

A47 North Tuddenham to Easton Dualling

Scheme Number: TR010038

Volume 6

6.3 Environmental Statement Appendices

Appendix 8.6 - Great Crested Newt Survey Report

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed
Forms and Procedure) Regulations 2009

March 2021

Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning
(Applications: Prescribed Forms and
Procedure) Regulations 2009**

The A47 North Tuddenham to Easton
Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT APPENDICES
Appendix 8.6 - Great Crested Newt Survey Report

Regulation Number:	5(2)(a)
Planning Inspectorate Scheme Reference	TR010038
Application Document Reference	TR010038/APP/6.3
BIM Document Reference	HE551489-GTY-EBD-000-RP-LB-30011
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Version	Date	Status of Version
Rev 0	March 2021	Application Issue

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1. Scheme introduction and location

1.1.1. In April, May and June 2019, Sweco undertook great crested newt *Triturus cristatus* surveys of a route (Route 2) which was chosen at the options stage, along a stretch of the A47 between North Tuddenham and Easton, hereafter referred to as “the site”, on behalf of Highways England. This report is to inform the Environmental Statement (ES) Chapter at PCF Stage 3 for the A47 North Tuddenham to Easton Improvement Scheme, hereafter referred to as ‘the Proposed Scheme’.

1.1.2. The Proposed Scheme improvements will:

- improve accessibility to and around the region, reducing congestion and delays to enable more reliable journey times
- improve safety performance for all road users, contributing to a 40% reduction target in accidents across Highways England’s roads over the implemented schemes’ first five years in operation
- provide alternative access to local roads
- improve the environmental impact of traffic along the A47 route, particularly for the communities in the six scheme areas
- support economic growth in the Peterborough, Norwich and Great Yarmouth areas by improving overall road capacity

1.1.3. The North Tuddenham to Easton section of the A47 lies to the west of Norwich at national grid reference (NGR) TG 05952 13577. This 7.9km single carriageway section forms a part of the main strategic highway route. The proposed scheme includes the partial dualling of the existing road with some deviations along the route.

1.1.4. This baseline report details the results of the great crested newt surveys undertaken at the site in April, May and June 2019 and recommendations for mitigation and/or further survey where necessary.

2. Ecological background

2.1. Previous studies

Desk study

- 2.1.1. Highways England (2017) undertook ecological surveys to inform PCF Stage 2 of the Proposed Scheme, a stage in which four differing route options were being considered by Highways England.
- 2.1.2. Highways England undertook a desk study which included the purchase of ecological records from the Norfolk Biodiversity Information Service ((NBIS) Amey, 2017). NBIS returned seven historical records of great crested newt recorded between 1974 and 1998 (Amey, 2017).

Extended phase 1 habitat survey

- 2.1.3. The Extended Phase 1 Habitat survey undertaken by Highways England in summer 2016 identified standing water within the survey area (100m from the outermost option) (Amey, 2017).

Phase two great crested newt surveys

- 2.1.4. In 2016 at PCF Stage 1, Highways England undertook habitat suitability index (HSI) assessments of 102 waterbodies identified within 500m of the outermost option. Of the 102 surveyed waterbodies, 53 were recommended for further survey work and subject to environmental DNA (eDNA) surveys (Amey, 2017).
- 2.1.5. The eDNA surveys undertaken in 2016 identified four waterbodies which were positive for great crested newt, three which were returned as indeterminate and nine which could not be assessed, with the remaining ponds showing negative results for great crested newt eDNA (Amey, 2017).
- 2.1.6. eDNA surveys and/or population size-class assessment survey methods were also undertaken in 2017 on those 16 waterbodies which were previously subject to eDNA in 2016 and which could not be assessed or were found positive or indeterminate for great crested newt. In addition to those four waterbodies previously positive for great crested newt (section 2.1.4), one further waterbody was found positive for great crested newt (**TR010038/APP/6.1**).
- 2.1.7. In 2017, phase two population size-class assessment survey methods including bottle trapping and torch surveys were employed on those five waterbodies which were found positive for great crested newt eDNA and three waterbodies which were returned as indeterminate in the eDNA survey. One waterbody which was not assessed in the eDNA survey was also subject to population size-class assessment survey methods.

2.1.8. The results of the combined phase two surveys identified five ponds with 'small' great crested newt populations and one pond with a 'medium' great crested newt population (Amey, 2017).

2.2. Legislation

2.2.1. The great crested newt is afforded protection under the Conservation of Habitats & Species Regulations (CHSR) 2017, which applies to all of its life stages. The great crested newt is also listed on Schedule 5 of the Wildlife and Countryside Act (WCA) 1981 (as amended) which makes it an offence to:

- deliberately, intentionally, or recklessly kill, injure or take a great crested newt
- deliberately, intentionally, or recklessly take or destroy the eggs
- possess or control any live or dead specimen or anything derived from a great crested newt
- deliberately, intentionally, or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a great crested newt
- deliberately, intentionally, or recklessly disturb a great crested newt while it is occupying a structure or place which it uses for that purpose

Mistreatment

2.2.2. The Animal Welfare Act 2006 came into force in 2007 and places a duty of care on an individual responsible for an animal. The duty of care is placed on an individual to meet the welfare needs of the animal. The Act states that the following are an animal's welfare needs:

- A suitable environment
- A suitable diet
- The ability to exhibit normal behaviour patterns
- Needs to be housed with, or apart from, other animals
- Protection from pain, suffering, injury and disease

2.2.3. Should mitigation such as capture and translocation of animals be required as a result of the development, the Animal Welfare Act 2006 would apply.

2.2.4. This species is also protected by the Protection of Animals Act 1911, which prohibits any acts of cruelty or mistreatment.

2.3. Aims and objectives

2.3.1. These surveys are intended as an update to those great crested newt surveys undertaken by Highways England in 2016 and 2017 (Amey, 2017) outlined in Section 2.1, in accordance with the Chartered Institute of Ecology and

Environmental Management's ((CIEEMs) CIEEM, 2019) guidelines on the lifespan of ecological data (**TR010038/APP/6.1**).

2.3.2. The aims of the 2019 survey work and this report are to:

- determine the presence or likely absence of great crested newts in waterbodies within 500m of the site and subsequently determine the likely presence of great crested newt within the site
- determine the population size class of great crested newts if confirmed to be present
- assess the potential implications on the Proposed Scheme if great crested newts were found to be present and inform the design of appropriate mitigation
- provide instructions for mitigation and/or further survey work, where necessary
- ensure that the required level of survey work is conducted to apply for a licence, should one be necessary

3. Methodology

3.1. Desk study

3.1.1. At PCF Stage 3, for which the 2019 surveys were undertaken, a single route option, Route 2, had been chosen. This route has the closest location to the current A47 carriageway, and as such many of the ponds previously surveyed by Highways England in 2017 at PCF Stages 1 and 2 are now outside of the 500m survey area for great crested newt.

