage (as reflected by ISIS) requires both grassland and woodland habitats. Two examples of species that support this comment are the Nationally Scarce tumbling flower beetle, *Mordellistena neuwaldeggiana*, which requires deadwood for breeding and nectar sources as an adult, and the stenotopic solitary bee *Hylaeus confusus* which nests in hollow plant stems and similar small cavities but requires nectar resources as an adult.

The ISIS and IEC analysis determines that the assemblage is of below national value, but consideration needs to be given to the individual weighting that should be placed on the three Red Data Book species recorded, i.e. the rove beetle *Alaobia hybrida*, the snail-killing fly *Dichetophora finlandica*, and the comb-footed spider *Achaearanea riparia*. Consideration of the context of the application site is helpful in drawing a conclusion.

The application site includes a small part of the western corner of Greetwell North LWS, which has been designated for its woodland and sandy grassland communities. The LWS shares its northern boundary with Unit 3 (Greetwell Bog) of the Manton and Twigmoor SSSI, which has been designated for its acid grassland and dry and wet heath communities. Thus the SSSI and LWS are contiguous and would appear from their citations and field evidence to share habitats. The invertebrate assemblage recorded within the application site reflects the habitats present within this wider landscape as encompassed within the boundaries of the LWS and SSSI, with just over half having some reliance and c. 14% are stenotopic on these habitats. Therefore the assemblages and rare species recorded within the application site are also likely to be present in the wider LWS and the SSSI. This reduces the relative importance of the application site to the availability of suitable habitat for the relevant invertebrates.

On balance, and taking into account the ISIS analysis, IEC index, context with adjacent land designations and the importance that could be attached to the RDB and nationally notable/ scarce species, it would seem reasonable to conclude that the woodland and acid grassland communities within the application site are collectively of County value for their invertebrate assemblage.

**Table 4.13 Assessment of Species Assemblage Types (SATs)**

| SAT NAME | NUMBER OF SPECIES | % OF NATIONAL SPECIES POOL | RELATED BROAD ASSEMBLAGE TYPE (BAT) RARITY SCORE |
|---|---|---|---|
| Bark and sapwood decay | 12 | 2 | 152 |
| Rich flower resource | 7 | 3 | - |
| Scrub edge | 6 | 3 | - |
| Open short sward | 3 | 2 | 130 |
| Bare sand and chalk | 3 | 3 | 130 |
| Fungal fruiting bodies | 2 | 2 | 152 |
| Heartwood decay | 1 | 1 | 152 |
| Reed fen and pools | 1 | 1 | - |

**Table 4.14 Invertebrate Species-habitat Information System Assessment of Broad Assemblage Types (BATs)**

| BAT NAME | REPRESENTATION (1 TO 100) | RARITY SCORE | CONDITION THRESHOLD[1] | BAT SPECIES RICHNESS |
|---|---|---|---|---|
| Grassland and scrub matrix | 32 | 118 | 160 | 74 |
| Wood decay | 10 | 152 | 190 | 23 |
| Unshaded early successional matrix | 9 | 130 | 160 | 20 |
| Shaded field and ground layer | 7 | 125 | 150 | 16 |
| Permanent wet mire | 6 | - | 160 | 13 |
| Arboreal canopy | 5 | - | 170 | 10 |

4.3.10 ***Aquatic Macroinvertebrate Survey***

Desk Study

No records of aquatic invertebrates were returned for the application site. Several records were returned for Messingham Sand Quarry SSSI but as these are not considered relevant to assessment of the site they are not considered further.

Field Survey

Table 4.15 provides the results of the macroinvertebrate analysis of Waterbodies 6, 14, 16 (sample sites 1 and 2) and 30 (Figure 7). Where species identification was not certain (e.g. due to insufficiently mature specimens, damaged specimens or specimens of the 'wrong' sex for identification purposes) any tentative identifications are recorded as 'cf.'

All of the ditches were characterised by a low to moderate diversity of macroinvertebrate species, with those recorded typical of slow flowing drain habitats.

A total of 39 taxa were recorded from the five sample sites, of which 21 were identified to species level and a further 20 identified to genus, family or higher taxonomic levels. The most diverse group in terms of species was beetles (nine species); although several species of caddisfly, true fly and true bugs were also present. The majority of the species recorded were common and are considered to be of low conservation value; however, some more notable species were also present, as discussed below. None of the species recorded are legally protected or listed on S41 of the NERC Act or in the LBAP.

Waterbody 6 had the highest taxon richness, with 23 taxa recorded, including at least seven species of water beetle (Dytiscidae, Hydrophilidae), several true bugs (Gerridae, Pleidae, Corixidae, Hydrometridae) and true fly larvae (Chironomidae, Limoniidae, Psychodidae, Chaoboridae); albeit in low numbers. In addition, moderately water quality sensitive damselfly (Coenagrionidae) larvae were also recorded. This suggests a moderate biological quality (BMWP score 57, ASPT 4.4), and communities potentially moderately sensitive to changes in water quality. Although most of the species recorded are relatively common, the CCI score (10.7) is indicative of 'fairly high' conservation value. This can be explained by the presence of

[1] Condition thresholds are considered to represent when an invertebrate community has reached a rarity level such that if the habitat studied was in a SSSI and the threshold was met/ passed, it would be considered to be in favourable condition. The condition threshold can therefore provide some guidance as to the nature conservation value of the community it applies to and therefore the study application site.

two species of water beetle (*Ilybius quadriguttatus* and *Rhantus exsoletus*) with Conservation Scores of 5 (Local). See Table 4.16 for additional comment on these species.

Waterbody 14 had a moderate taxonomic diversity (15 taxa recorded), with the most abundant taxa being mussels (*Pisidium* sp.) and crustaceans (*Gammarus pulex*, *Asellus meridianus*), although leeches, true flies, and larvae of the moderately pollution sensitive caddisfly Limnephilidae were also recorded. This community suggests a poor biological quality (BMWP score 37, ASPT 3.7), and the community is likely to be relatively tolerant of changes in water quality. All of the species recorded are very common and widespread, as indicated by the low CCI score (4.5) suggesting that the ditch is of “Low” conservation value (<5).

Taxon richness within Waterbody 16 was relatively low with 11 to 13 taxa recorded. Sample site 1 was dominated by true flies (Limoniidae, Tipulidae, Chironomidae, Psychodidae), while at sample site 2, snails (*Armiger crista*, *Radix balthica*), true bugs (*Gerris* sp., *Hesperocorixa sahlbergi*, *Notonecta* sp.) and beetle larvae (Dysticidae) were also recorded. In addition, abundances were generally very low at sample site 1 across all taxa, which may indicate that this stretch of the drain dries up periodically, or has experienced recent habitat disturbance. The results for Waterbody 16 suggest a poor biological quality (BMWP scores 30 to 37, ASPT 3.7 to 3.8) and a community that is likely to be relatively tolerant to changes in water quality.

In terms of conservation value, all species recorded at sample site 1 were very common, as shown by the CCI score (4.5), indicative of a low conservation value. At sample site 2 most of the species recorded were again very common, but the Nationally Scarce diving beetle *Acilius sulcatus* (Conservation Score of 7: Notable but not RDB status) was also present (Foster, 2010). As a result, the CCI score derived for sample site 2 is indicative of a high conservation value. See the additional comments on this species given in Table 4.16.

Waterbody 30 had the lowest taxon richness (six recorded taxa) of all of the waterbodies. The community was dominated by pea mussels (*Pisidium sp.*) and crustaceans (*Gammarus pulex*). This suggests a poor biological quality, as reflected by the low BMWP score (22) and ASPT (3.7), and a community that is likely to be tolerant to changes in water quality. All of the species recorded are common and widespread, as indicated by the low CCI score (1), which suggests the ditch is of low conservation value (<5).

**Table 4.15 Macroinvertebrate Survey Results**

| BMWP GROUP | SPECIES | BMWP SCORE | CONSERVATION SCORE | WATERBODY | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 6 | 14 | 16 (SITE 1) | 16 (SITE 2) | 30 |
| **Snails** | | | | | | | | |
| Lymnaeidae | *Radix balthica* | **3** | **1** | | | | 24 | |
| Planorbidae | Planordiibae (damaged) | **3** | | 1 | | | | |
| | *Armiger crista* | | **2** | | 2 | | 324 | |
| **Limpets and mussels** | | | | | | | | |
| Sphaeridae | *Pisidium sp.* | **3** | | | 250 | | | 96 |
| **Worms** | | | | | | | | |
| Oligochaeta | Oligochaeta | **1** | | | 3 | 3 | | 3 |
| **Leeches** | | | | | | | | |
| Glossiphoniid | *Glossiphoni* | **3** | **1** | | 3 | 1 | | 2 |

| BMWP GROUP | SPECIES | BMWP SCORE | CONSERVATION SCORE | WATERBODY | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 6 | 14 | 16 (SITE 1) | 16 (SITE 2) | 30 |
| ae | *a complanata* | | | | | | | |
| | *Helobdella stagnalis* | | **1** | 1 | 1 | | | |
| **Mites** | | | | | | | | |
| Hydracarina | Hydracarina | **-** | | | 1 | | 1 | |
| **Crustaceans** | | | | | | | | |
| Gammaridae | *Gammarus pulex* | **6** | **1** | 20 | 70 | | | 51 |
| Asellidae | *Asellus meridianus* | **3** | **3** | 39 | 25 | | | |
| **Mayflies** | | | | | | | | |
| Baetidae | Baetidae (damaged) | **4** | | 1 | | | | |
| **Damselflies** | | | | | | | | |
| Coenagrionidae | Coenagrionidae (damaged) | **6** | | 2 | | | | |
| **True bugs** | | | | | | | | |
| Gerridae | *Gerris lacustris* | **5** | **1** | 1 | | | | |
| | *Gerris sp.* | | **2** | | | | 1 | |
| Nepidae | *Nepa cinerea* | **5** | **3** | | | 1 | | |
| Pleidae | *Plea minutissima* | **5** | **4** | 1 | | | | |
| Corixidae | *Hesperocorixa sahlbergi* | **5** | **2** | 1 | | | 2 | |
| Hydrometridae | *Hydrometra stagnorum* | **-** | **2** | 1 | | | | |
| Notonectidae | *Notonecta sp.* (damaged) | **5** | | | | | 1 | |
| **Beetles** | | | | | | | | |
| Dytiscidae | Larvae | **5** | | 42 | | | 32 | |
| | *Laccophilus minutus* | | **2** | 1 | | | | |
| | *Agabus bipustulatus* | | **1** | 1 | | 1 | | |
| | *Agabus sturmii* | | **1** | 1 | | | | |
| | *Ilybius fuliginosus* | | **1** | 1 | | | | |
| | *Ilybius quadriguttatus* | | **5** | 1 | | | | |
| | *Rhantus* | | **5** | 1 | | | | |

