

Twycross Zoo, Burton Road, Atherstone

A Report To: Baker Mallett LLP
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Quality Assurance

Date	Version	Author	Checked and Approved by
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Declaration of Compliance

This study has been undertaken in accordance with British Standard 42020:2013 "Biodiversity, Code of Practice for Planning and Development". The information which we have prepared is true, and has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management's Code of Professional Conduct. We confirm that the opinions expressed are our true and professional bona fide opinions.

Disclaimer

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Validity of Data

The findings of this study are valid for a period of two to four years, depending upon the nature of works proposed and the potential for these works to impact upon great crested newts. If works have not commenced within two years of this study, it may be necessary to undertake an updated survey to allow any changes in the status of great crested newts on site to be assessed, and to inform a review of the conclusions and recommendations made.

Non-Technical Summary

Project Background

In September 2023, Baker Mallett LLP commissioned Middlemarch to undertake a Great Crested Newt Habitat Suitability Index Assessment of the ponds within 250 m radius of the site of a proposed development at Twycross Zoo, Atherstone. This assessment is required to inform a planning application associated with the demolition of the lemur house, removal of several animal enclosures and clearance of trees and vegetation to make way for the construction of a National Science Conservation Centre.

Scope of Survey

To fulfil the above brief, a Great Crested Newt Habitat Suitability Index Assessment of the accessible ponds within 250 m radius of the site was carried out on 25th September 2023 by Charline Hue MSc (Senior Ecological Consultant) and Joanne Harper MSc (Ecological Project Officer).

Survey Results

Fifteen ponds within a 250 m radius were assessed for their suitability for breeding Great Crested Newt. The results were as follows:

- Six ponds had 'Good' suitability, including P1 which is located within the development boundary;
- Four ponds had 'Below average' suitability; and,
- Five ponds had 'Poor' suitability.

Potential Impacts on Great Crested Newts

The proposals will impact suitable terrestrial habitats in proximity to a potential GCN breeding pond. Further surveys are required to determine whether GCN are likely to be present on site and what impacts the development will have on GCN.

Recommendations

Pond eDNA Survey: Pond P1 has been identified as being suitable to support GCN by the HSI assessment and should be surveyed for the presence of GCN environmental DNA (eDNA). This involves collecting water samples from waterbodies between 15th April and 30th June and sending them to an approved laboratory to be tested. This will inform the potential need for further survey or methods of work during the clearance of the site.

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1. Introduction

1.1 Project Background

In September 2023, Baker Mallett LLP commissioned Middlemarch to undertake a Habitat Suitability Index Assessment for great crested newts *Triturus cristatus* at the site of a proposed development at Twycross Zoo, Atherstone. This assessment is required to inform a planning application associated with the demolition of the lemur house, removal of several animal enclosures and clearance of trees and vegetation to make way for the construction of a National Science Conservation Centre. Middlemarch has previously carried out a number of surveys for Baker Mallett LLP at this site. The findings of these surveys are detailed in the following reports:

- Preliminary Ecological Appraisal, 2019, report RT-MME-131054-01;
- Preliminary Bat Roost Assessment, 2019, report RT-MME-131054-02;
- Preliminary Ecological Appraisal, 2019, report RT-MME-150735-01;
- Preliminary Bat Roost Assessment, 2019, report RT-MME-150735-02;
- Preliminary Arboricultural Assessment, 2022, report RT-MME-159277-01;
- Preliminary Ecological Appraisal, 2022, report RT-MME-159277-04; and,
- Preliminary Bat Roost Assessment, 2022, report RT-MME-159277-05.

Middlemarch has also been commissioned to undertake the following surveys for Baker Mallett LLP at this site in connection with the construction of the National Science Conservation Centre:

- Habitats Regulation Assessment Stage 1 Screening, report RT-MME-160474-01;
- Preliminary Ecological Appraisal, report RT-MME-160474-02 Rev A;
- Preliminary Bat Roost Assessment, report RT-MME-160474-03 Rev A; and,
- Biodiversity Metric Assessment, report RT-MME-160474-04.

Great crested newts are a legally protected species and are capable of being a material consideration in the planning process. A summary of the legislation protecting great crested newts is included within Appendix 1.