3.1.2. The following drawing was used to identify those ponds surveyed by Highways England in 2017:

- *Amey ((a) 2017). A47 Schemes North Tuddenham to Easton Great Crested Newt Survey Results. A47 Corridor – Stage 2. Figure 9.5. Drawing number: HE551489-AMY-EBDTE_STG2-DR-EN-0005.*

3.1.3. The following sources of information were used to identify any further waterbodies present within 500m of the site:

- Ordnance Survey mapping (to identify potentially notable habitats including waterbodies)
- Multi-Agency Geographical Information for the Countryside (*MAGIC*) maps
- Aerial imagery

3.1.4. In total 110 waterbodies were identified within the 500m survey area.

3.2. Waterbody descriptions

3.2.1. During the site visits between 8 April and 11 April 2019 by Sweco, descriptions of each waterbody within 500m of the site were noted including information on water depth, water quality, bank profile, presence of aquatic, emergent and surrounding vegetation, as well as suitability of the surrounding terrestrial habitat to determine the waterbodies' suitability as breeding habitat for great crested newts. The assessment was based on guidance within *Langton T. E. S. et al, (2003)* and *ARG UK, (2010)*. Waterbodies within 500m of the DCO boundary but having a significant barrier to newt dispersal between them and the site were excluded. Examples of significant barriers include motorways, major roads, busy railway lines, large expanses of bare habitat and fast-flowing rivers.

3.3. Habitat suitability index (HSI) assessment

3.3.1. In accordance with *English Nature's Great Crested Newt Mitigation Guidelines (2001)* 89 waterbodies within 500m of the site were subject to HSI assessments, which were undertaken between 8 and 11 April 2019. The HSI assessment

provides an objective method for assessing the suitability of a waterbody as habitat for great crested newts (Oldham et al., 2000; ARG UK, 2010). The system provides an index between 0 and 1, with 0 indicating unsuitable habitat and 1 optimal habitat. Ten suitability indices are used to calculate the index score, each representing a factor considered to affect great crested newts. These factors are listed and briefly explained below:

1. Location: that is where the waterbody is located in the British Isles. Lowlands are generally thought to be most suitable; suitability declines with increases in altitude.
2. Waterbody area: that is the water surface area of a waterbody. Suitability peaks at approximately 800m².
3. Waterbody drying: how often a particular waterbody dries out. Waterbodies which dry out more frequently are less suitable.
4. Water quality: an indication of water quality based on the invertebrate diversity present. High invertebrate diversity indicates high water quality and suitability.
5. Shade: an estimate of the total shaded perimeter of a waterbody. Shoreline shade below 60% is optimal.
6. Fowl: indication of impact by waterfowl. High waterfowl numbers are generally considered detrimental.
7. Fish: indication of fish abundance. High fish numbers are generally considered detrimental.
8. Waterbody count: based on the density of waterbodies occurring within 1km of a particular waterbody. Suitability is positively correlated with waterbody density.
9. Terrestrial habitat: based on the availability of suitable habitat in the waterbody vicinity, e.g. rough grassland, scrub and woodland. For this assessment, the categories provided in *ARG UK, (2010)* were used. This differs from the assessment criteria by Oldham et al. (2000) and is based on work by Lee Brady (unpublished).
10. Macrophytes: based on an estimate of the percentage cover by emergent and aquatic vegetation. Suitability peaks at between 70% and 80% cover.

3.3.2. The results are also compared against a categorical scale developed by Lee Brady (*unpublished*). Results from individual waterbodies are categorised as follows:

- <0.5 = poor
- 0.5 – 0.59 = below average
- 0.6 – 0.69 = average
- 0.7 – 0.79 = good

- >0.8 = excellent

- 3.3.3. Natural England suggests a threshold HSI score of 0.5 as an indication that a waterbody is of very low value and unlikely to support great crested newts (Natural England, 2019). Further presence/likely absence surveys are normally undertaken at waterbodies with HSI scores above 0.5.
- 3.3.4. The survey was undertaken by Diane Wood MCIEEM (Principal Ecologist, Sweco, Natural England great crested newt class licence CL08 holder – registration number 2015-19177-CLS-CLS), Ishbel Campbell ACIEEM (Consultant Ecologist, Sweco, Natural England great crested newt class licence CL08 holder - registration number 2016-20998-CLS-CLS), Adam West GradCIEEM (Consultant Ecologist, Sweco, Natural England great crested newt class licence CL08 holder – registration number 2019-40324-CLS-CLS) and Beth Mell GradCIEEM (Graduate Ecologist, Sweco).
- 3.3.5. Of the 110 waterbodies within the 500m survey area, 89 were subject to HSI assessment. HSI assessments were undertaken in April 2019. Fourteen of the waterbodies were scoped out of having an HSI assessment as they were dry, two were fishing lakes and two were refused access by the owner as they had been surveyed by the Environment Agency in 2018. Three waterbodies no longer existed.

3.4. Presence or likely absence surveys

- 3.4.1. Of the 89 waterbodies subject to HSI assessment, 62 waterbodies were considered suitable to support breeding great crested newts and were subject to presence/likely absence eDNA water sampling surveys between 29 April and 2 May 2019.
- 3.4.2. eDNA water sampling surveys followed the guidance in the *Natural England protocol* (Biggs, J. et al. 2014). The eDNA sampling kits were collected from, and upon completion returned to, the SureScreen Scientifics laboratory in Derby.

3.5. Population size-class assessment surveys

- 3.5.1. Where positive results were obtained during the presence/likely absence eDNA surveys (on six waterbodies plus one adjacent waterbody), and three waterbodies which were not subject to eDNA surveys as they were found to have great crested newt present by Highways England in 2017, in accordance with guidance from Natural England <https://www.gov.uk/guidance/great-crested-newts-surveys-and-mitigation-for-development-projects>; six visits to each of these ten waterbodies were undertaken between mid-March and mid-June 2019, with at least two of those visits between mid-April and mid-May.

- 3.5.2. The eDNA and population size class assessment surveys were undertaken by Diane Wood MCIEEM (Principal Ecologist, Sweco, Natural England great crested newt class licence CL08 holder – registration number 2015-19177-CLS-CLS), Ishbel Campbell ACIEEM (Consultant Ecologist, Sweco, Natural England great crested newt class licence CL08 holder - registration number 2016-20998-CLS-CLS), Adam West GradCIEEM (Consultant Ecologist, Sweco, Natural England great crested newt class licence CL08 holder – registration number 2019-40324-CLS-CLS) Beth Mell GradCIEEM (Graduate Ecologist, Sweco) and assisted by Charlotte Ward and Harry Jarvis.
- 3.5.3. The three following survey methods were performed on each survey (where possible) in accordance with guidelines given in English Nature, (2001) as described below.

Bottle trapping

- 3.5.4. Traps were constructed from two-litre plastic bottles (the neck is inverted to form a funnel at the trap entrance, and the whole is attached into position by a stake) and were set around the margins of water bodies approximately every 2-3m where access allowed, shortly before dusk. The traps were checked and removed the following morning between 06:00am and 10:00am. All surveys were undertaken when the predicted air temperature exceeded 5°C, when great crested newts are most active.