| BMWP GROUP | SPECIES | BMWP SCORE | CONSERVATION SCORE | WATERBODY | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 6 | 14 | 16 (SITE 1) | 16 (SITE 2) | 30 |
| | *exsoletus* | | | | | | | |
| | *Acilius canaliculatus* | | **7** | | | | 1 | |
| Hydrophilidae | Hydrophilidae (damaged) | **5** | | 1 | | | | |
| | *Hydrobius fuscipes* | | **1** | | | | 1 | |
| | *Anacaena globulus* | | **1** | 1 | | | | |
| Scirtidae | Larvae | **5** | | | 4 | | | 1 |
| **Alderflies** | | | | | | | | |
| Sialidae | *Sialis lutaria* | **4** | **1** | | 15 | 2 | | 10 |
| **Caddisflies** | | | | | | | | |
| Limnephilidae | Limnephilidae (Juvenile) | **7** | | | 8 | | | |
| **True flies** | | | | | | | | |
| Chironomidae | Orthocladiinae / Diamesinae | **2** | | 2 | 2 | 2 | | |
| | Chironominae | | | 2 | 2 | 3 | 52 | |
| | Tanypodinae | | | | 12 | | | |
| Limoniidae | *Neolimnomyia sp.* | **5** | | | | 5 | | |
| | *Helius sp.* | | | 6 | | 3 | 1 | |
| Tipulidae | Pupae | **5** | | | | 1 | | |
| Dixidae | Dixella sp. | **-** | | 3 | | | | |
| Psychodidae | *Pericoma sp.* | **-** | | 1 | 2 | 2 | | |
| | Pupae | **-** | | 3 | | 1 | 1 | |
| Chaoboridae | Chaoboridae | **-** | | 3 | | | 12 | |
| **Other Taxa** | | | | | | | | |
| Sciomyzidae | Sciomyzidae | **-** | | | | | 1 | |
| **Number of BMWP scoring families** | | | | 13 | 10 | 8 | 9 | 6 |
| **Number of non-scoring families** | | | | 3 | 2 | 1 | 4 | 0 |
| **Total number of families** | | | | 16 | 12 | 9 | 13 | 6 |
| **BMWP score** | | | | **57** | **37** | **30** | **38** | **22** |
| **ASPT** | | | | **4.4** | **3.7** | **3.8** | **4.2** | **3.7** |
| **CCI Score** | | | | **10.7** | **4.5** | **4.5** | **18.2** | **1.0** |

**Table 4.16 Summary of the Notable Macroinvertebrate Species Recorded (Conservation Score > 5)**

| SPECIES | RELEVANT WATERBODY | STATUS & CONSERVATION SCORE | HABITAT AND DISTRIBUTION |
|---|---|---|---|
| *Acilius canaliculatus* (diving beetle) | 16 | Nationally Scarce but not threatened (Foster, 2010). Conservation Score 7 (Notable but not RDB status). | This species is typical of peat cuttings and is often found in shallow, well vegetated pools and fens, sometimes in part shade. Patchily distributed in England in lowland areas of Yorkshire and North Lincolnshire (Foster *et al*. 2011). Previous records for North Lincolnshire. |
| *Ilybius quadriguttatus* (diving beetle) | 6 | Not Nationally Scarce or threatened (Foster, 2010). Conservation Score 5 (Local but not RDB status). | In densely vegetated permanent ponds, ditches and canals, widely distributed (Foster *et al*. 2011). Previous records for North Lincolnshire. |
| *Rhantus exsoletus* (diving beetle) | 6 | Not Nationally Scarce or threatened (Foster, 2010). Conservation Score 5 (Local but not RDB status). | Found amongst vegetation on the margins of lowland lakes, reservoirs and ponds usually in acid or mesotrophic conditions, (Foster *et al*. 2011). Previous records for North Lincolnshire. |

<u>Ecology and Nature Conservation Value</u>

Waterbodies 6 and 16 support notable aquatic invertebrate assemblages that include three uncommon and/or Nationally Scarce species of diving beetle. These species of diving beetle are of local distribution but there are other occurrences in North Lincolnshire, suggesting that suitable habitat conditions occur more widely and that the site is not of specific importance for these species.

However, as with the terrestrial invertebrates, this has a bearing on but does not negate the relative value of the populations of notable species, the wider assemblage and the significance and nature conservation value of their supporting habitats associated with the site. While suitable habitats occur more widely it can be assumed that they are only of local occurrence given the relative rarity of the most notable species present (the three diving beetles). Balancing these various considerations, the aquatic invertebrate assemblages of Waterbodies 6 and 16 are considered to be of county ecology and nature conservation value.

The remaining waterbodies are of relatively low importance for aquatic invertebrates and considered to be of no more than local ecology and nature conservation value.

# 5 IMPACT ASSESSMENT

## 5.1 Approach

The assessment approach adopted is based upon recognised techniques of ecological impact assessment published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2016) and is summarised below.

### 5.1.1 *Characterising potential ecological impacts - terminology*

When describing potential impacts (and where relevant the resultant effects) reference is made to the following characteristics:

- Beneficial/ adverse - is the change likely to be in accordance with nature conservation objectives and policy:
    - Beneficial - a change that results in net ecological gain through improvements to the ecological quality of the natural or built environment, or by making a meaningful contribution to measures to halt or slow an existing ecological decline in quality. In some cases beneficial effects will be integral to the development as designed, while in other cases beneficial effects will be delivered through subsequent agreement of an ecological enhancement scheme;
    - Adverse - a change that reduces the quality of the natural environment e.g. through degradation, loss or fragmentation of habitat, or reduced survival rates or recruitment within species populations.
- Spatial extent - the spatial or geographical area or distance over which the impact/ effect occurs;
- Duration - the time over which an impact is expected to last prior to recovery or replacement of the ecological feature. Where practicable, consideration will be given to how this duration relates to relevant ecological characteristics e.g. the lifecycle of a species. However, it will not always be appropriate to report the duration of impacts in these terms. The duration of an effect may be longer than the duration of an activity or impact;
- Reversibility - whether the impact temporary or permanent. A temporary impact is one from which recovery is possible or for which effective mitigation is both possible and enforceable. A permanent effect is one from which recovery is either not possible, or cannot be achieved within a reasonable timescale meaningful for the ecological feature under consideration; and
- Timing and frequency - i.e. consideration of the point at which the impact occurs in relation to critical life-stages or seasons.

Together the above characteristics influence the relative size or scale (magnitude) of the potential impact and whether or not the resultant effect is likely to be considered significant (see Section 5.1.2).

### 5.1.2 *Method for determining the significance of effects*

The CIEEM (2016) states that: "*For the purposes of EcIA a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological* *features*[2] (i.e. relevant ecological features) *or for biodiversity in general … In broad terms, significant effects encompass impacts on the structure and function of defined application sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)."*

The assessment approach follows the good practice guidelines for EcIA described in CIEEM (2016). For each ecological feature only those characteristics relevant to understanding the ecological consequences (effect) of the impact and its relative significance are described, based on the project description and the assumption that standard industry best practice would be applied (e.g. implementation of standard dust suppression and pollution prevention measures).

Potential impacts on each relevant ecological feature are considered and a judgement made on whether or not the combined effect arising from these individual impacts are likely to be significant. This process takes into consideration the characteristics of the impact, the sensitivity of the ecological feature concerned and the geographic scale at which the feature is considered of importance.

For nature conservation designations, other defined habitats and ecosystems the assessment considers what effect the potential impacts are likely to have on conservation objectives or interest/ qualifying features. For ecosystems, consideration is given to whether a change in ecosystem structure and/ or function is likely that would substantively alter its ecological integrity.

For habitats and species, the assessment considers what effect the potential impacts will have on "conservation status", and whether or not the effect is likely to substantively alter the ecological integrity of the habitat or species under consideration. Further guidance on how to assess conservation status is provided in CIEEM (2016) as follows:

- For habitats: "*conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area.*"

- For species: "*conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area*."

In considering effects on conservation status, reference is made to relevant available guidance on the current conservation status of the ecological feature under consideration. Effects will either be:

- Not significant (i.e. no ecologically meaningful effect on conservation status); or

- Significant (i.e. an ecologically meaningful effect on conservation status).

Such judgements will be based, wherever possible, on quantitative evidence. However, where necessary the professional judgement of an experienced ecologist will be applied.

For those effects considered significant, the effect will also be characterised as appropriate (e.g. adverse or beneficial), and qualified with reference to the geographic scale at which the effect is significant (e.g. an adverse effect significant at a national level).

The scale of significance of an effect may not be the same as the geographic context in which the feature is considered important. For example, a local effect on a species of principal

[2] The term 'important ecological features' used in the 2nd Edition of the CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2016) is equivalent to the term 'relevant ecological features' used throughout this EcIA.

importance for nature conservation at the national level (as listed on NERC Act s41) may not have a significant effect on the national population of that species.