1.2 Site Description and Context

Table 1.1 provides a brief summary of the site and its surroundings.

Attribute	Description
Location	Twycross Zoo, Burton Road, Atherstone
National Grid Reference	SK 31559 06068
Site Area (ha)	2.19
Topography	Generally flat, slightly sloping to the south.

Table 1.1: Summary of Site and Surroundings (continues)

Attribute	Description
Land Cover (on site)	The site forms the south-west corner of the larger site of Twycross Zoo and a stretch of land immediately south of the current zoo boundary. Approximately one third of the site was composed of semi-improved grassland with scattered scrub. The remaining land comprised a mosaic of dense scrub, amenity grass, conifer plantation, broad-leaved woodland, scattered and groups of planted trees, hedgerow, ditch, pond, hardstanding paths and animal enclosures, mainly containing bark chippings and grasses.
Land Cover (site surrounds)	Twycross Zoo dominates the landscape to the north/north-east of the proposed development area with the wider area comprising intensively managed arable farmland dotted with small farmsteads and residential properties. The M42 lies around 3 km to the west.

Table 1.1 (continued): Summary of Site and Surroundings

1.3 Survey Area and Justification

Reference to Ordnance Survey mapped data indicates the potential presence of up to 28 ponds within a 500 m radius of the site.

Ponds within 250 m radius of the development site were surveyed. A 250 m survey radius was deemed appropriate as the development will not be directly impacting a potential breeding pond, the closest GCN record is located over 500 m away and the habitats within a 250 m radius are mostly intensively managed for the public, reducing the suitability for GCN moving into the development area from further than 250 m.

The distances of all ponds within the survey area from the development boundary, are provided in Table 1.2, along with the justification for inclusion or exclusion from the survey effort. The locations of these ponds in relation to the proposed development site are shown on Middlemarch Drawing C160474-05-01 in Chapter 7.

Pond Reference	Distance from Development Boundary	Subject to Survey?	Justification
P1	On site	Yes	The pond is on site and has the potential to be directly impacted by the proposals.
P2	8 m east	Yes	The pond is less than 10 m from the site and well connected to it.
P3	90 m north	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P4	155 m north	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN, and there is suitable habitat connecting it to the pond onsite (P1).
P5	160 m north-east	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P6	225 m north	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.

Pond Reference	Distance from Development Boundary	Subject to Survey?	Justification
P7	280 m north	Yes	The pond is just outside of the 250 m radius of the boundary, well within the recognised range for GCN.
P8	270 m north	Yes	The pond is just outside of the 250 m radius of the boundary, well within the recognised range for GCN.
P14	85 m east	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P16	185 m east	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P17	225 m east	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P18	160 m east	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P19	220 m east	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P22	150 m south	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.
P27	165 m south-west	Yes	The pond is within a 250 m radius of the boundary, well within the recognised range for GCN.

Table 1.2: Distance of Ponds from Development Boundary

1.4 Documentation Provided

The conclusions and recommendations made in this report are based on information provided by the client regarding the scope of the project. Documentation made available by the client is listed in Table 1.3.

Document / Drawing Number	Author
Combined Landscape Masterplan P22009-00-001-DZ-0110-02	Dearadh Zú
Soft Landscape Strategy P22009-00-001-DZ-400-00	Dearadh Zú
Proposed Site Plan / TWZ-HLM-00-00-DR-L-00001	HLM Architects
Proposed Soft Landscape (Draft) / TWZ-HLM-00-00-DR-L-45001	HLM Architects

Table 1.3: Documentation Provided by Client

2. Methods

2.1 Desk study

As part of the Preliminary Ecological Appraisal (Report RT-MME-159277-04) an ecological desk study was undertaken. The consultees for the desk study were:

- Natural England - MAGIC website for statutory conservation sites;
- Warwickshire Biological Records Centre; and,
- Leicestershire and Rutland Environmental Records Centre.

Middlemarch then assimilated and reviewed the desk study data provided by these organisations. Relevant newt data are discussed in Chapter 3. In compliance with the terms and conditions relating to its commercial use, the full desk study data is not provided within this report.