Torchlight survey

- 3.5.5. This technique involves a visual search for any individual newts inhabiting the pond. 1,000,000 candle power torches were shone into the water during searches; care was taken to count individuals once only. To maximise the reliability of this technique, all torch surveys were conducted in the evening while air temperature exceeded 5°C, when newts are generally considered being most active.

Egg search

- 3.5.6. Great crested newt eggs were searched for among submerged, floating and other aquatic vegetation. When laying their eggs, this species folds leaves of aquatic plants around the egg, although dead leaves and a variety of artificial materials are also known to be used. This behaviour is used to confirm the presence of breeding great crested newts in a particular water body; the eggs of great crested and smooth newts *Lissotriton vulgaris* are easily discerned by their differing colour and size. However, egg numbers cannot be used to estimate population size due to predation and high mortality rates. Therefore, to limit disturbance, this method is ceased as soon as the first egg has been positively identified.

3.6. Population size-class assessment

3.6.1. Size classes are based on maximum count of great crested newts achieved during any single survey at a particular waterbody - i.e. the highest count was obtained from bottle trapping or torchlight survey on a single visit. Maximum counts are classed as 'small', 'medium' or 'large'. The population size classes are defined as follows:

- 'Small' is for maximum counts of up to 10 adult great crested newts.
- 'Medium' for maximum counts of between 11 and 100 adults.
- 'Large' for maximum counts of over 100 adults.

3.7. Limitations

3.7.1. All three survey methods were used wherever possible; however, the consistency of their use was variable due to the specific conditions of individual water bodies. Every effort was made to place bottle traps and undertake torch and egg search surveys around the whole of the perimeter of each waterbody.

3.7.2. Waterbody 28, which scored an 'average' HSI result, was not subject to eDNA or population size-class assessment survey methodologies as access was denied by the landowner. The nearest waterbody to waterbody 28 which was found to have great crested newt present through the eDNA and population size-class assessment survey methodologies, and which is not separated from waterbody 28 by a barrier to dispersal such as the A47, is waterbody 16 approximately 860m west from waterbody 28. As this is a significant distance from waterbody 28 (>500m) and the other waterbodies within the survey area and 500m of waterbody 28 which included The Street, 26, 27 (negative eDNA), 23 (Dry), 29 (poor HSI), and 79 and 80 (large fishing lakes scoped out prior to the HSI assessment), it is considered unlikely that great crested newt are present in waterbody 28.

3.7.3. During the population size-class assessment surveys waterbody three had dried up on the fifth visit undertaken on 5 June 2019. As such waterbody three had five of the recommended six surveys undertaken to determine population size-class due to seasonal constraints on the surveys. In addition, for the sixth population size-class assessment survey undertaken on 12 June 2019, five traps only were deployed (as opposed to the previous 8 – 10 traps) due to low water levels. As the five surveys undertaken on this waterbody identified one great crested newt during one survey visit only (the survey visit undertaken on 20 May 2019) it is considered unlikely that undertaking a sixth survey visit would record 9/10 or more great crested newts. Therefore, the peak count and population size-class for this waterbody, and the combined population size-class for

waterbodies one and three which are located close together, would remain the same.

3.7.4. During the population-size class surveys the number of traps deployed in each waterbody differed across the six survey visits for all waterbodies except waterbody 69, for which five traps were used on each of the six survey visits. The differing number of traps deployed across the survey visits for each of the other waterbodies is explained below:

- Waterbody one had 15 traps deployed on the third survey visit, however only 10 on the other five visits due to difficulties deploying the traps due to access and impenetrable waterbody substrate.
- Waterbody three, as previously mentioned, had dried up on the survey visit undertaken on 5 June 2019 and suffered fluctuating and receding water levels leading to a fewer number of traps being deployed on the sixth survey visit.
- Waterbody 13b only had eight traps deployed on 6 June 2019, as opposed to 10 which were used in the other survey visits as surveyors had difficulty deploying the traps due to impenetrable substrate.
- Waterbody 16 suffered fluctuating and receding water levels leading to a different number of traps being used across the majority of survey visits, with particularly low numbers of traps used on 5 June 2019 (three traps) and 12 June 2019 (five traps).
- Waterbody 50 had receding water levels in June which led to fewer traps being deployed in the three survey visits in that month with eight traps deployed on 5 June and six traps deployed on 6 June and 12 June 2019.
- The water level in waterbody 90 receded and in addition some areas of the banks were inaccessible due to dense vegetation and fallen vegetation debris which led to a variation in the number of traps deployed across each of the six survey visits with only five traps deployed on 29 May 2019.
- Whilst waterbody 92 did not suffer from receding water levels there is a slight variation in the number of bottles deployed across the six survey visits due to difficulties accessing the waterbody and areas of the waterbody substrate being impenetrable.

3.7.5. The maximum peak counts for any one survey visit at waterbodies one, three and 16 were of one great crested newt recorded. No great crested newts were recorded in waterbodies 13b, 50, 69, 90 and 92 on any of the survey visits. It is therefore considered unlikely that the deployment of more traps on those survey visits when less were deployed due to impenetrable substrate and receding water levels would result in the recording of 10 or more great crested newts. As such the population size class assessment of 'small' for these waterbodies is considered accurate.

- 3.7.6. Waterbody 52, which has a HSI assessment score of 'below average', was found too shallow to collect an adequate eDNA sample clean of debris and waterbody bed substrate. As waterbody 50 returned a positive result for great crested newt eDNA and is located approximately 216m closer to the A47 than waterbody 52, any areas within the scoping boundary which would require great crested newt mitigation for waterbody 52 should it contain great crested newts would already be subject to mitigation for waterbody 50.
- 3.7.7. High levels of turbidity and/or dense amounts of floating material including algae, least duckweed and vegetation debris resulted in a number of the torchlight surveys at waterbodies 50 and 69 unfeasible. Again, due to no great crested newts being recorded in the bottle traps over the six survey visits at these waterbodies it is considered unlikely that the torchlight surveys would reveal 10 or more great crested newts on any one survey visit.
- 3.7.8. Due to the eDNA results not arriving until 16 May 2019, three waterbodies did not have the minimum of two population size-class survey visits between mid-April and mid-May. Waterbodies 90, 92 and 50 were surveyed for population size-class for the first time on 22 May 2019. Waterbody 13b had one survey visit between mid-April and mid-May on the 20 May 2019. Whilst this is a limitation, it is not considered a significant limitation as the full six population size-class assessment surveys were undertaken within the survey season with reference to good practice guidelines and the results using these methods found no great crested newts, so the likelihood of a population size class greater than small is unlikely (English Nature, 2001).
- 3.7.9. Due to these limitations it must be acknowledged that it is possible some evidence of the presence of great crested newts may have been missed.
- 3.7.10. However, despite the limitations highlighted above, the survey effort applied is considered sufficient to meet the aims and objectives of the survey and this report, in accordance with the aforementioned guidelines.
- 3.7.11. The results of this survey will remain valid until March 2021. Beyond this period, if works have not commenced, it is recommended that a new review of the ecological conditions is undertaken.