### 5.1.3 *Mitigation principles*

The identification and specification of mitigation proposals in this assessment has been undertaken with regard to the principles of the mitigation hierarchy i.e.:

1. Avoid ecological features where possible;
2. Reduce (minimise) the magnitude of the potential impact to occur e.g. through iterative design and/ or advance commitment to sensitive methods or timing of working (sometimes termed as embedded mitigation or mitigation by design);
3. Mitigate the potential effect through the application of additional proven measures, such that the residual effect realised is reduced in magnitude (non-embedded mitigation); and
4. Compensate for significant residual effects, e.g. by providing suitable habitats elsewhere. Proposals should achieve appropriate compensation in a reasonable timeframe and be legally enforceable.

This hierarchy requires the highest level to be applied where possible. Only where this cannot reasonably be adopted should lower levels be considered. Where it is reasonably practicable to do so then attempts have been made to avoid potential impacts. Where impacts cannot be avoided then efforts have been made to limit the magnitude of the potential impact and to mitigate the resultant effects through the provision of appropriate measures. Where effects cannot be mitigated to a level where they are not significant then compensatory measures have been employed to (as far as is reasonably possible) offset any remaining adverse effects.

This assessment deals principally with the last two steps in this mitigation hierarchy namely the provision of mitigation and compensation. Alternative options considered are detailed in Section 4 of the main ES. Measures taken to reduce the magnitude of potential impact are incorporated into the proposal as described in the Planning Statement, and are summarised in Section 5.3 of this EcIA.

### 5.1.4 *Assessment of cumulative effects*

Cumulative effect assessment is required only where the cumulative effect of a proposal, taken with other existing or proposed projects, could be a major factor in determining the acceptability of a development and hence may affect the eventual planning decision. It is considered unlikely that the proposed quarry extension would result in significant cumulative effects, and as explained below the assessment of cumulative effects is scoped out.

This is based on consideration of the location of the application site in a predominantly rural landscape away from other sources of comparable impact (the presence of the existing Messingham Quarry excepted), the limited ZoI associated with the proposed quarry extension as determined with reference to the project description and the other assessments submitted with the ES, the relatively limited scale and duration of the proposed development including progressive restoration to agriculture and nature conservation, and the ecological baseline conditions described in Section 4 of this Technical Appendix.

While, it is acknowledged that the proposed quarry extension would be worked in parallel or in succession with other previously consented quarry phases, no ecological constraints have been identified to date that would indicate that the proposed quarry extension would result in cumulative effects material to determination of the planning application. In reaching this determination, regard has been given to the proposed new haul road on land to the south that would service the proposed quarry extension. The ecological assessment of the proposed haul road has confirmed that it would not result in any significant ecological effects. This is because it is primarily aligned to follow an established haul route, and the required new landtake would be almost entirely restricted to land that was quarried in the recent past and that is still in the early stages of restoration.

### 5.1.5 *Assessment limitations*

The proposed quarry extension would be implemented using standard quarrying and restoration techniques as currently employed on adjacent land, and the relevant ecological features have been defined through appropriate survey. There is sufficient information available from the ecological surveys and about the works involved in the proposed quarry extension to carry out an ecological impact assessment with confidence in the findings presented in this report.

## 5.2 Future Baseline

It is considered unlikely that there would be any marked change in the ecological baseline conditions over the short to medium term (within the next 10 years), in the run up to commencement of the proposed quarry extension. All existing habitats would continue to be present, although some minor changes in habitat composition and structure might occur as a result of ecological succession e.g. the gradual establishment of tree and shrub seedlings in unmanaged grassland.

The habitats present would likely continue to support a comparable assemblage of species, including the relevant species detailed in this assessment. Changes in the distribution of some species would be likely to occur in line with changes in habitats as a result of ecological succession, but over the short to medium term (within the next 10 years) any such changes are likely to be relatively minor. There is likely to be movement of mobile species regardless of changes in land-use and habitat context.

Given no significant change in the baseline conditions is anticipated, the existing baseline data provides an appropriate basis the following EcIA.

## 5.3 Summary of Embedded Mitigation

The proposed quarry extension would be implemented and operated in manner that complies with the requirements of relevant legislation. The following additional measures would be applied when implementing the proposed quarry extension to avoid or reduce potential ecological effects. These measures are:

- implementation of a stand-off between the limit of extraction and all external application site boundaries, within which habitats would be retained and relevant protected species (e.g. reptiles) maintained. This would be a minimum 10 metres wide, but larger in many cases e.g. 25 metres along the southern boundary. This takes account of requirements for protected species mitigation and the maintenance of appropriate tree root protection zones;

- application site entrance off Brigg Road coincides with an existing gap in the boundary hedgerow and therefore does not require hedgerow removal. While the hedgerow on either side of the entrance to the mineral stockpile at the existing main site requires pruning to improve visibility sightlines, but requirements are comparable to typical hedgerow management regimes and do not require specific impact assessment as no hedgerow or tree removal is required;

- the application site would not be lit and no processing plant would be installed;

- topsoil is to be stockpiled on species-poor neutral grassland and away from retained boundary habitats where there would be a risk of interaction with relevant protected species (reptiles);
- de-watering would only be undertaken 1st March to 31st October, minimising the potential hydrological effect on adjacent habitats both during mineral working and post-working; hydrological studies have confirmed that there are no pathways for a hydrological effect on retained ponds and surrounding designations. The radius of influence for de-watering is shown on Figure 4 of the Hydrogeological Assessment (ES Appendix I); and
- commitment to restore 11.3 ha (67%) of the habitat area lost to a nature conservation end use, with the remaining 5.6 ha of best and most versatile land reinstated as an arable field. This arable land will have an associated biodiversity value, but will be managed primarily for agricultural production. Additional peripheral land within the application boundary, but outwith the working area, would also be incorporated into the area allocated for nature conservation as shown on the proposed restoration scheme submitted with the ES.

## 5.4 Summary of Relevant Ecological Features

Only potential impacts on ecological features of district and above ecological value are assessed, except where relevant legislation or planning policy indicates that certain local value ecological features should be considered further. Ecological features of local value are not considered noteworthy beyond the level of the application site and its immediate environs and are therefore considered typical of the wider landscape within which the proposed quarry extension is located, in the county and nationally. By inference any impact on ecological features of local value are within the capacity of the environment to absorb and are unlikely to result in a significant adverse effect on their wider conservation status of the relevant ecological features.

Based on the defined baseline conditions and the embedded mitigation described in Section 5.3, the relevant ecological features requiring assessment are summarised in Table 5.1 below. In addition, breeding birds and great crested newt are assessed with reference to the legal protection afforded to them.

No pathways for an impact on other ecological features, including nature conservation designations and habitats located outside the planning application boundary, are identified. This is supported by the assessment of potential impacts on groundwater regimes as described in the hydrogeology assessment (ES Appendix I).

**Table 5.1 Relevant Ecological Features and Potential Adverse Effects**

| ECOLOGICAL FEATURE | GEOGRAPHIC VALUE | POTENTIAL IMPACT | POTENTIAL EFFECT |
|---|---|---|---|
| Greetwell North LWS | County | Loss of 0.9 ha of secondary broad-leaved woodland.<br>Interception of groundwater and reduced availability during periods of de-watering. | Potential reduction in conservation status of LWS and its component habitats. |

| ECOLOGICAL FEATURE | GEOGRAPHIC VALUE | POTENTIAL IMPACT | POTENTIAL EFFECT |
|---|---|---|---|
| Acid grassland and associated notable flora | County | Loss of 0.2 ha of habitat. | Reduction in conservation status within the ZoI, including dependent flora and fauna. |
| Terrestrial invertebrates | County | Loss of habitat. | Loss of notable species and decline in value of the assemblage within the ZoI, with potential consequences for conservation status. |
| Aquatic invertebrates | County | Loss of habitat due to changes in hydrology and flow of key waterbodies | Loss of notable species and decline in value of the assemblage within the ZoI, with potential consequences for conservation status. |
| Common lizard | District | Loss and degradation of 1 ha of habitat of functional importance.<br>Potential injury or mortality. | Reduction in conservation status potentially leading to decline or loss in the ZoI. |
| Bats | District | Loss of foraging and commuting habitat. | Reduction in conservation status. |

## 5.5 Potential Effects and Mitigation Measures

### 5.5.1 *Greetwell North LWS*

Impacts requiring assessment for their potential to produce a significant effect on the conservation status of the non-statutory Greetwell North LWS are:

- woodland clearance for Phase 1 of the proposed quarry extension; and
- alteration to the groundwater hydrology of the surrounding retained woodland due to de-watering operations.

Impacts on associated protected species are assessed separately. Land take requirements have been reduced by the maintenance of a habitat buffer along the northern edge of the proposed quarry extension (within the application boundary), within which the existing tree cover would be maintained.

Phase 1 of the proposed quarry extension would result in the loss of 0.9 ha of secondary broad-leaved woodland within the boundary of a LWS of county value. This total includes the adjacent bracken, which complements the woodland and occurs in a setting functionally equivalent to a woodland glade. The LWS has a total area of 65.4 ha, and therefore the proposed land take would result in the permanent loss of 1.4% of the LWS area. The habitat loss would be peripheral, being restricted to a relatively small area at the southwest corner of the LWS. Therefore the habitat loss would not result in habitat severance within the LWS, and habitat connectivity of the remaining habitat would be maintained. There would also be no material change in the habitat context of the LWS boundary adjacent to the proposed quarry extension, and therefore the context of other habitats within the LWS would not change.

The LWS boundary would remain wooded and would continue to screen other habitats located further into the LWS to the north and east. Indeed, the re-configuration of the LWS boundary would result in a small increase in woodland edge habitat, which may be beneficial for certain dependent species. Given these considerations, it is unlikely that the functional integrity necessary to maintain the wider conservation status of the LWS would be substantively altered. The development would not affect the ongoing maintenance and favourable management of the ecological interest of the remaining area of the LWS.