2.2. Field Survey

The survey comprised the following elements:

Habitat Suitability Index Assessment

All surveyed ponds were visually assessed for their suitability to support great crested newts by a suitably qualified ecologist. Ponds were assessed utilising the great crested newt Habitat Suitability Index (HSI) developed by Oldham *et al* in 2000¹ and revised by ARG UK in 2010. The HSI is a numerical index between 0 and 1, wherein a score of 1 represents optimal habitat for great crested newts. The HSI score is used to define the suitability of the pond on a categorical scale (Table 2.1). It should be noted, however, that the system is not precise enough to allow the conclusion that a pond with a high score will definitely support great crested newts whilst those with a low score will not.

HSI Score	Pond Suitability
< 0.5	Poor
0.5 – 0.59	Below average
0.6 – 0.69	Average
0.7 – 0.79	Good
> 0.8	Excellent

Table 2.1: Great Crested Newt HSI Scoring

The HSI is given by assigning a quantitative figure to each of 10 variables, including pond area, water quality and level of shading, which are all factors thought to affect great crested newts. The tenth root of the product of these variables is then calculated, giving a figure for habitat suitability.

¹ Oldham R. S., Keeble, J., Swan, M. J. S. and Jeffcote, M. (2000). 'Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*)'. Herpetological Journal 10 (4), 143-155.

The field assessment was undertaken on 25th September 2023 by Charline Hue MSc (Senior Ecological Consultant and Natural England Great Crested Newt Licence Holder) and Joanne Harper MSc (Ecological Project Officer). Table 2.2 details the weather conditions at the time of the assessment.

Parameter	Condition
Temperature (°C)	16-18
Cloud (%)	0-30
Wind (Beaufort)	F1-3
Precipitation	Nil

Table 2.2: Weather Conditions During Field Survey

Site Suitability and Connectivity Assessment

As part of the updated Preliminary Ecological Appraisal (Report RT-MME-160474-02 Rev A) a Phase 1 Habitat Survey was undertaken of the proposed development area. Middlemarch used this habitat survey data to undertake an assessment of the suitability of the proposed development site to support great crested newts. An assessment was also made of the habitat connectivity between ponds and the site, based on a review of habitat survey data (if available), aerial imagery and mapped sources.

2.3 Constraints

As many of the ponds were located within animal enclosures, full access to the ponds was not possible, however surveyors were able to view the ponds from various vantage points to make a full assessment of their suitability.

3. Desk Study

3.1 Species Records

The data search was carried out on 10th November 2022 by Leicestershire and Rutland Environmental Records Centre. Records of great crested newt within a 1 km radius of the survey area provided by the consultee are summarised in Table 3.1.

Date	Grid Reference	Proximity of Record	Additional Information
2021	N/A	640 m north-east	2 records.

Table 3.1: Great Crested Newt Records Within 1 km of the Development Boundary

3.2 Previous Great Crested Newt Surveys

Great Crested Newt surveys were conducted in 2021 on the land to the north of Twycross Zoo by Middlemarch. A small population of great crested newt was recorded to be breeding in the pond located to the north-east of Twycross Zoo, on the other side of Burton Road.

4. Survey Results

4.1 Habitat Suitability Index Assessment

The HSI score for each of the ponds assessed is detailed in Table 4.1. Further description of each of the surveyed ponds assessing the presence or absence of habitat features favoured by great crested newts is provided in Appendix 2. Pond locations are shown on Middlemarch Drawing C160474-05-01 in the Chapter 7.