4. Results

4.1. Desk study

- 4.1.1. As part of a desk study undertaken by Highways England (see Section 2.1) records of protected and notable species within 2km of the site purchased from NBIS returned seven historical records of great crested newt recorded between 1974 and 1998 (Amey, 2017) (**TR010038/APP/6.1**).
- 4.1.2. Of the 16 ponds surveyed by Highways England in 2017 (Amey (a), 2017), eight are within 500m of the site (the 'survey area') and subject to survey.
- 4.1.3. In addition, MAGIC and aerial imagery identified a further 101 ponds within the survey area. In addition, a new man-made waterbody (The Street) was identified during the HSI assessments which was not visible on aerial imagery and thus not identified in the desk study.
- 4.1.4. Of the total 110 waterbodies within the survey area, two (waterbodies 37 and 38) were previously surveyed in 2018 by the Environment Agency and found negative for great crested newt. As such, these were not subject to survey. Therefore, 108 waterbodies in total were subject to survey.
- 4.1.5. See Appendix A for locations of all 110 identified waterbodies within 500m of the Proposed Scheme (**TR010038/APP/6.3**).

4.2. Habitat description

- 4.2.1. During the HSI assessment surveys 14 waterbodies (six, 11, 12, 18, 20, 23, 54, 58, 63, 82, 83, 93, 97 and 90b) were found to be dry. Waterbody 58 (identified on MAGIC during the desk study) was found to be an area of marshy grassland with no standing water. In addition, three waterbodies (34, 35 and 40) were found to no longer exist and as such these dry and absent waterbodies were not subject to HSI assessment.
- 4.2.2. A further two waterbodies were found to be fishing lakes (79 and 80). Waterbodies with high numbers of stocked fish are considered unsuitable for great crested newt and as such waterbodies 79 and 80 were scoped out prior to the HSI assessment. Therefore, a total of 89 waterbodies were subject to HSI assessment.
- 4.2.3. Detailed descriptions of each of the 89 waterbodies within the survey area subject to HSI assessment are given in Table 4.2.1 below. The purpose of these descriptions is to determine the waterbodies' suitability as breeding habitat for great crested newts. Therefore, information on water depth, water quality, bank profile, presence of emergent vegetation, as well as suitability of the surrounding

terrestrial habitat has been provided. A grid reference is provided for each waterbody; refer to Appendix A for their positions in relation to the site (TR010038/APP/6.3).

Table 4.2.1: waterbodies within 500m of the site and their descriptions.

Waterbody Number	Description	Location and Grid Reference
1	A moderate-sized farm pond with approximately 60% shading from adjacent trees. The banks are very shallow with emergent vegetation with approximately 30% macrophyte cover. Water quality is considered moderate. The surrounding terrestrial habitat is moderate with hedgerows present.	Off Low Road, North Tuddenham TG 05742 13244
2	A small farmland pond shaded by surrounding trees (approximately 90% shade. Water quality is considered poor. The banks are steep and macrophyte cover is 0%. The surrounding habitat is considered poor for great crested newt.	Off Low Road, North Tuddenham TG 05795 13267
3	A small garden pond with an ornamental bridge. The banks are very shallow with approximately 15% macrophyte cover. Water quality is considered moderate and the surrounding habitat is considered poor as it is primarily a garden and adjacent arable land.	Off Low Road, North Tuddenham TG 05915 13291
4	A large garden pond with vertical banks which are undercut in areas. Evidence of heavy use by waterfowl was recorded. Water quality is considered moderate and macrophyte cover is approximately <5%. Shading from adjacent habitat is approximately 5%. The surrounding terrestrial habitat is considered moderate with hedgerows present.	Oak Farm, off Low Road, North Tuddenham TG 06046 13413
5	A moderately-sized woodland pond with least duckweed present. Shading from the adjacent woodland is approximately 45% and macrophytes are absent. The surrounding habitat is considered moderate with significant amounts of woodland present within 250m.	North of the A47 west of Hockering TG 06173 13557
7	A small woodland pond entirely shaded by adjacent trees. Water quality is considered moderate and macrophytes are absent. The surrounding terrestrial habitat is considered excellent with woodland present.	Adjacent to the south of the A47 north of Low Road TG 06389 13438
8	A small woodland pond entirely shaded by adjacent trees with shallow banks. Water quality is considered poor and macrophytes are absent. The surrounding terrestrial habitat is considered excellent with woodland present.	Adjacent to the south of the A47 north of Low Road TG 06409 13428
8b	A small woodland pond almost dry at the time of survey. The pond is 100% shaded from adjacent trees and water quality is considered poor with 0% macrophyte cover. The surrounding terrestrial habitat is considered excellent with woodland present.	Adjacent to the south of the A47 north of Low Road TG 06409 13428
9	A small, entirely shaded farmland pond with shallow banks and no macrophytes. Water quality is considered moderate and the surrounding terrestrial habitat is considered poor as it is primarily arable land.	North of the A47 east of Hockering Wood TG 06580 14053
10	A small, shaded (approximately 90%) farmland pond with no macrophytes. Water quality is considered moderate and the surrounding terrestrial habitat is considered poor.	North of the A47 east of Hockering Wood TG 06635 14154
13a	A moderate-sized, shaded (approximately 95%) farmland pond with approximately 5% macrophyte cover and shallow banks. Water quality is considered moderate and the surrounding habitat is considered poor as it is primarily arable.	North of the A47 west of Hockering TG 06863 13652
13b	A small, shaded (approximately 95%) farmland pond with approximately 5% macrophyte cover and very shallow banks. The water quality is	North of the A47 west of Hockering