The woodland that would be lost to the proposed quarry extension occupies a basin comprising W2 wet woodland in the low lying wetter centre of the woodland and an associated peripheral area of drier W4 woodland on areas of higher ground (see section 4.2.2 for a description of the woodland). The balance between the two woodland types is estimated to be 50:50, i.e. +/- 0.45 ha of each woodland sub-type. These wet and dry woodland habitats represent some of the main habitats within the LWS, based on information on the LWS citation, and therefore the habitat loss is unlikely to result in the complete loss of these habitats, which by inference must be widespread. The LWS citation does not provide data on the relative extent of the component habitats of the LWS, but based on examination of recent aerial photography it appears that semi-natural woodland comprises at least 50% of the total area. In this light, the permanent habitat loss comprises c. 3% of the woodland habitats in the LWS. While 3% is not a trivial loss, by inference 97% of the existing woodland cover would be maintained. Therefore, the habitat context of the LWS would not substantively change, and habitat structure and function would be expected to remain comparable to the baseline situation. In addition, the results of the NVC survey do not indicate that the affected area of woodland is of specific integral importance to the biological interest of the LWS, and it is considered that the boundary of the LWS will have been defined based on the maximum extent of comparable semi-natural habitats, rather than being demarcated to encompass only those habitats of highest biodiversity value.

The LBAP estimates the county wet woodland resource at a maximum of 200 ha, therefore the woodland in the application site represents 0.2% of the total area. While the removal of this woodland runs counter to local objectives for LBAP habitat maintenance and restoration, the loss of such a small area of relatively species-poor wet woodland is unlikely to be of any more than local significance.

The woodland area to be removed is of relatively recent origin and is therefore semi-mature and supports only a limited ground flora, and does not include plant species that would be indicative of a long-history of woodland cover e.g. bluebell (*Hyacinthoides non-scripta*). The woodland is dominated by fast growing tree species, particularly birches and scrubby species of willow. These tree species are rapidly colonisers of new ground, as their seeds are wind dispersed. A side effect of the dominance of willows in much of the woodland is that these provide dense shade during the growing season. This reduces the ability of ground flora to colonise and therefore may explain the current limited development of wet woodland ground flora.

The recent origin of the woodland, along with considerations based on its species composition, makes it reasonable to expect that meaningful habitat compensation (Section 6) can be delivered and in a reasonable timeframe relative to the current estimated age of the existing woodland (c. 30 to 40 years of age), such that the habitat loss can be considered temporary and medium term (woodland cover re-establishing within 15 years). Over the longer term, the new woodland would have comparable opportunity to accrue ecological value as the existing baseline woodland, which as stated above has not achieved the floral diversity and structure typical of mature long-established woodland of the same NVC community types. Similarly, the woodland (in isolation from consideration of the wider LWS) has not yet achieved sufficient floral diversity to meet criteria for the selection of LWS for wet woodland. It is unlikely to achieve this target over the short to medium term (within the next 10 years).

In addition to the ecological effect resulting from the woodland loss, there is also a need to consider relevant planning policy. The proposed woodland loss conflicts with policy CS16 of the Core Strategy, while the associated loss of part of the LWS to the proposed quarry extension conflicts with policy CS17 of the Core Strategy and policy LC4 of the Local Plan.

Mitigation is not possible to ameliorate the loss of the woodland and associated ecological effects at the time they occur, but habitat compensation is proposed to off-set the loss of woodland habitat and to address the potential conflict with local planning policy. This commitment to deliver habitat compensation would be delivered through the proposed restoration scheme (Section 6). This involves restoration to deliver a nature conservation end use, with the objective of securing a net increase in the area, connectivity and integrity of the woodland and wider complementary habitat resource relative to the baseline conditions.

While habitat compensation would not provide immediate mitigation for the ecological effect of the loss of secondary woodland of 30 to 40 years of age, it does mean that comparable woodland cover can be reinstated over a shorter timeframe than would be the case for a quarry with a longer operational life. Therefore the habitat loss can be considered temporary. Over the medium term (5 to 15 years), wooded habitats are likely to establish to a condition whereby they complement and support the ecological value of the retained LWS habitats, and provide opportunities to extend the area of ecologically beneficial habitat relative to the baseline conditions. Opportunity to secure an increase in the area of wet woodland habitat, a S41 habitat of principal importance, through the restoration scheme has been identified and incorporated.

Moving on to consider potential indirect effects on retained woodland within and outwith the application site. The hydrogeology assessment (ES Appendix I) confirms that the proposed quarry extension would not impact nature conservation designations and the wider woodland resource surrounding the application site, including the retained woodland within the application boundary. Dewatering of the proposed quarry extension would be limited to periods immediately prior to and during sand extraction campaigns between 1$^{st}$ March and 31$^{st}$ October limit, and therefore drawdown would be over operational periods only, outside which groundwater levels would be allowed to rise to recharge soils. At restoration, a new waterbody would be created and there would be no long term change in groundwater levels beyond a 25 metre radius of the limit of extraction.

While the retained woodland within the ZoI includes wet woodland, the consequences for vegetation of any temporary seasonal drawdown of groundwater from dewatering would be limited. This is because (a) of the relatively short duration of operation of the proposed quarry extension (seasonal operation for a period of 3 to 4 years), and (b) the predicted drawdown is within the established context of the current natural seasonal drawdown of the groundwater table (ES Appendix I). In addition, existing habitats are unlikely to be specifically vulnerable to the predicted minor drawdown. The woodland does not support a well-developed wet woodland ground flora that might potentially be sensitive to seasonal drying of surface soils. Indeed, the NVC survey found that the wettest substrates within the woodland were also those that were least vegetated, with the best developed ground flora being present in transitional areas supporting a dry woodland community. The trees and shrubs making up the canopy and sub-canopy are unlikely to be particularly sensitive to short-term drawdown of water levels during operation of the proposed quarry extension. This is because they are deeper rooted than the ground flora, having access to deeper water resources. In addition, the species composition, while characteristic of certain wet woodland types, does not contain any tree or shrub species with a specific affinity for wet habitats. Instead, the tree and shrub species present (predominantly birches and willows) are typically found over quite a wide hydrological gradient from wet habitats to relatively dry woodland types. Given this range of tolerance, it is highly unlikely that the retained woodland cover would be adversely impacted by operational drawdown associated with a proposed quarry extension of the relatively limited duration proposed.

Three groundwater monitoring boreholes have been established along the northern boundary of the application site to allow monitoring of groundwater levels over the operational life of the proposed quarry extension.

Taking account of the foregoing assessment and proposals for habitat compensation and enhancement, and notwithstanding the unmitigated short term effect, the medium to long term effect of the proposed quarry extension on the conservation status of Greetwell North LWS is assessed as **not significant** as comparable habitats can be reinstated and there is potential for nature conservation gain.

### 5.5.2 *Habitats*

The permanent and temporary habitat losses and gains associated with the proposed quarry extension are summarised below as Table 5.2.

The proposed quarry extension requires 16.9 ha of permanent habitat loss within the 23.2 ha planning application boundary. In addition, there will be an additional 3 ha temporary land take from species-poor neutral grassland for the screening bunds and topsoil stockpiles. It is expected that these bunds and stockpiles will be seeded between installation and restoration (approximately 3 to 4 years), maintaining comparable grassland cover over the interim.

Given the limited duration and incremental working of the proposed quarry extension, habitat change is considered in aggregate and no attempt is made to break this down by quarry phase. Habitat gains are based on the proposed restoration scheme.

As explained in Section 5.4, only losses of habitats of district or greater ecological value are subject to further EcIA. Potential beneficial effects from gains in habitat area or extent, e.g. the substantial improvement in hedgerow habitat quality, are described in Section 7.

**Table 5.2 Estimate of Permanent Habitat Losses and Gains**

| HABITAT | BASELINE VALUE | AREA LOST | PROPOSED RESTORATION (INCLUDING MITIGATION, COMPENSATION AND ENHANCEMENT MEASURES) | POTENTIAL NET CHANGE AFTER RESTORATION |
|---|---|---|---|---|
| Acid semi-improved grassland | County | -0.2 ha | +2.7 ha (new habitat on quarry slopes) | +2.5 ha (potential net gain) |
| Arable (game bird cover crops) | Local | -4.3 ha (game cover) | +5.6 ha (best and most versatile land returned to cultivation) | +1.3 ha (no net loss, potential for biodiversity value but dependent on cropping regime) |
| Immature broad-leaved plantation woodland (Target Note 1, Figure 1) | Local | -0.9 ha | 0 ha | -0.9 ha (but note potential net gain in semi-natural woodland) |

| HABITAT | BASELINE VALUE | AREA LOST | PROPOSED RESTORATION (INCLUDING MITIGATION, COMPENSATIO N AND ENHANCEMENT MEASURES) | POTENTIAL NET CHANGE AFTER RESTORATION |
|---|---|---|---|---|
| (Greetwell North LWS): Broad-leaved semi-natural woodland and marginal bracken | County | -0.9 ha (of which an estimated 0.45 ha is wet woodland, and 0.45 ha is a drier woodland type with bracken fringe) | +0.7 ha (wet woodland)<br>+0.2 ha (wooded island) | 0 ha (no net loss, potential net gain in wet woodland) |
| Minor drains/ditches | Local (excluding retained boundary drains of county value) | -404 linear metres (minor ditches) | +388 linear metres (new ditch retained at restoration)<br>+67 linear metres (reinstated) | +51 linear metres (no net loss) |
| Permanent Standing water | Not applicable | 0 ha | +7.7 ha (new lake, including 1 ha of marginal wetland, and 1 ha of sculpted shallow water habitat) | +7.7 ha (potential net gain) |
| Hedgerow | Local | -50 linear m | +650 linear metres (new and gapped up hedgerows with standards) | +600 linear m |
| Neutral semi-improved grassland | Local | -10.6 ha | 0 ha | -10.6 ha |

### 5.5.3 *Woodland habitat (excluding woodland in Greetwell North LWS)*

The loss of broad-leaved semi-natural woodland and the associated area of bracken (the latter functionally equivalent to a woodland glade) has been considered within the assessment of potential impacts on Greetwell North LWS and does not require further assessment in this section.