Pond Ref.	HSI Category										HSI Score
	SI 1	SI 2	SI 3	SI 4	SI 5	SI 6	SI 7	SI 8	SI 9	SI 10	
P1	1	0.2	0.5	0.67	1	1	1	1	0.67	0.8	0.72 (Good)
P2	1	0.05	0.9	0.33	1	1	1	1	0.67	0.3	0.56 (Below average)
P3	1	0.05	0.9	0.33	1	1	1	1	0.33	0.3	0.56 (Below average)
P4	1	0.4	0.9	0.67	1	1	0.67	1	0.67	0.3	0.71 (Good)
P5	1	0.1	0.1	0.33	1	1	1	1	0.33	0.3	0.45 (Poor)
P6	1	0.2	0.9	0.01	1	0.01	1	1	0.33	0.3	0.27 (Poor)
P7	1	0.05	0.1	0.33	0.6	1	1	1	0.33	0.3	0.40 (Poor)
P8	1	0.05	1	0.33	0.7	0.67	1	1	0.33	0.3	0.49 (Poor)
P14	1	0.05	0.5	0.33	1	1	1	1	0.67	0.3	0.53 (Below average)
P16	1	0.9	0.9	0.33	1	0.67	1	1	0.67	0.3	0.72 (Good)
P17	1	0.8	0.9	0.33	1	0.67	1	1	0.67	0.3	0.71 (Good)
P18	1	0.8	0.9	0.33	1	0.67	1	1	0.67	0.3	0.71 (Good)
P19	1	0.9	0.9	0.33	1	0.67	1	1	0.67	0.3	0.72 (Good)
P22	1	0.4	0.1	0.33	1	1	1	1	0.33	0.3	0.51 (Below average)
P27	1	0.05	0.9	0.33	0.2	1	1	1	0.33	0.3	0.44 (Poor)
Key: SI 1 – Location SI 2 – Pond Area SI 3 – Pond Drying SI 4 – Water Quality SI 5 – Shade						SI 6 – Waterfowl SI 7 – Fish SI 8 – Ponds Within 1km SI 9 – Terrestrial Habitat SI 10 – Macrophytes					

Table 4.1: Habitat Suitability Index of Accessible Ponds Within 250 m of Study Area

4.2 Site Suitability and Connectivity Assessment

Although some suitable terrestrial habitat was present in the form of woodland, hedge, log piles, dead wood and rough grassland, most of the site is intensively managed as an attraction for the public which reduces its suitability and limits the connectivity between ponds within a 250 m radius.

Connectivity between these ponds and the development area is therefore considered limited. If GCN are present in the pond on site (P1), suitable terrestrial habitat features are present which would allow GCN to disperse to other suitable areas within the development boundary.

5. Impact Assessment

5.1 Summary of Proposals

The proposals require the demolition of the lemur house, removal of several animal enclosures and clearance of trees and vegetation to make way for the construction of a National Science Conservation Centre. Therefore, permanent loss of these habitats is anticipated, as well as permanent and temporary loss of grasslands and scrub.

Construction Phase

The following activities are likely to be associated with the proposed development during the construction phase.

- Site clearance and ground preparation;
- Use and movement of heavy goods vehicles and machinery;
- Storage of plant, materials and waste; and,
- Presence of and movement of site personnel.

Operational Phase

The following activities are likely to be associated with the operational phase of the proposed development.

- Permanent siting of buildings, structures and roads;
- Frequent movement of heavy goods vehicle, cars and other forms of transportation;
- Use of lighting associated with roads and buildings;
- Presence of and movement of site personnel; and,
- Maintenance of landscaping.

5.2 Summary of Key Features for Great Crested Newts

Fifteen ponds within a 250 m radius of the development boundary were assessed for their habitat suitability for GCN. Six ponds were assessed as having 'Good' suitability, including P1 which is located within the development boundary. Four were assessed as having 'Below average' suitability and five were assessed as having 'Poor' suitability.

Ponds P1 and P4 were assessed as having 'good' suitability to support great crested newts. Factors considered important for the presence of great crested newts within waterbodies comprised size (great crested newts have a preference for waterbodies in the 50-250 m²), absence of fish and waterbirds which are known to be efficient predators of great crested newts, lack of significant shading and reasonable water quality with a clear water column. However, pond P4 did lack aquatic vegetation suitable for laying of eggs and the water level is artificially regulated, which render this pond less suitable to support a breeding population of great crested newts.

Ponds P16 to P19 were assessed as having 'good' suitability to support great crested newts. Factors considered important for the presence of great crested newts within these waterbodies comprised absence of fish and waterbirds which are known to be efficient predators of great crested newts, lack of significant shading and reasonable water quality with a clear water column. However, these ponds did lack aquatic vegetation suitable for laying of eggs and were lined, which render them less suitable to support breeding amphibians.

Ponds P2, P3, P14 and P22 were assessed as having 'below average' suitability to support great crested newts. Ponds P5, P6, P7, P8 and P27 were assessed as having 'poor' suitability to support great crested newts. With the exception of ponds P22 and P27, they were all manmade concrete based, sometimes lined ponds. Most of them were very small (less than 50 m²) with poor quality water and no vegetation, which is essential for egg laying purposes. All these factors contribute to the unlikelihood of supporting any amphibian population.