Waterbody Number	Description	Location and Grid Reference
	considered moderate and the surrounding habitat is considered poor as it is primarily arable. Evidence of waterfowl use was recorded.	TG 06889 13641
14	A relatively small, shaded farmland pond containing amounts of least duckweed <i>Lemna minuta</i> . Shading from adjacent habitat is approximately 75% and water quality is considered moderate. The banks are shallow with moderately steep areas and macrophyte cover is approximately 5%. The surrounding terrestrial habitat is considered poor as it is primarily arable land.	North of the A47 west of Hockering TG 06815 13463
15	A relatively small, shaded farmland pond with approximately 90% shading from adjacent trees. Water quality is considered moderate and banks are shallow. Macrophyte cover is approximately 5% and the surrounding terrestrial habitat is considered poor as it is primarily arable land.	North of the A47 west of Hockering TG 07101 13681
16	A shaded (approximately 75%) farmland pond with very shallow banks and approximately 30% macrophyte cover. The water quality is considered moderate and the surrounding terrestrial habitat is considered poor as it is primarily arable land.	North of the A47 west of Hockering TG 07156 13475
17	A large garden pond with evidence of heavy use by waterfowl. Water quality is considered moderate and shading from adjacent habitat is approximately 40%. Macrophyte cover is approximately 15% and the surrounding terrestrial habitat is considered poor consisting of gardens and arable land.	Off The Street, Hockering TG 07246 13164
19	A relatively large woodland pond with 100% shading from adjacent trees and moderately-steep banks. Water quality is considered moderate and macrophyte cover is approximately 10%. The surrounding habitat is considered good with woodland present.	South-west off Mattishall Lane TG 07027 12769
19b	A waterbody which has formed at the termination of a drain with approximately 25% shading from adjacent habitat. Water quality is considered good and macrophyte cover is approximately 95%. The surrounding terrestrial habitat is considered good for great crested newts.	South-west off Mattishall Lane TG 06839 12770
19c	A standing water drain with approximately 98% macrophyte cover and approximately 50% shading from the bank. Water quality is considered good and the surrounding terrestrial habitat is considered moderate, however evidence of flooding present.	South-west off Mattishall Lane TG 06907 12790 (approximate)
20b	A very small pool of water at the termination ditch. The ditch was merely damp at the time of survey. Shading from adjacent habitat is approximately 25% and water quality is considered good. Macrophyte cover is approximately 25% and the surrounding terrestrial habitat is considered moderate and includes woodland and hedgerows.	South-west of Hockering, south of Mattishall Lane TG 06967 12639 (approximate)
21	Moderate-sized pond in pasture land with approximately 90% shading from adjacent habitat. Macrophyte cover is approximately 30% and water quality is considered moderate. The surrounding habitat is considered good and includes woodland and hedgerows.	South of Hockering east of Mattishall Lane TG 07145 12592
22	A large decoy pond with a large island in the centre and mostly vertical banks. Water quality is considered poor and shading from adjacent habitat is $\geq 60\%$. Evidence of a minor impact from waterfowl was recorded and macrophyte cover is approximately 5%. The surrounding habitat is considered poor and includes areas of grassland and arable land.	South of Hockering TG 07332 12600
24	A small pond formed within a ditch. Shading from bankside trees entirely covers the pond and banks are moderately steep. Water quality is considered poor and macrophytes are absent. The surrounding habitat is considered poor and includes arable land and grassland.	South of Hockering TG 07624 12561
25	A very small lined garden pond which was nearly dry at the time of survey. Shading from adjacent habitat is approximately 50% and water	South-east of Hockering

Waterbody Number	Description	Location and Grid Reference
	quality is considered poor. Macrophytes are absent and the surrounding habitat is considered good with significant amounts of woodland present.	TG 07793 12801
26	A body of water within a sewage works with very steep banks. Shading from adjacent habitat is approximately 25% and macrophyte cover approximately 10%. The surface of the pond was covered by floating mixed pondweed and algae. Water quality is considered poor. The surrounding habitat is considered good and includes significant areas of woodland and some stretches of hedgerow.	South-east of Hockering TG 07881 12744
27	A moderate-sized woodland/garden pond with moderately-steep banks. Evidence of a minor impact from waterfowl was present. Macrophyte cover is approximately 5% and water quality is considered poor. Shading from adjacent habitat is approximately 70% and the surrounding habitat is considered moderate with areas of woodland, waterbodies and hedgerows present.	North-east edge of Hockering TG 07780 13216
28	A large lake adjacent to fishing lakes. Shading from adjacent habitat is approximately 15% and macrophyte cover is estimated at <10%. Water quality is considered moderate and the surrounding habitat is considered poor as it is arable land.	North-east of Heath Road, Hockering TG 08027 13206
29	A small pond surrounded by trees within arable farmland. The banks are very shallow and shading is approximately 95%. Water quality is considered poor and macrophytes are absent. The surrounding habitat is considered poor as it is primarily arable land.	West of Park Lane TG 08256 13126
30	Large ornamental garden pond with approximately 10% shading from adjacent habitat. Water quality is considered good and macrophyte cover is approximately 90% consisting of <i>Typha</i> sp. The surrounding habitat includes hedgerows and significant amounts of woodland and is considered good.	West of Rotten Row TG 07744 12319
31	A small pond adjacent to the larger waterbody thirty (30). Shading from adjacent trees is approximately 25% and water quality is considered good. Macrophyte cover is approximately 20% and includes <i>Typha</i> sp. and the surrounding habitat is considered good with woodland present.	West of Rotten Row TG 07788 12330
32	A small farmland pond enclosed and entirely shaded by vegetation. Macrophytes are absent and water quality is considered moderate. The surrounding habitat includes woodland and hedgerows and is considered good.	South-west of Rotten Row TG 07956 12227
33	A small garden pond with evidence of a major impact by waterfowl. Shading is approximately 40%, water quality is considered moderate and macrophytes are absent. The surrounding habitat is considered as it consists primarily of arable land and grassland.	Off Rotten Row TG 08133 12260
33b	A small, lined garden pond stocked with significant numbers of fish. No shade is cast over the pond from adjacent habitat and no macrophytes are present. Water quality is considered poor and the surrounding habitat is considered poor as it includes large areas of arable land.	West off Rotten Row TG 08088 12279 (approximate)
39	A large farmland pond with an island. Shading from adjacent habitat is approximately 10% and water quality is considered good. Anecdotal evidence was received from a nearby resident of a terrapin sp. <i>Testudine</i> sp. in the pond. Macrophyte cover is approximately 70% with abundant marginal vegetation including horsetail sp. <i>Equisetum</i> sp. The surrounding habitat includes woodland and hedgerows and is considered moderate.	East of Church Lane west of Hockering TG 08879 12171
40b	Large ornamental pond within woodland with 50% shading from adjacent habitat. Water quality is considered good and macrophytes cover approximately 25% of the surface. The surrounding habitat is considered good with significant areas of woodland present.	East of Berry's Lane TG 09416 11904