The only other woodland habitat to be lost is an area of immature plantation woodland, and the loss of the scattered trees associated with Waterbody 14. While the proposed quarry extension only requires loss of the immature plantation located within the working footprint, in practice the remaining area of plantation would also be removed (or at least managed to prevent over-shading of the associated grassland) in order to maximise habitat functionality and connectivity for reptiles and provide sufficient suitable land for the purposes of reptile mitigation. These additional, losses do not require specific assessment as effects would only be meaningful at the local scale of the application site.

5.5.4 ***Acid grassland habitat***

While the proposed quarry extension retains much of the boundary grassland habitats of ecological value, it is not possible to retain 0.2 ha of acid grassland of county value comprising an:

- approximately 145 metres long by 2 metres wide linear acid grassland verge on the western bank of Waterbody 14 (Phase 3 of the proposed quarry extension); and
- approximately 260 metres long by 8 metres wide linear area of short acid grassland transitional between the woodland of the LWS to the north and the species-poor neutral grassland associated with the abandoned agricultural field to the south (Phase 1 of the proposed quarry extension).

It is emphasised that this grassland is not currently in active favourable management. Because of this, the ongoing persistence of the acid grassland adjacent to the LWS is dependent on ongoing rabbit grazing and disturbance, to limit encroachment by rank grass species from the adjacent neutral grassland, and to maintain the short turf and open conditions required by the small ephemeral plant species that comprise the primary botanical interest of the grassland. The ongoing contribution from the rabbit population towards favourable management is not guaranteed e.g. there is potential for disease to go through the local rabbit population, as periodically happens when outbreaks of Myxomatosis occur. Any perturbation that removes supportive maintenance regimes for several years has potential to result in permanent change and a decline in floral interest, particularly where (as in this case) the habitat concerned is limited in extent and width and constrained between two areas of habitat that might lead to seral change (woodland with potential to seed into the grassland, and rank neutral grassland with potential to expand its extent).

The acid grassland associated with the verge by Waterbody 14 is not currently in favourable condition and without management it is unlikely to maintain its floral interest over the long term (15 years). While this verge is locally disturbed by rabbit digging, the sward is predominantly rank in character, which limits it suitability for the small ephemeral plant species that contribute to the botanical interest of the grassland. In addition, scrub encroachment and shading are also impacting the integrity of the grassland, and this detrimental effect is likely to continue to increase over time without active management (removal) of woody vegetation along the verge.

There are no practical measures that would mitigate for the permanent loss of existing acid grassland habitat as it occurs over the operational life of the proposed quarry extension. As discussed above in relation to the effect on Greetwell North LWS, the proposed quarry extension is expected to operate for a period of 3 to 4 years only. Therefore, the lag period between the loss of the acid grassland habitats and implementation of habitat compensation through the proposed progressive restoration would be relatively short.

It should be noted that a deliberate decision has been taken not to propose habitat mitigation in retained land areas outside the limit of extraction. This is because these areas support a ‘good’ population of common lizard and need to be managed to (a) maintain this existing baseline value, as well as (b) allowing the use of some of this habitat as a temporary receptor area for additional common lizards removed from habitats within the operational limit of extraction. The technical requirements necessary to bring these habitats into the condition required to allow the establishment of acid grassland, for the sole purpose of short term (3 to 4 years) mitigation for the loss of acid grassland, are considered too intrusive to be compatible with the maintenance of the conservation status of the existing common lizard population.

Mitigation can be applied to address the potential loss of soils containing a seed bank of acid grassland flora, particularly seeds of valued ephemeral plant species. Topsoil from the acid grassland would be salvaged and stored in a segregated temporary stockpile area for re-use during restoration of the application site in accordance with the restoration scheme. It is considered that re-use of existing acid grassland topsoil will be beneficial for the re-establishment of acid grassland of comparable vegetation structure and composition over the short to medium term (within 10 years of restoration). Requirements for soil salvage and re-use would be detailed in the committed HEMP, and would be agreed prior to the start of quarrying.

The temporary adverse effect on the loss of 0.2 ha of acid grassland of county value is assessed as significant because the habitat is of inherent ecological value based on LWS selection criteria, and conflicts with county objectives (maintain and increase) for the habitat as defined in the LBAP. In addition, it has potential, but mitigable, consequences for notable terrestrial invertebrates (see 5.5.9 below), and conflicts with planning policy (Core Strategy policies 16 and 17).

Habitat compensation is proposed to off-set the predicted significant effect. This commitment to deliver habitat compensation would be delivered through the proposed restoration scheme (see Section 6). This involves restoration to deliver a nature conservation end use, with the objective of securing a net increase in the area, connectivity and integrity of the acid grassland resource relative to the baseline conditions. It is reasonable to expect that meaningful habitat compensation can be delivered and in a reasonable timeframe relative (c. 10 years), such that the habitat loss can be assessed as temporary and medium term. The proposed quarry extension will remove existing topsoil, exposing extensive suitable substrates for the re-establishment of acid grassland. While the removed topsoil will need to be redistributed at restoration, there is flexibility over how this is used and located. This has been taken into account in the design and profiling of the proposed new lake, which allows for the use of surplus soils to create islands and to reduce final water depths. The profiles of the restored quarry faces would also promote the re-establishment of acid grassland, as the free draining conditions are likely to reduce the potential for a limited number of rank plant species to dominant and by so doing promote structural and floral diversity in the re-established grassland. Finally, the application site is adjacent to a LWS notable for its acid grassland and heathland habitats, so suitable seed sources occur on adjacent land to support the re-establishment of acid grassland.

Taking account of the proposed habitat compensation to off-set the loss of acid grassland, and notwithstanding the unmitigated short term effect, the medium to long term effect is assessed as **not significant** as comparable habitats can be reinstated and there is potential for habitat gain.

5.5.5 ***Breeding birds***

The bird population associated with the application site is assessed as being of local value only, so requirements for assessment are limited and relate to the identification of impacts that would conflict with relevant legislation and planning policy.

The proposed quarry extension engages with and meets the objectives of the Defra guidance for the protection habitats for wild birds (see Table 2.2). While it is acknowledged that there would be an unavoidable temporary (3 to 4 years) loss of habitat, the consequences are understood and considered limited because survey work has determined the application site to be of only local value for birds. Subsequently, habitat conditions would be reinstated through the proposed restoration scheme and there is a commitment to deliver a nature conservation end use. There can be confidence that this would reinstate and likely exceed the baseline conditions for birds, given the existing value of the application site is relatively low. This is because the existing baseline of uniform rank grassland of limited value to birds would be replaced by a structurally, topographically and hydrologically more complex suite of habitats. In addition, the new habitats would complement and support the value of other habitats on surrounding land for birds. As such, there is potential for net gains for birds to be achieved as a consequence of the proposed quarry extension.

For the reasons stated above the proposed development is also consistent with local planning policy.

In Sections 5.1.2 and 5.3 it is identified that the proposed quarry extension would need to be implemented and operated in a manner that complies with all relevant nature conservation legislation. To ensure, this the following mitigation would be applied to meet the requirements of the WCA:

- no vegetation clearance or other ground disturbance with potential to impact nesting birds would take place between 1st March and 31st August inclusive, unless the ecologist has checked the area immediately before the commencement of such works and confirmed the absence of nesting birds.

Where the defined breeding season cannot be avoided due to the working requirements of an operational quarry, the following approach would be applied as relevant and appropriate:

- prior to the commencement of each discrete phase of vegetation clearance an ecologist would walk the relevant works area to determine the presence/absence of bird nests.
- in the absence of nests, works can progress as planned. If works are delayed the ecologist would advise the applicant on whether or not a re-survey is required prior to works commending.
- should any active bird nests be found then the ecologist will advise on appropriate stand-off distances and working requirements. Stand-offs would need to be maintained until the cessation of nesting activity, as determined through monitoring by the supervising ecologist

Further to the general risk associated with nesting birds, the WCA also includes specific provisions for bird species listed on Schedule 1 of the Act. This includes quail, a species confirmed as present during the field surveys and that may make future opportunistic use of the application site for as long as suitable game cover crops are present. There are no pathways for impacts on quail because habitats would be managed, and habitats and soils removed, in a manner that delivers legal compliance. On this basis, it is highly unlikely that suitable nesting habitat would be present at the time of application site clearance. The following mitigation would be applied in support of this:

- All tall vegetation within the limit of extraction of the proposed quarry extension would be mown to ground level over the period 1st September to 28th February, and then be regularly mown as necessary thereafter so that vegetation is kept short and unsuitable for breeding quail. This management would also be driven by working requirements for common lizard, and would not proceed until the necessary enabling mitigation for common lizard had been completed. Habitats in retained areas outside the limit of extraction are unsuitable for quail and would not be subject to mitigation detailed above.

The potential adverse effect on bird species and a bird assemblage of local value is assessed as **not significant**.

### 5.5.6 ***Bats***

The baseline surveys for the proposed quarry extension have identified patterns of bat activity and have confirmed that there are no bat roosts within the likely ZoI. As such, the only potential impact that needs assessment is the loss and severance of bat foraging and commuting habitat.

The baseline bat surveys indicate that most bat activity is associated with mature woodland and hedgerows on the application site boundaries. This represents only a small proportion of the total foraging habitat for bats in the vicinity of the proposed quarry extension. The open fields are sub-optimal for foraging bats and therefore the loss of this habitat would not reasonably be considered adverse for the maintenance of the local bat population.