5.3 Potential Impacts on Great Crested Newts

None of the ponds (P2, P3, P4, P5, P6, P7, P8, P14, P16, P17, P18, P19, P22 and P27) within 250 m of the site will be directly impacted. Due to their manmade nature, their lack of vegetation and/or low suitability score; all ponds surveyed within a 250 m radius of the site, have been scoped out of further surveys as they are considered unsuitable for breeding GCN.

The pond on site (P1) had good suitability for GCN and there are records of GCN within 1 km radius of the development boundary. The connectivity between the pond (P1) and the local records of GCN is limited, as the surrounding landscape of the zoo is intensively managed, and the A444 separates the records from the development area. The likelihood of GCN being present with the development area is therefore considered low, however there is still a possibility that GCN use the pond (P1) and terrestrial habitats within the development area.

As the proposals will impact suitable terrestrial habitats in proximity to a potential GCN breeding pond, further surveys are required to determine whether GCN are likely to be present in the pond on site and what impacts the development will have on GCN.

6. Recommendations

All recommendations provided in this section are based on Middlemarch's current understanding of the site proposals, correct at the time the report was compiled. Should the proposals alter, the conclusions and recommendations made in the report should be reviewed to ensure that they remain appropriate.

- R1 eDNA Survey:** Pond P1 has been identified as suitable to support GCN by the HSI assessment and should be surveyed for the presence of GCN environmental DNA (eDNA). This involves collecting water samples from waterbodies between 15th April and 30th June and sending them to an approved laboratory to be tested. This will inform the potential need for further survey or methods of work during the clearance of the site.

7. Drawings

Drawing C160474-05-01 – Pond Location Plan



Legend

- Site boundary
- Pond proposed to survey
- 250m from site boundary
- 500m from site boundary

Project	Twycross Zoo	
Drawing	Pond Location Map	
Client	Baker Mallett c/o Twycross Zoo	
Drawing Number	C160474-05-01	Revision 00
Scale @ A3	1:5,000	Date September 2023
Approved By	CH	Drawn By VO/BD
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C160474-05-01

Appendix 1

Relevant Legislation

Great crested newts (GCN) and the places they use for shelter or protection receive legal protection under the Conservation of Habitats and Species Regulations 2017, (Habitats Regulations 2017) and the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019 (Habitats Regulations 2019). They receive further legal protection under the Wildlife and Countryside Act (WCA) 1981, as amended. This protection means that GCN, and the places they use for shelter or protection, are capable of being a material consideration in the planning process.

Regulation 41 of the Habitats Regulations 2017, states that a person commits an offence if they:

- deliberately capture, injure or kill a GCN;
- deliberately disturb GCN;
- deliberately take or destroy eggs of a GCN; or
- damage or destroy a GCN breeding site or resting place.

Disturbance of animals includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young, or in the case of animals of a hibernating or migratory species, to hibernate or migrate; or to affect significantly the local distribution or abundance of the species to which they belong.

It is an offence under the Habitats Regulations 2017 for any person to have in his possession or control, to transport, to sell or exchange or to offer for sale, any live or dead GCN, part of a GCN or anything derived from GCN, which has been unlawfully taken from the wild. This legislation applies to all life stages of GCN.

Changes have been made to parts of the Habitats Regulations 2017 so that they operate effectively from 1st January 2021. The changes are made by the Habitats Regulations 2019, which transfer functions from the European Commission to the appropriate authorities in England and Wales.

All other processes or terms in the 2017 Regulations remain unchanged and existing guidance is still relevant.

The obligations of a competent authority in the 2017 Regulations for the protection of species do not change. A competent authority is a public body, statutory undertaker, minister or department of government, or anyone holding public office.

Whilst broadly similar to the above legislation, the WCA 1981 (as amended) differs in the following ways:

- Section 9(1) of the WCA makes it an offence to *intentionally* kill, injure or take any protected species.
- Section 9(4)(a) of the WCA makes it an offence to *intentionally or recklessly** damage or destroy, or *obstruct access to*, any structure or place which a protected species uses for shelter or protection.
- Section 9(4)(b) of the WCA makes it an offence to *intentionally or recklessly** disturb any protected species *while it is occupying a structure or place which it uses for shelter or protection*.