Waterbody Number	Description	Location and Grid Reference
41	A small woodland pond with approximately 80% shading from adjacent habitat. Macrophytes cover approximately 10% of the waterbody and water quality is considered moderate. The surrounding habitat is considered good with hedgerows and significant areas of woodland present.	East of Berry's Lane TG 09444 11838
42	Farmland pond in the centre of an arable field encircled by vegetation which entirely shades the pond. The pond was shallow and nearly dry at the time of survey. No macrophytes are present and water quality is considered moderate. The surrounding habitat is considered good with woodlands and hedgerows present.	West off Wood Lane TG 09533 12608
43	Moderate-sized ornamental garden pond. No shading is cast from adjacent habitat. Macrophyte cover is approximately 25% and water quality is considered moderate. The surrounding habitat is considered poor and includes improved, managed grassland.	Off Berry's Lane west of Honingham TG 09763 11865
44	A moderately-sized farmland pond with approximately 50% shading from adjacent trees. Water quality is considered moderate and macrophyte cover is approximately 75%. Waterfowl were recorded as present in small numbers. The surrounding habitat is considered poor as it is primarily arable land.	On Easton Estates east of Wood Lane TG 10067 12280
45	A small farmland pond enclosed within trimmed vegetation along a hedgerow. Approximately 95-100% of the pond is shaded by the vegetation and there are no macrophytes present. Water quality is considered poor and the surrounding habitat is considered poor as it is primarily arable land.	On Easton Estates east of Wood Lane TG 10197 12262
46	A small farmland pond surrounded by trees along a hedgerow. Shading from the adjacent trees is approximately 80% and macrophyte cover is approximately 40%. Water quality is considered moderate and the surrounding habitat is considered poor as it is primarily arable land.	On Easton Estates east of Wood Lane TG 10360 12371
47	A small woodland pond with approximately 80% shading from adjacent habitat. The pond showed evidence of the water having receded. Water quality is considered poor and macrophytes are absent. The surrounding terrestrial habitat is considered moderate with woodland, hedgerows and arable land present.	On Easton Estates TG 10378 12029
48	A small woodland pond with approximately 85% shading from adjacent habitat. The pond showed evidence of the water having receded. Macrophytes are absent and water quality is considered moderate. The banks are shallow and the surrounding habitat is considered moderate with woodland, hedgerows and arable land present.	On Easton Estates TG 10387 12013
49	A relatively small farmland pond with shallow banks and approximately 65% shading from adjacent trees. Least duckweed is present, however macrophytes are absent. Water quality is considered moderate and the surrounding habitat is considered poor as it is primarily arable land.	On Easton Estates TG 10665 12133
50	A small farmland pond enclosed by vegetation within a hedgerow. Least duckweed was present on the surface. Macrophytes are absent and water quality is considered poor. Shading from adjacent habitat is approximately 60% and the surrounding habitat is considered moderate and consist of arable land, hedgerows and woodland.	On Easton Estates TG 10863 11969
51	A small woodland pond with shallow banks and approximately 70% shading from adjacent habitat. Water quality is considered poor and macrophytes are absent. The surrounding terrestrial habitat is considered moderate as a significant amount of woodland is present within 250m of the pond.	On Easton Estates TG 10911 12177
52	A woodland pond with heavily receded water. The surface area of the water at the time of survey was very small, however evidence suggests the pond was at some point a significant size. Shading from adjacent	On Easton Estates TG 10970 12200

Waterbody Number	Description	Location and Grid Reference
	habitat is approximately 75% and water quality is considered moderate. No macrophytes were present. The surrounding habitat is considered moderate as woodland is present.	
53	A moderate-sized garden pond enclosed within vegetation with approximately 30% from adjacent habitat. Water quality is considered poor and macrophyte cover is approximately 50%. Evidence of a minor impact from waterfowl was recorded. The surrounding habitat is considered moderate with woodland, hedgerows and gardens present.	North-east edge of Honingham TG 10658 11745
55	Large, shallow woodland pond with approximately 90% shading from woodland. Macrophytes are absent and water quality is considered moderate. The surrounding habitat is considered good with woodland and hedgerows present.	South-east of Honingham between Mattishall Road and Norwich Road TG 10522 11446
56	A moderately-sized, entirely shaded woodland pond with no macrophytes present. Water quality is considered poor and the surrounding habitat is considered good with woodland and hedgerows present within 250m.	South-east of Honingham between Norwich Road and Mattishall Road TG 10592 11406
57	A small pond within an area of wet, marshy grassland with moderately-steep heavily vegetated banks. Shading is approximately 20% and water quality is considered moderate. Macrophyte cover is 50% consisting primarily of marginal vegetation. The surrounding habitat is considered good with areas of connected woodland and rough grassland present.	On Easton Estates TG 10954 11622
59	Small farmland pond enclosed by vegetation in the centre of a field. Shading from the adjacent habitat is approximately 80% and macrophytes are absent. Water quality is considered poor and the surrounding habitat is considered moderate with arable, semi-improved grassland and woodland present.	On Easton Estates west of Taverham Road. TG 11140 11600
64	A body of water formed at the confluence of two (2) ditches. Banks are very shallow and macrophyte cover is approximately 10%. Water quality is considered good and shading from adjacent habitat is approximately 15%. The surrounding habitat is considered good with hedgerow, grassland and woodland present.	On Easton Estates west of Ringland Road TG 12871 11385
65	A pond formed at the confluence of two (2) ditches which is connected to pond 64 by one (1) of the ditches. Water quality is considered good and shading from adjacent habitat is approximately 20%. Macrophyte cover is 90% and the surrounding habitat is considered moderate with hedgerows, rough grassland and woodland present.	West off Ringland Road TG 12970 11385
66	A pond formed at the confluence of two (2) ditches. Water quality is considered good and shading from adjacent habitat is approximately 10%. Macrophyte cover is 20% and the surrounding habitat is considered moderate with hedgerows, rough grassland and woodland present.	West off Ringland Road TG 13035 11427
67	A large woodland/garden pond with used for recreation with a boat house present. Banks are moderately steep and vertical and shading from adjacent habitat is $\geq 60\%$. Water quality is considered moderate and evidence of a minor impact from waterfowl was recorded. Macrophyte cover is approximately 10% and the surrounding habitat is considered good with significant areas of woodland within 250m of the pond.	West off Ringland Road TG 13240 11444
68	A small woodland pond with approximately 60% shading from adjacent habitat. Water quality is considered moderate and no macrophytes were present. The surrounding habitat is considered good with woodland and hedgerows present.	East off Ringland Road TG 13533 11452
69	A ditch entirely overshadowed by trees with the invasive non-native species (INNS) Himalayan balsam <i>Impatiens glandulifera</i> present. Macrophyte cover is approximately 5% and water quality is considered	East of Church Lane west of Honingham

Waterbody Number	Description	Location and Grid Reference
	poor. The surrounding habitat is considered moderate with hedgerows, woodland and waterbodies 39 and 69b present.	TG 09012 12050 (approximate)
69b	A ditch entirely overshadowed by trees. Water quality is considered moderate and macrophyte cover is approximately 5%. The surrounding habitat is considered moderate with hedgerows, woodland and waterbody 39 present.	East of Church Lane west of Honingham TG 08976 12078 (approximate)
70	A small, shallow woodland pond with approximately 50% shading from adjacent habitat. Water quality is considered moderate and macrophyte cover is approximately 50%. The surrounding terrestrial habitat is considered good with significant amounts of woodland present.	South-west of Honingham, north-west of Fellowes Road TG 10033 11630
71	A large pond with cattle-poached banks. Shading from adjacent habitat is approximately 10% and macrophytes are absent. Water quality is considered good and the surrounding habitat includes woodland and is considered moderate.	Off Low Road west of Fox Lane TG 04898 13519
71b	A very small (approximately 4m ²) garden pond with approximately 75% shading from adjacent habitat. Water quality is considered moderate and macrophytes are absent. The surrounding habitat consists of woodland, hedgerows and another pond and is considered good.	Off Low Road west of Fox Lane TG 04820 13497
72	A small farmland pond enclosed by vegetation which casts shade over approximately 80% of the surface. Evidence of minor impacts by waterfowl was recorded. Macrophytes are absent and water quality is considered moderate. The surrounding terrestrial habitat is considered poor as it is primarily arable land.	West of Fox Lane TG 05193 13386
73	A very small, shallow farmland pond entirely shaded by adjacent habitat. Water quality is considered poor and there are no macrophytes present. The surrounding habitat includes hedgerows and is considered moderate.	Off Low Road west of Fox Lane TG 04913 13315
74	A very small, lined garden pond with approximately 50% shading from adjacent habitat and vertical stone-built banks. Water quality is considered moderate and macrophytes cover 20% of the surface. The surrounding habitat is considered poor as it consists primarily of gardens and arable land.	Off Low Road west of Fox Lane TG 04953 13290
74b	A small, lined garden pond with brick walls and pumped water. Water quality is considered poor and macrophytes cover approximately 5% of the surface. No shade is cast over the pond from adjacent habitat. The surrounding habitat is considered poor and includes gardens and arable land.	Off Low Road west of Fox Lane TG 04985 13228 (approximate)
75	A small, natural garden pond with approximately 25% shading and 25% macrophyte cover. Banks are shallow and heavily vegetated. Water quality is considered moderate and the surrounding habitat is considered good with woodland present.	Off Low Road west of Fox Lane TG 05053 13174
76	A small, shallow woodland pond entirely shaded by surrounding woodland. Water quality is considered good and macrophytes cover approximately 10% of the surface. The surrounding habitat includes significant amounts of woodland and is considered good.	South off Low Road west of Hockering TG 05727 13061
77	Farmland pond with approximately 50% shading from adjacent vegetation. The water quality is considered moderate and macrophytes cover approximately 80% of the pond. Banks are shallow and the surrounding habitat is considered poor as it is primarily arable land.	North of the A47, east of Hockering Wood TG 06478 14326
78	A small farmland pond with approximately 80% shading from adjacent habitat. Banks are steep and dense with vegetation. Macrophytes are absent and water quality is considered moderate. The surrounding	South-east of Hockering TG 07829 11972