There would be no loss of habitat connectivity and function for bats along the northern and southern boundaries of the application site, as most of this habitat has been off-set from the proposed quarry extension and would be retained. While there would be some woodland loss associated with Phase 1 (woodland within Greetwell North LWS), this would not result in habitat severance and would not exclude bats from habitats of potential functional importance. Instead, the woodland loss will only result in a reconfiguration of the woodland edge habitat used by bats for foraging and commuting. Because of the configuration of the quarry face in Phase 1, there would be a net increase in the availability of woodland edge for bats, and this habitat would be more sheltered from the prevailing wind than the baseline situation. The consequence of this for bats is likely to be neutral or beneficial, due to a small increase in the extent of optimal woodland edge foraging and commuting habitat.

There would be a localised loss of north/ south habitat connectivity for bats due to the removal of two internal field boundaries associated with Waterbodies 14 and 30 (Figure 7). This loss is associated with Phase 3. Based on the survey data, the boundary associated with Watercourse 30 is of negligible value to bats and therefore the loss of this boundary is unlikely to be adverse, particularly as access would remain to the potentially more attractive north/ south linkage on the western application site boundary where there is an extensive area of more structurally complex and cohesive woodland edge habitat just outside the application boundary.

The boundary associated with Watercourse 14 was used more often by bats during the surveys, but the activity levels were still relatively limited and therefore this boundary, while of value, is unlikely to be of high functional importance for the maintenance of the local bat population. Instead, it is considered likely that the focus of bat activity would be directed to the north, east and west of the application site where there is extensive mature woodland, and this would serve to reduce the attractiveness of the Watercourse 14 linkage for bats. In addition, the Watercourse 14 linkage does not provide a habitat corridor linking two discrete areas of high attractant value to bats. The habitats at the southern end of Watercourse 14 are relatively fragmented, with a gappy hedgerow along the northern road verge, and habitat severance from Brigg Road reducing connectivity further south, where habitats are largely open and sub-optimal for bats. Taken together, it is considered unlikely that the limited habitat severance associated with the proposed quarry extension would be adverse for the local bat population or impact on its conservation status. At restoration, habitats of likely attractant value for bats, including new open water habitats of potential foraging value to additional bat species for which the application site is currently unsuitable for foraging, would be reinstated/ created.

There is no potential for the legislation protecting bats to be triggered, and the requirements of relevant planning policy are met. Because of the maintenance of habitat functionality, and the distances involved, it is considered that there is no potential for the proposed quarry extension to impact the integrity of the bat mitigation enacted at Greetwell Hall Farm (planning application reference PA/2010/1009).

The potential adverse effect on the conservation status of bat population comprised of species of district value is assessed as **not significant**.

### 5.5.7 *Common lizard*

The application site supports a good population of common lizard of district value, associated with approximately 2 ha of suitable habitat. The proposed quarry extension may impact common lizard through a) loss and disturbance of up to 1 ha (50%) of the available habitat, and b) the risk of injury of individual common lizards during habitat clearance.

The habitat loss is predominantly restricted to internal field boundaries, with some potential minor or temporary habitat disturbance also assumed along the alignment of the proposed drainage diversion on the western boundary of the application site. All other reptile habitats would be retained as these are located outside the required working and restoration footprint. The habitat loss to the proposed quarry extension may impact the conservation status of the common lizard population, as the remaining habitat resource may be insufficient to sustain the population, resulting in possible mortality and a decline in abundance, distribution and population viability within the application site.

Habitat losses would be for the 3 to 4 year duration of mineral working, and comparable or enhanced habitats would be reinstated at restoration. Indeed, the proposed restoration scheme intends to secure a net increase in habitat availability, as 2.7 ha of acid grassland creation is proposed in addition to the retention of 1 ha of existing habitat. Because the proposed habitat loss is partial and short-term, it may reduce the risk of an adverse permanent effect on conservation status being realised. The proposed quarry extension would be unlikely to cause the loss of the population (only a decline in conservation status over the short term i.e. less than 5 years) and over the medium term (less than 10 years) there would be potential for population recovery due to increased habitat quality, extent and connectivity.

Injury of common lizards has potential to occur as an indirect result of vegetation clearance and preparatory works, after which the relevant areas would be unsuitable for reptiles and unlikely to be used. The risk would apply during the active season when common lizard may occur in association with all suitable habitats, and there would also be a potential risk during the winter where disturbance to suitable hibernation habitats would occur. Should injury occur, this would result in offences under the WCA.

To address the potential impacts and effects associated with the proposed quarry extension, the applicant commits to specification and agreement of an appropriate mitigation strategy under planning condition. For the purposes of this assessment, it is sufficient to demonstrate that mitigation is feasible and can maintain the conservation status of this species within the application site, in compliance with relevant legislation and planning policy.

All mitigation would be implemented by or under the supervision of appropriately experienced ecologists. Land suitable as a temporary (for the life of the proposed quarry extension until completion of restoration) holding area for common lizards has been identified to the north of the limit of extraction in association with habitats that would be retained during all phases of the proposed quarry extension. This area covers 1.7 ha and is shown on Figure 15. It would be enclosed within appropriate permanent/ semi-permanent fencing that would be maintained until the completion of restoration works.

The identified holding area is grassland and supports a sub-set of the recorded common lizard population, although much of the existing habitat is suboptimal and unoccupied due to its past agricultural management. Habitat enhancement would be undertaken within the holding area to further improve its suitability, and therefore carrying capacity for reptiles, with the aim of maintaining and potentially increasing the common lizard population in the holding area. Enhancement requirements would be determined in the run up to enactment of mitigation, so that there is lead in time to enhance habitats before they are required. Enhancement measures are likely to include management works to provide a more varied grassland structure, perhaps supplemented by local ground disturbances to alter the topography (which is currently flat as a result of past agricultural management), removal of existing immature trees of planted origin to prevent shading of the underlying grassland, and installation of several artificial reptile hibernacula.

Reptiles would be captured and excluded from all working areas within the limit of extraction, and the area on the western boundary where the proposed drainage diversion would be constructed. Temporary fencing would be installed around suitable reptile habitats in the limit of extraction, and these areas would be trapped out using a combination of hand catching, artificial refuges, and destructive searches of potential refuges. Requirements for the number of artificial refuges and trapping days would be based on the good practice recommendations detailed in Herpetofauna Groups of Britain and Ireland (HGBI) (1998).

Post-restoration there is potential for net gains for reptiles to be secured, as the habitat enhancement proposals to be delivered through the proposed restoration scheme would reasonably be expected to result in a net improvement in habitat quality and extent for reptiles over the medium term (5 to 10 years after restoration). Therefore, the objective of the mitigation strategy would be to maintain the conservation status of common lizard over the 3 to 4 year operational life of the proposed quarry extension to deliver compliance with relevant legislation and planning policy. Post-restoration ongoing specific mitigation would not be required, as the restoration scheme has been designed with consideration of requirements for relevant protected species.

Given mitigation is feasible, the potential effect of the proposed quarry extension on a common lizard population of district value is assessed as **not significant**. Over the medium to long term the proposed restoration scheme has potential to have a beneficial effect on the local conservation status of common lizard.

### 5.5.8 *Great crested newt*

There are no waterbodies supporting great crested newt within the application site, but a small population of great crested newt of district value occurs in association with two ponds located 400 metres to the north of the application site. Based on guidance (English Nature, 2001) on the worst case distances that great crested newts can migrate from breeding ponds there is a potential risk of individual great crested newts from these ponds using terrestrial habitats within the application site for foraging and/ or hibernation. This risk is considered further below to demonstrate that the proposed quarry extension would be unlikely to result in offences under relevant legislation and is compliant with relevant planning policy.

The potential for great crested newt to use terrestrial habitats within the application site is considered very low. Natural England (2015) guidance emphasises that considerations based on population size have a bearing on whether or not an offence is likely in practice. Only a small population of great crested newts was recorded and the habitat context of the breeding ponds is such that extensive optimal foraging and hibernation habitat (pasture and woodland) occurs in close proximity to the ponds and in association with all intervening land between the ponds and the proposed quarry extension. The available habitat resource within 250 metres of the breeding ponds would reasonably be considered sufficient to meet the requirements of the small great conservation newt population recorded. Therefore, the application site is unlikely to have a specific attractant value for great crested newt, and it is unlikely that great crested newts would seek to access distant habitats more than 250 metres from the breeding ponds when there is sufficient suitable habitat in closer proximity to the breeding ponds.

Loss of distant terrestrial habitat to the proposed quarry extension is very unlikely to be adverse for maintenance of the conservation status of a small great crested newt population of district value. Therefore, legal offences relating to habitat loss and disturbance would be unlikely. The habitats in the application site would not reasonably be considered critical for the maintenance of the population, as they are unlikely to be used by great crested newt or be essential for the survival of the population.

Given the above rationale, and even without mitigation, an impact on great crested newt would be unlikely and there is no reasonable likelihood of individuals from the small great crested newt population associated with breeding ponds located more than 400 metres from the proposed quarry extension making use of the application site. Therefore, the proposed quarry extension would be unlikely to conflict with legal requirements, and a mitigation licence is unlikely to be required. In the absence of a mechanism for impact, the proposed quarry extension is consistent with the requirements of planning policy with regard to great crested newt.

Brief consideration also needs to be given to the possible implications of the proposed development for a future (post-quarry) baseline, when great crested newts may have become more abundant in the local area as a result of a potential increase in breeding success due to recent pond creation activities on third party land. The proposed quarry extension does not conflict with this potential future scenario, as it would not reduce the carrying capacity of the local environment needed to sustain an enlarged great crested newt population. This is because the quarry would be operated for a limited duration after which it would be restored to a nature conservation end use. There is sufficient commitment to a nature conservation end use to be certain that the application site would be restored to a condition suitable for use by foraging and hibernating great crested newt.

The potential adverse effect on the conservation status of great crested newt population comprised of species of district value is assessed as **not significant**.