*Reckless offences were added by the Countryside and Rights of Way (CROW) Act 2000.

The reader should refer to the original legislation for the definitive interpretation.

GCN are listed a Species of Principal Importance for Nature Conservation in England which means they are a material consideration in the planning process. The list of species is derived from Section 41 list of the Natural Environmental and Rural Communities (NERC) Act 2006.

Appendix 2

Pond Descriptions and Assessment of Habitat Features

Attribute	Description
Pond P1	
Description	Small manmade pond near woodland. 
Grid Reference	SK 31523 06078
Pond Area	100 m ²
Permanence	Sometimes dries. Pond was dry at the time of survey but contained water during the first survey visit in 2022.
Water Quality	Moderate, water was clear with some invertebrates present.
Shade	50% shaded by woodland and scrub.
Waterfowl	Absent.
Pond Count	62
Fish	Absent.
Surrounding Terrestrial Habitat	Moderate suitability – immediate suitable terrestrial habitat included woodland, scrub, and rough grassland.
Macrophytes	50% cover included bullrush, yellow flag iris, teasel, goat willow, great willowherb and redshank.
Open Courtship Area	Open courtship areas are present as only 50% of the surface is covered by macrophytes.
Egg Laying Habitat	Aquatic vegetation is present and submerged leaf litter may be suitable for egg laying.

Attribute	Description
Pond P2	
Description	Small manmade pond in the west of the tiger enclosure, concrete base and no vegetation present in the water. 
Grid Reference	SK 31630 06106
Pond Area	35 m ²
Permanence	Never dries – normal water level.
Water Quality	Likely poor, moderate water clarity with no vegetation and no signs of invertebrates.
Shade	50% shaded by bamboo and concrete wall.
Waterfowl	Absent.
Pond Count	59
Fish	Absent.
Surrounding Terrestrial Habitat	Moderate suitability. Immediate suitable terrestrial habitat included rough grassland, scrub, logs and rocks.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying.

Attribute	Description
Pond P3	
Description	Small manmade concrete pond with no vegetation. No banks, just concrete rocks/sides. 
Grid Reference	SK 31656 06220
Pond Area	8 m ²
Permanence	Never dries – low water level.
Water Quality	Poor – moderate clarity, leaf litter and a bit of scum present.
Shade	40% shaded by concrete and rock wall.
Waterfowl	Absent.
Pond Count	61
Fish	Absent.
Surrounding Terrestrial Habitat	Poor suitability. Short mown grassland, hardstanding and buildings, only a small amount of scrub in the immediate surroundings.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying.

Attribute	Description
Pond P4	
Description	Manmade pond with concrete bank on one side, concrete wall on opposite side and grassy banks on the other two sides. Shallow incline on one grassy bank, steeper (up to 45°) on the other. 
Grid Reference	SK 31599 06319
Pond Area	200 m ²
Permanence	Likely never dries. Medium water depth. Pump present to reduce water level when needed.
Water Quality	Moderate. Water appeared muddy but there was no scum on the surface and lots of dragonflies were present.
Shade	5%
Waterfowl	Absent
Pond Count	58
Fish	Possible
Surrounding Terrestrial Habitat	Moderate suitability. Amenity grassland, rough grassland, dead wood/logs, sand, trees and rocks.
Macrophytes	5% cover, comprising yellow flag iris <i>Iris pseudacorus</i> , rush <i>Juncus</i> sp. and water plantain <i>Alisma plantago-aquatica</i> .
Open Courtship Area	Open courtship areas were present.
Egg Laying Habitat	Water plantain and leaf litter were present.

Attribute	Description
Pond P5	
Description	Manmade concrete pond, nearly dry at time of survey, not fed, allowed to dry. No banks. Within short, grazed grassland. 
Grid Reference	SK 31741 06256
Pond Area	60 m ²
Permanence	Dries annually – low water level.
Water Quality	Poor – clear water but no vegetation or sign of invertebrates.
Shade	20% shaded by a non-native ornamental tree.
Waterfowl	Absent
Pond Count	61
Fish	Absent
Surrounding Terrestrial Habitat	Poor suitability. Short mown grassland, hardstanding and buildings, only a small amount of scrub in the immediate surroundings.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying. Submerged leaf litter may provide suboptimal egg laying opportunities.