Waterbody Number	Description	Location and Grid Reference
	terrestrial habitat consists primarily of arable land and as such is considered poor.	
81	A small farmland pond enclosed in vegetation in the centre of an arable field. The pond is entirely shaded and macrophytes are absent. Water quality is considered moderate and the surrounding habitat is primarily arable land and thus considered poor.	East off Church Lane, west of Honingham TG 08713 11817
81b	A small farmland pond along a hedgerow arable field margin. The pond is entirely shaded and macrophytes are absent. Water quality is considered moderate and the surrounding habitat is considered poor as it is primarily arable land with semi-improved grassland.	East off Church Lane, west of Honingham TG 08733 11984
84	A relatively small, shaded (approximately 70%) farmland pond with no macrophytes and water quality which is considered moderate. The surrounding terrestrial landscape is considered poor as it is primarily arable land.	On Easton Estates west of Wood Lane TG 10178 12625
85	A large woodland pond with 5% macrophyte cover. Water quality is considered moderate and the banks are very shallow. Approximately 40% of the pond is shaded from adjacent habitat and the surrounding habitat is considered good with woodland present.	On Easton Estates west of Wood Lane TG 10724 12749
86	A large pond with approximately 10% shading from adjacent habitat. Water quality is considered moderate and macrophyte cover is approximately 20%. The surrounding habitat is considered good with marshy areas, woodland and reedbed present.	On Easton Estates TG 11233 12166
87	A large (>2000m ²) pond with approximately 10% shading from adjacent habitat. Water quality is considered good and macrophytes cover approximately 30% of the surface. Evidence of minor impacts from waterfowl was recorded. The surrounding habitat includes woodland and hedgerows and is considered good.	Off Colton Road south of Grange Lane, south of Honingham TG 10431 10783
88	A moderately-sized woodland pond with evidence of a minor impact by waterfowl. Shading is approximately 40% and water quality is considered poor. Macrophyte cover is approximately 10% and the surrounding habitat is considered good with woodland and hedgerows present.	Off Grange Lane south- east of Honingham TG 10724 10905
89	A very small farmland pond enclosed by woodland between arable field margins. Evidence of a receded water level was recorded at the time of survey and the water depth was very shallow. Shading from adjacent trees is approximately 50% and the water quality is considered moderate. <i>Typha</i> sp. covers approximately 50% of the surface and the surrounding terrestrial habitat is considered poor with primarily arable land present.	South-east of Honingham north of Grange Lane TG 11345 10895
90	A small farmland pond enclosed by trees at the confluence of two hedgerows. Evidence of a receded water level was recorded at the time of survey. Water quality is considered moderate and the shading from adjacent trees is approximately 60%. Macrophytes are absent and the surrounding terrestrial habitat is considered moderate with woodland, hedgerows and arable land present.	South-east of Honingham, north of Grange Lane. TG 11350 10980
91	A small farmland pond enclosed by vegetation in the centre of an arable field. The pond is located in a deep depression in the arable field and macrophytes consist of grasses <i>Poaceaea</i> sp. covering approximately 60% of the surface. Water quality is considered moderate and no shade is cast from the adjacent arable land. The surrounding habitat is primarily arable land and thus is considered poor.	South-east of Honingham, north of Grange Lane. TG 11617 10980
92	A large pond surrounded by reed. INNS Himalayan balsam, a species listed on WCA Schedule 9, was present within the reed and around the pond. Parrot's feather <i>Microphyllum aquaticum</i> , another Schedule 9 species, was also present, along with the INNS and problematic least duckweed and fennel pondweed <i>Potamogeton pectinatus</i> . Shading from adjacent habitat is approximately 40% and water quality is considered	On Easton Estates TG 12617 11603

Waterbody Number	Description	Location and Grid Reference
	moderate. Macrophyte cover, consisting primarily of marginal vegetation, is approximately 50% and evidence of a minor impact from waterfowl was recorded. The surrounding habitat is considered good with significant areas of woodland present.	
94	A small farmland pond with approximately 15% shading from adjacent habitat and shallow banks. Water quality is considered moderate and macrophyte cover is approximately 85%. The surrounding habitat is primarily arable land and is considered poor for great crested newt.	North of the A47, west of Hockering TG 06716 13586
95	A small woodland pond with heavily receded, shallow water. Banks are very shallow and macrophytes are absent. Shading from the adjacent woodland is approximately 95%. The surrounding habitat is considered moderate with woodland within Hockering Wood SSSI present as well as arable land and hedgerows.	In the south-west corner of Hockering Wood SSSI, west of Hockering TG 06724 14018
96	A farmland pond enclosed by surrounding trees, the shading is approximately 60%. The banks are very shallow and water quality is considered poor. No macrophytes are present and the surrounding habitat is considered poor as it is primarily arable land.	On Easton Estates east off Wood Lane TG 09879 12531
100	A moderate-sized garden pond with evidence of heavy use by waterfowl (faeces and bare banks). Banks are vertical and water quality is considered poor. No macrophytes are present and the surrounding habitat is considered moderate with woodland present.	Off Sandy Lane TG 08867 12654
101	A small, lined ornamental garden pond with scattered stone banks. Macrophytes are absent and water quality is considered poor. Shading from adjacent habitat is approximately 50% and the surrounding habitat is predominantly urban, however is considered moderate due to the presence of hedgerows and urban gardens.	Between Granary Close and Yew Tree Court, Hockering TG 07539 12949
Ditch 1	A narrow ditch (approximately 1-1.5m wide) containing standing water in marshy grassland with least duckweed present. Approximately 50% of the ditch is shaded by surrounding habitat and banks and the water quality is considered moderate. Macrophyte cover is 70%, including rushes growing on the edge of the banks and the surrounding habitat is considered good with hedgerows, woodland and marshy grassland present.	On Easton Estates east of Ringland Road TG 12719 11542
Ditch 2 and 3	A long, narrow ditch (approximately 1-1.5m wide) containing standing water within marshy grassland. Water quality is considered good and shading from adjacent habitat is approximately 70%. Macrophyte cover is approximately 80% and surrounding habitat is considered good with marshy grassland, hedgerows and woodland present.	On Easton Estates east of Taverham Road TG 12671 11467
The Street	A pond in an open public access area with no shade cast from adjacent habitat and approximately 30% macrophyte cover including <i>Typha</i> sp. Water quality is considered moderate and the surrounding habitat is considered moderate with hedgerows and woodland present.	Off The Street on the eastern edge of Hockering TG 07901 12966