### 5.5.9 *Terrestrial invertebrates*

The baseline surveys identified the presence of a terrestrial invertebrate assemblage of county value in association with the acid grassland and LWS habitats assessed above. This terrestrial invertebrate assemblage would be impacted by the loss of most of the most suitable habitat resource within the application boundary to the proposed quarry extension. Localised areas of remnant habitat would be retained where these are located in habitat stand-offs outside the limit of extraction. However, this remaining habitat encompasses only small parcels of land, and may be severed from connections with similar habitats in the wider landscape necessary to support the invertebrate interest.

The above acknowledged, it is reasonable to expect that a comparable terrestrial invertebrate fauna occurs in the wider Greetwell North LWS, outside the application site, where comparable habitats are (a) more extensive and better connected, (b) of relatively higher botanical interest, and (c) less influenced by past agricultural management and ongoing edge effects. Therefore the habitats that would be lost to the proposed quarry extension are unlikely to be specifically or disproportionately important for the maintenance of the conservation status of the wider terrestrial invertebrate assemblage. So, while there would be a short term effect (c. 5 years) on the suitability of habitats associated with the proposed quarry extension for the identified invertebrate interest, the effect would be within the application site only and there would be potential for a comparable terrestrial invertebrate interest to re-establish following restoration to a nature conservation end use.

The applicant commits to mitigation and habitat restoration that would maintain, create and enhance suitable habitats, topographies and habitat succession favourable for the notable terrestrial invertebrate assemblage. As part of pre-commencement mitigation, the suitability of retained habitats located outside the limit of extraction would be improved to provide general mitigation for the loss of existing habitats for notable invertebrates. Proposals are based on the ecologies of the most notable species recorded, and can be incorporated within the proposed common lizard holding area (Figure 15) where they are likely to complement habitat improvement measures for reptiles, and in additional areas to the south and west of the limit of extraction. The area available for mitigation is greater than the habitat being lost, and therefore has potential to realise net gains as well as providing mitigation. This mitigation approach would include:

- creation of short turf and shallow scrapes for the benefit of solitary bees and in particular the comb-footed spider *Alaobia riparia*. This species has a web attached to overhanging grass stems connected to the substrate, which snag passing crawling invertebrates such as ants. Suitable conditions may be achievable through natural rabbit grazing and disturbances alone without a need for intervention, but elsewhere localised mechanical disturbances to the surface topography may be required. This can readily be achieved using typically quarry machinery;

- creation of larger scrapes to benefit additional species including burrowing bees and wasps (these would also benefit reptiles). These should be of varying aspects, but particularly south-facing. The spoil removed during scrape construction would be used in situ to create bee banks (also of value as reptile basking habitat);
- measures to encourage rabbit grazing in support of the above mitigation. Rabbit refuges would be created from woody material derived from vegetation clearance works cut from the woodland to be lost and would be loosely piled. The provision of refuges will encourage grazing in the vicinity of the refuges; and
- retention and re-use of existing large dead wood and additional material derived from the proposed woodland clearance (some would also be used to create reptile hibernacula and may have an ancillary benefit for invertebrates). These would be stacked in appropriate locations to recreate fallen timber. Where fallen woodland is scarce in adjacent retained woodland, so of the wood would also be moved into these area, particularly where there are areas of impeded drainage similar to the conditions present in the woodland to be lost.

With these mitigation measures a significant adverse effect on the terrestrial invertebrate assemblage of county value would be unlikely. Medium term (5 to 10 years after restoration), there is potential for net gains for invertebrates to be secured through the habitat enhancement proposals that would be delivered under the proposed restoration scheme. Therefore, post-restoration ongoing specific mitigation would not be required, as the proposed restoration scheme has been developed with consideration to objectives for relevant target species.

The potential effect on the terrestrial invertebrate assemblage of county value is assessed as **not significant**.

### 5.5.10 *Aquatic invertebrates*

Two watercourses, Waterbodies 6 and 16, support aquatic invertebrate assemblages of county value. These assemblages and component species are not legally protected, but they are covered by policy CS17 of the Core Strategy as the assemblage and supporting watercourses can be considered ecological features of biodiversity interest. All other watercourses associated with the proposed quarry extension support invertebrate assemblages of local value and they are scoped out of the impact assessment on the basis that any adverse effect would not be significant.

The FRA (ES Appendix H) has confirmed that the proposed quarry extension requires no works that would impact Waterbody 6. The closest drainage works are on the retained section of Waterbody 14 downstream of Waterbody 6 and the effect of these works would not be adverse for the aquatic invertebrate assemblage of Waterbody 6. As explained in paragraph 4.3 to 4.5 of the FRA, a new transverse embankment would be constructed across the alignment of Waterbody 14 and would result in a build-up of water behind the embankment to an approximately maximum depth of 1.3 metres. The consequence of this is that the character of the retained section of Waterbody 14 will change from one that is of low value for aquatic invertebrates to one that, at least seasonally, retains deeper water more comparable to the hydrological regime associated with Waterbody 6. On this basis Waterbody 6 can be scoped out of assessment as there is no likelihood of an adverse effect on the hydrological regime supporting the aquatic invertebrate interest of Waterbody 6. Any beneficial effect realised would be localised, small scale and potentially only seasonal in nature (water levels would rise following periods of high rainfall, but may not be maintained due to gradual infiltration during drier periods of weather). But it is still likely to represent a net improvement in habitat quality for aquatic invertebrates and may benefit some of the notable species recorded from Waterbody 6.

The drainage regime associated with Waterbody 16 would be temporarily altered during operation of the proposed quarry extension, as a new outfall will be constructed that during periods of high precipitation may require overspill of water arriving into the upstream retained section of Waterbody 14 into Waterbody 16 (paragraph 4.6, ES Appendix H), rather than allowing it to continue along the existing alignment of Waterbody 14 (which will be lost to the proposed quarry extension). Such circumstances would be comparable to the existing baseline conditions, with Waterbody 16 only receiving increased volume and flow after significant rainfall events. Given this, it is unlikely that the change in drainage would alter the hydrology of Waterbody 16 such that it was no longer suitable for the notable aquatic invertebrate species recorded. There is no likelihood of an adverse effect on the hydrological regime supporting the aquatic invertebrate interest of Waterbody 16

No specific ecological mitigation is required as no significant effects are predicted. But, for the purposes of clarity, the proposed drainage diversion that would take water flowing from Waterbody 16 and direct it to the drainage network to the south of Brigg Road would be retained at restoration. This is on the basis, that the ditch will have accrued a minor ecology value over the operational life of the proposed quarry extension and therefore there is merit in retaining this ecological feature over the longer term. The drainage diversion would retain its hydrological connection to Waterbody 16, with the latter retaining its baseline connections to the existing land drainage that supplies the drain. On this basis, the drainage diversion has potential to provide a comparable ecological function to the existing Waterbody 30, which would be lost during Phase 3 of the proposed quarry extension.

# 6 HABITAT COMPENSATION

## 6.1 Timeframe for Habitat Compensation

Habitat compensation would be delivered through the proposed restoration scheme. Some of the compensation measures may be implemented as part of progressive restoration of quarry phases over the operational life of the proposed quarry extension. Any remaining compensation measures would be implemented following cessation of mineral working in the relevant areas and the completion of the re-profiling and soil reinstatement works necessary to permit restoration. Accordingly, there would be a lag between the loss of the habitats to be compensated and the reinstatement of conditions necessary for their re-establishment. In some areas of the proposed development this would result in a slightly longer timeframe for the reinstatement of mature habitats than would be the case if all habitat compensation could be implemented concurrently with the proposed quarry extension.

Given the timeframe between habitat clearance (including habitat clearances linked to advance protected species mitigation measures) and the completion of mineral working is relatively short and estimated at approximately 3 to 4 years, the lead-in time before habitat compensation can commence is not considered unacceptable. In addition, it is re-emphasised that the area of habitat to be lost is relatively small in the context of the adjacent habitat resource. In this context, the potential impact of this habitat loss for dependent species is considered to be so localised that the reinstatement of the relevant habitats, while necessary, is not of critical urgency. The compensation measures would contribute a significantly enlarged area of favourably managed habitat, which would be connected to and would complement adjacent habitat of relatively high ecological value. This would occur within a relatively short timeframe (within 10 years from the start of works), particularly when acknowledging the ecological benefits associated with the proposed passive restoration process. It will support wider biodiversity objectives for habitat creation within Lincolnshire (Policies LC6, CS5, CS16 and CS17). These wider gains would be unlikely to be achieved without the proposed quarry extension, as a significant beneficial change in the future baseline would be unlikely without quarrying.

## 6.2 Habitat Compensation Proposals

Habitat compensation proposals would be delivered through passive recolonization of the application site by target vegetation. This will maximise opportunities for relevant ecological gain over the long term. This proposed approach is consistent with the agreed approach for other recent local quarry restoration schemes, and otherwise accords with recommended good practice (e.g. Whitehouse, 2008; Davies, 2006). This would be developed further in the committed HEMP, and would be agreed with North Lincolnshire Council prior to the start of quarrying. The proposed measures can be summarised as:

- creation of a minimum of 0.7 ha of wet woodland in association with low lying land adjacent to the new lake. This would achieve a net gain in wet woodland cover and would be achieved through passive recolonization of appropriate reinstated substrates by tree species present on adjacent land. Passive restoration would be rapid (some colonisation would be expected within 12 months of the facilitating earth works) given the proximity of adjacent woodland, and because the relevant community dominants are wind dispersed. Use of natural processes is also consistent with the origin of the existing woodland;

- creation of a minimum of 0.2 ha of drier woodland on the proposed island within the new lake, with additional new trees in the proposed new and gapped-up hedgerows. In combination with the wet woodland, there would be no net loss of woodland cover. The woodland would be achieved through natural process, consistent with the rationale for wet woodland. New standard trees within new and gapped-up hedgerows would be delivered through the planting of appropriately sourced native trees;

- creation of a minimum of 2.7 ha of acid grassland on free draining, sandy substrates associated with the restored quarry faces. Area, width and topography would be more extensive than the existing baseline, delivering a net gain in acid grassland cover. To be achieved through re-instatement of original acid grassland soils and passive recolonization from adjacent retained habitats and the LWS. Options for harvest of suitable seed sources from the LWS and use within the application site would be considered if deemed appropriate by third parties and subject to agreement of access for seed harvest; and

- planting and gapping-up to create 0.65 km of species-rich hedgerow with standards along Brigg Road, and to provide a north/ south habitat linkage across the application site. This would represent a significant net gain in comparison with the very limited (50 m) hedgerow loss to the proposed quarry extension.