Attribute	Description
Pond P6	
Description	Small concrete manmade lined pond. Chlorinated and filtered (including sand filter). Surrounded by stones and rocks with a concrete wall all around the penguin enclosure. 
Grid Reference	SK 31778 06311
Pond Area	100 m ²
Permanence	Never dries – normal water level.
Water Quality	Bad – good clarity but chlorinated and filtered, likely no living organisms.
Shade	50% shaded by trees including ash and Norway maple.
Waterfowl	Major; penguin in the enclosure, heron seen on site at feeding times.
Pond Count	61
Fish	Absent (penguin pond).
Surrounding Terrestrial Habitat	Poor suitability. Immediate surrounding terrestrial habitat included amenity grassland and hardstanding, suitable habitat was limited and included some rocks, scrub and trees. High walls surrounding the enclosure limited access to the area by amphibians.
Macrophytes	0%
Open Courtship Area	Open courtship area was present (0% macrophyte cover).
Egg Laying Habitat	No suitable egg laying features present. Chlorinated water makes it unsuitable for GCN/amphibians to live in.

Attribute	Description
Pond P7	
Description	Small concrete manmade lined pond in former bush dog enclosure, dry at the time of survey, surrounded by hardstanding and building. 
Grid Reference	SK 31725 06395
Pond Area	8 m ²
Permanence	Dries annually, dry at the time of survey.
Water Quality	Likely poor.
Shade	80% shaded by trees and building.
Waterfowl	Absent.
Pond Count	58
Fish	Absent.
Surrounding Terrestrial Habitat	Poor suitability. Arable land further afield and amenity grassland within the zoo, immediate habitat included building and hardstanding which are unsuitable.
Macrophytes	0%
Open Courtship Area	Open courtship area was present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying, some leaf litter.

Attribute	Description
Pond P8	
Description	Small concrete manmade pond in bird enclosure, surrounded by small rocks then gravel beyond. 
Grid Reference	SK 31750 06383
Pond Area	8 m ²
Permanence	Likely rarely dries, water level was low.
Water Quality	Likely poor.
Shade	75% shaded by trees.
Waterfowl	Minor.
Pond Count	58
Fish	Absent.
Surrounding Terrestrial Habitat	Poor suitability. Arable land further afield and amenity grassland within the zoo, suitable immediate terrestrial habitat included scrub and ornamental trees.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying, some leaf litter.

Attribute	Description
Pond P14	
Description	Small manmade pond in the east of the tiger enclosure, concrete base and no vegetation present in the water. 
Grid Reference	SK 31719 06137
Pond Area	15 m ²
Permanence	Likely sometimes dries – low water level.
Water Quality	Likely poor, moderate water clarity with no vegetation and no signs of invertebrates.
Shade	10% shaded by cherry <i>Prunus</i> sp.
Waterfowl	Absent.
Pond Count	60
Fish	Absent.
Surrounding Terrestrial Habitat	Moderate suitability. Immediate suitable terrestrial habitat included rough grassland, scrub, logs and rocks.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying.

Attribute	Description
Pond P16	
Description	Manmade concrete and lined pond, in the shape of a moat within the gibbon enclosure. No vegetation present in the pond, gentle sloped short banks with no vegetation. Artificially fed. 
Grid Reference	SK 31828 06115
Pond Area	495 m ²
Permanence	Never dries – normal water level.
Water Quality	Likely poor, poor water clarity with green algae on the surface in areas, no vegetation and no signs of invertebrates.
Shade	20% shaded by building.
Waterfowl	Minor – mallard ducks and moorhen.
Pond Count	61
Fish	Absent.
Surrounding Terrestrial Habitat	Moderate suitability. Suitable immediate terrestrial habitat included rough grassland, scrub, logs and rocks.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying.

Attribute	Description
Pond P17	
Description	Manmade concrete and lined pond, in the shape of a moat within the gibbon enclosure. No vegetation present in the pond, gentle sloped short banks with no vegetation. Artificially fed, P12 feeds into P13 via manmade stream with rocky bottom and bullrush, willowherb and broadleaved dock. 
Grid Reference	SK 31873 06105
Pond Area	450 m ²
Permanence	Never dries – normal water level.
Water Quality	Likely poor, clear water but no vegetation and no signs of invertebrates.
Shade	20% shaded by building and scrub.
Waterfowl	Minor – mallard ducks and moorhen.
Pond Count	61
Fish	Absent.
Surrounding Terrestrial Habitat	Moderate suitability. Suitable immediate terrestrial habitat included rough grassland, scrub, logs and rocks.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying.

Attribute	Description
Pond P18	
Description	Manmade concrete and lined pond, in the shape of a moat within the gibbon enclosure. No vegetation present in the pond, gentle sloped short banks with no vegetation. Artificially fed. 
Grid Reference	SK 31812 06077
Pond Area	450 m ²
Permanence	Never dries – normal water level.
Water Quality	Likely poor, clear water but no vegetation and no signs of invertebrates.
Shade	20% shaded by building.
Waterfowl	Minor – mallard ducks and moorhen.
Pond Count	61
Fish	Absent.
Surrounding Terrestrial Habitat	Moderate suitability. Suitable immediate terrestrial habitat included rough grassland, scrub, logs and rocks.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying.

Attribute	Description
Pond P19	
Description	Manmade concrete and lined pond, in the shape of a moat within the gibbon enclosure. No vegetation present in the pond, gentle sloped short banks with no vegetation. Artificially fed. 
Grid Reference	SK 31873 06063
Pond Area	480 m ²
Permanence	Never dries – normal water level.
Water Quality	Likely poor, poor water clarity with green algae on the surface in areas, no vegetation and no signs of invertebrates.
Shade	10% shaded by building and scrub.
Waterfowl	Minor – mallard ducks and moorhen.
Pond Count	61
Fish	Absent.
Surrounding Terrestrial Habitat	Moderate suitability. Immediate suitable terrestrial habitat included rough grassland, scrub, logs and rocks.
Macrophytes	0%
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).
Egg Laying Habitat	No aquatic vegetation is present for egg laying.

Attribute	Description
Pond P22	
Description	Pond being restored through the Countryside Stewardship Scheme at the time of survey. Pond was being cleared of debris, desilted, cleared of some scrub and dead wood. A 10 m buffer zone on either side will be implemented in the future, it will be fenced and naturally regenerated. Dry at time of survey, hedge laying is planned to be carried out on either side. 
Grid Reference	SK 31479 05862
Pond Area	200 m ²
Permanence	Dries annually – only holds water 5-6 months of the year according to the landowner.
Water Quality	Likely poor.
Shade	50% shaded by oak, ash, cherry, blackthorn and hawthorn.
Waterfowl	Absent.
Pond Count	64
Fish	Absent.
Surrounding Terrestrial Habitat	Poor suitability, surrounding habitat is mostly arable, suitable habitat included hedge.
Macrophytes	0%
Open Courtship Area	N/A – no water.
Egg Laying Habitat	No egg laying opportunities.

Attribute		Description
Pond P27		
Description	Small woodland pond, fed through rain water, very silty and shaded.	
Grid Reference	SK 31373 05880	
Pond Area	25 m ²	
Permanence	Likely never dries although the water level was low.	
Water Quality	Poor – poor clarity and scum on the surface.	
Shade	100% shaded by trees as pond was within a small woodland area, species included mature horse chestnut trees.	
Waterfowl	Absent.	
Pond Count	52	
Fish	Absent.	
Surrounding Terrestrial Habitat	Poor suitability. Large areas of arable within 250 m of the pond; immediate suitable terrestrial habitat included woodland, standing deadwood, rough grassland, scrub and logs.	
Macrophytes	0%	
Open Courtship Area	Open courtship areas were present (0% macrophyte cover).	
Egg Laying Habitat	No aquatic vegetation is present for egg laying. Submerged leaf litter likely present as a suboptimal egg laying opportunity.	

Table A2.1: Pond Descriptions and Assessment of Habitat Features for Great Crested Newts