# 7 ECOLOGICAL ENHANCEMENT

The ecological enhancement that would be delivered is shown on the restoration scheme. Requirements would be formalised in more detail in the HEMP to be prepared and agreed prior to commencement of quarrying. The measures proposed reflect the opportunities associated with a quarry of the type and geographic location proposed, local priorities for habitat creation and restoration (based on LBAP and NRA profile), local priorities for species conservation and are responsive to local planning policy and good practice guidelines (e.g. Whitehouse, 2008; Davies, 2006). As such, the proposed restoration scheme has the potential to have a significant beneficial effect on biodiversity at the county level.

The proposed ecological enhancement measures can be summarised as:

- a new lake with an island, a range in water depths from shallow (0 to 1 metre) to areas of deeper water (greater than 1 metre), and extensive marginal wetland. Sensitive profiling of the lake margins may provide new opportunities for wading birds. Vegetation colonisation would primarily be through natural processes, but limited supplementary planting may be undertaken to minimise wave wash along exposed shorelines and to deliver a diverse wetland fringe. This would be decided later based in feedback from stakeholders and following review of the conditions present in nearby waterbodies which would be the seed sources for passive colonisation;

- a broad south-facing ride of acid grassland on the quarry face between the proposed wet woodland and the existing LWS woodland. Conditions are likely to favour reptiles, bats, bird species of woodland edge habitats and invertebrates;

- enhancement of Waterbody 11 to reduce over-shading from marginal trees and to improve bank profiles, with the aim of improving structure and composition of aquatic and marginal vegetation. This would reasonably be expected to provide benefits for a range of flora and fauna of ponds.

- concomitant with the above habitat enhancements, and the proposed habitat compensation, gains are expected for protected species including birds, bats, reptiles, terrestrial and aquatic invertebrates, amphibians (terrestrial habitat quality). These gains would result from the greater range in vegetation structure, substrate composition, topography, wetland habitat, and the niches associated with this broad habitat variation; and

- related to the above, a net increase in favourably structured habitats for reptiles, with greater connectivity across the application site and with the LWS to the west and north. Currently the management of much of the existing grassland resource is sub-optimal for reptiles, and the population is concentrated in local areas of peripheral habitat.

# 8 SUMMARY AND CONCLUSIONS

Table 8.1 below provides a summary of the relevant likely impacts and effects of the proposed quarry extension on ecology and nature conservation.

No medium to long term significant ecological effects are predicted as a result of the operation and restoration of the proposed quarry extension. This is based on consideration of the relevant baseline ecological features, proposed methods of working, the relatively small scale and limited duration (3 to 4 years) of the proposed quarry activities, and the options available to mitigate and compensate potential adverse effects.

The assessment demonstrates that the proposed quarry extension would be implemented in a manner that complies with relevant legislation and planning policy. Mechanisms are identified to explain how compliance can be achieved, including opportunity for the involvement of relevant stakeholders in finalising specifications for ecological mitigation, compensation (habitat creation and restoration) and enhancement through a HEMP to be delivered under planning condition.

Attention is drawn in the EcIA to the potential net gains for biodiversity that can be secured as a direct consequence of the proposed quarry extension. This includes measures that would secure an increase in area of key habitats (wet woodland and acid grassland), with likely benefits for a range of protected and notable fauna and flora. Some of the identified potential net gains are only likely to be deliverable through mineral working, as this affords opportunity to re-profile soils and topography in a manner supportive of the proposed habitat creation. A restoration scheme has been submitted with the ES to show how the proposed quarry extension will be restored to a nature conservation and agricultural end use, and is described further in Sections 6 and 7 of this EcIA.

**Table 8.1 Summary of Impact Assessment (Potentially Significant Impacts and Effects Only)**

| ECOLOGICAL FEATURE (VALUE) | POTENTIAL IMPACT | MITIGATION, COMPENSATION AND ENHANCEMENT | ECOLOGICAL ENHANCEMENT | SIGNIFICANCE OF EFFECT |
|---|---|---|---|---|
| Greetwell North LWS (County) | Loss of 0.9 ha of secondary broad-leaved woodland of c. 30-40 years of age.<br>Associated potential conflict with planning policy. | 0.9 ha of woodland habitat creation at restoration. | Restoration scheme allows opportunity for a net increase in area of wet woodland relative to baseline.<br>Restoration scheme would create extensive new habitats with a biodiversity end use adjacent to the LWS. These new habitats would buffer and complement habitats in the LWS with potential benefits for | No significant adverse effects likely.<br>Likely beneficial effect (potential net gain) on LWS following establishment of new habitats created through the restoration scheme. |

| ECOLOGICAL FEATURE (VALUE) | POTENTIAL IMPACT | MITIGATION, COMPENSATION AND ENHANCEMENT | ECOLOGICAL ENHANCEMENT | SIGNIFICANCE OF EFFECT |
|---|---|---|---|---|
| | | | conservation status of LWS. | |
| | Interception of groundwater. | None required – no likely significant effect. | - | |
| Acid grassland and associated flora (County) | Loss of 0.2 ha of habitat.<br>Associated potential conflict with planning policy. | Salvage of topsoil at site clearance, reinstatement of topsoil at restoration.<br>2.7 ha of acid grassland creation at restoration. | Potential net gain at restoration. | No significant adverse effects likely.<br>Likely beneficial effect (potential net gain) supportive of local conservation objectives following establishment of new habitats created through the restoration scheme. |
| Terrestrial invertebrate assemblage (County) | Loss of habitat within working boundary.<br>Associated potential conflict with planning policy. | Habitat enhancement and creation to provide short term mitigation for habitat loss over operation life of proposed quarry extension. | Extensive new habitat creation starting at operation and continuing at restoration. Includes a substantive increase in ground conditions, acid grassland and wet woodland suitable for relevant invertebrates. | No significant adverse effects likely.<br>Likely beneficial effect (likely net gain) on specialist invertebrates. Comparable benefits are unlikely to be achieved without mineral extraction. |
| Aquatic invertebrate assemblage (County) | None expected following review of drainage requirement (see FRA, ES Appendix H) | None required – no likely significant effect. | New lake and associated wetland habitats to be created at restoration. | Likely beneficial effect (likely net gain) on aquatic invertebrates from new lake. Comparable benefits are unlikely to be achieved without mineral extraction. |
| Common lizard (District) | Loss and degradation of 1 ha of habitat of | An appropriate pre-commencement | Extensive new habitat creation starting at | No significant adverse effects |

| ECOLOGICAL FEATURE (VALUE) | POTENTIAL IMPACT | MITIGATION, COMPENSATION AND ENHANCEMENT | ECOLOGICAL ENHANCEMENT | SIGNIFICANCE OF EFFECT |
|---|---|---|---|---|
| | functional importance (50% of available habitat within the application boundary).<br>Associated potential conflict with planning policy.<br>Injury and/ or mortality.<br>Associated potential conflict with relevant legislation. | mitigation strategy to be prepared and agreed with North Lincolnshire Council.<br>Mitigation to be implemented under supervision of appropriately experienced ecologists.<br>A suitable holding area has been identified within the application boundary and would be enhanced further prior to receiving reptiles.<br>Installation of fencing as required for purposes of mitigation and reptile protection.<br>Suitable habitats in working boundary to be trapped out and reptiles moved to holding area.<br>Fencing removed at restoration (3-4 years after first habitat loss). | operation and continuing at restoration. Includes a substantive increase in acid grassland suitable for reptiles and increased habitat connectivity within site and with suitable habitats on adjacent land | likely.<br>Likely beneficial effect (potential net gain) on district conservation status following establishment of new habitats (increased habitat area and connectivity) created through the restoration scheme. |
| Bats (District) | Loss of foraging and commuting habitat.<br>Associated potential conflict with planning policy. | None required – no likely significant effect. | Extensive new habitat creation starting at operation and continuing at restoration. Includes new hedgerow and woodland, a new lake with associated wetland, and other | No significant adverse effects likely.<br>Likely beneficial effect (potential net gain) on local conservation status following establishment of new habitats (increased habitat quality, variation |

| ECOLOGICAL FEATURE (VALUE) | POTENTIAL IMPACT | MITIGATION, COMPENSATION AND ENHANCEMENT | ECOLOGICAL ENHANCEMENT | SIGNIFICANCE OF EFFECT |
|---|---|---|---|---|
| | | | habitats managed for biodiversity. | and structure) created through the restoration scheme. |
| Breeding birds (Local) | Minor habitat loss.<br>Associated potential conflict with planning policy. | None required – no likely significant effect. | Extensive new habitat creation starting at operation and continuing at restoration. Includes new hedgerow and woodland, a new lake with associated wetland, and other habitats managed for biodiversity. | No significant adverse effects likely.<br>Likely beneficial effect (potential net gain) on local conservation status following establishment of new habitats (increased habitat quality, variation and structure) created through the restoration scheme. |
| | Potential impact on nesting birds during site clearance.<br>Associated potential conflict with relevant legislation. | Standard mitigation to deliver legal compliance (sensitive timing and Ecological Clerk of Works). | | |

## 9 REFERENCES

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