4.3. HSI assessment

4.3.1. Thirteen waterbodies were dry at the time of survey (waterbodies six, 11, 12, 18, 20, 23, 54, 63, 82, 83, 93, 97, 90b) and therefore not subject to any survey. In addition, waterbody 58 (identified on MAGIC during the desk study) was found to be an area of marshy grassland with no standing water and therefore also not subject to survey. A further three waterbodies were found to no longer exist (waterbodies 34, 35 and 40). Waterbodies 79 and 80 were large fishing ponds and thus scoped out as they are considered unsuitable for great crested newt. In

addition, waterbodies 37 and 38 were subject to survey by the Environment Agency in 2018 and great crested newt were found absent. As these surveys were undertaken by the EA within two years prior to the surveys undertaken by Sweco in 2019, their negative results were considered valid and still applicable, in line with CIEEMs guidelines (2019). The remaining 88 waterbodies identified in the desk study were subject to HSI assessments, in addition to a waterbody (The Street) which was identified during the HSI assessments. Therefore, a total of 89 waterbodies were subject to HSI assessment.

- 4.3.2. The results for the HSI assessment revealed seven waterbodies in the ‘excellent’ category, 14 in the ‘good’ category, 25 in the average category, 18 in the below average’ category and 25 in the ‘poor’ category.
- 4.3.3. Table 4.3.3 below lists the HSI score’s and categories for each of the 89 waterbodies subject to HSI assessment (**TR010038/APP/6.1**). The HSI scores give each waterbody a score category (‘excellent’, ‘good’, ‘average’, ‘below average’ or ‘poor’) which indicates its suitability for great crested newt. Waterbodies in the ‘excellent’ category have a 93% chance of containing great crested newts whilst waterbodies in the ‘good’ category have a 79% chance, those in the ‘average’ category have a 55% chance, waterbodies in the ‘below average’ category have a 20% chance and those waterbodies in the ‘poor’ category have a 3% chance of containing great crested newt.

Table 4.3.3 HSI scores and categories for the 89 waterbodies subject to assessment.

Waterbody	HSI Score	HSI Category
30	0.94	Excellent
39	0.86	
87	0.85	
86	0.83	
The Street	0.829533974	
92	0.82	
1	0.80	
85	0.096845686	Good
44	0.095281718	

Waterbody	HSI Score	HSI Category	
31	0.09045		
21	0.09		
71	0.08120601		
Ditch 2 and 3	0.0603		
40b	0.05472225		
88	0.05332932		
66	0.052934288		
4	0.04		
57	0.04093968		
16	0.04		
5	0.03		
19c	0.028502906		
27	0.697448662		Average
55	0.69		
53	0.69		
91	0.68		
28	0.680429621		
14	0.67		
Ditch 1	0.658207539		
65	0.66		
19	0.66		

Waterbody	HSI Score	HSI Category	
19b	0.65		
13a	0.65		
46	0.64		
75	0.64		
26	0.637825573		
41	0.64		
70	0.64		
49	0.63		
68	0.63		
64	0.63		
3	0.62		
15	0.62		
22	0.62		
94	0.609166084		
72	0.60		
56	0.60		
51	0.59		Below average
84	0.59		
76	0.59		
90	0.58		
50	0.58		

Waterbody	HSI Score	HSI Category
43	0.58	
77	0.57	
10	0.57	
96	0.564457853	
52	0.56	
78	0.55	
48	0.54	
13b	0.54	
101	0.537155135	
20b	0.53	
59	0.52	
74	0.52	
67	0.50	
74b	0.508204287	
89	0.50	
71b	0.490371933	
47	0.48	
17	0.48	
2	0.48	
29	0.48	
24	0.463476498	

Waterbody	HSI Score	HSI Category
69	0.46	
81	0.46	
95	0.457761445	
25	0.4507859	
45	0.45	
32	0.44	
9	0.44	
69 b	0.43	
8b	0.42	
42	0.42	
7	0.42	
8	0.39	
33	0.39	
33b	0.377521912	
73	0.37	
81b	0.367095009	
100	0.36	

4.3.4. See Appendix B for the full HSI assessment results of the 89 waterbodies subject to assessment (**TR010038/APP/6.3**).

5. Presence or likely absence surveys

- 5.1.1. Waterbodies with a HSI score of 'below average' or above (see Section 4.3) were subject to a presence or likely absence environmental DNA (eDNA) survey. Three waterbodies which were found positive for great crested newt through eDNA, population size-class assessment surveys or both, by Amey in 2017 (waterbodies three, 16 and 69 (see Section 2.1)) and were still within the new 500m boundary of the chosen route option were excluded from the eDNA surveys as presence had already previously been established by Amey (2017). Waterbody one was also positive for great crested newts in 2017 but was subject to eDNA in 2019 in error. In addition, three waterbodies (nine, 100 and 89) with HSI scores of 'poor' were subject to eDNA surveys simultaneously with HSI assessments, due to access restrictions and seasonal constraints on the surveys.
- 5.1.2. Waterbody 28, which has a HSI score of 'average' was not subject to eDNA due to access not being granted by the landowner. Waterbody 52, which has a HSI score of 'below average' was too shallow to allow surveyors to collect an adequate water sample for the eDNA survey, and as such was not subject to presence or likely absence survey.
- 5.1.3. Water samples were taken from 62 waterbodies for eDNA analysis between 29 April and 2 May 2019. The samples were taken to SureScreen Scientific laboratory in Derby for analysis on 2 May 2019.
- 5.1.4. The results indicate that great crested newt eDNA was detected in waterbodies one, 13b, 30, 50, 90 and 92. See Appendix C for locations of waterbodies subject to eDNA surveys and results (**TR010038/APP/6.3**).

6. Population size-class assessment surveys

- 6.1.1. Population size-class assessment surveys were undertaken on each of the six waterbodies with positive eDNA results (one, 13b, 30, 50, 90 and 92) in addition to the further three waterbodies which Amey found great crested newt presence in 2017 (three, 16 and 69). Waterbody 31 was also subject to population size-class surveys as it is located approximately 13m from waterbody 30, which was found positive for great crested newt eDNA, and as such it is considered likely that waterbody 31 would also be used by great crested newt. Therefore 10 waterbodies in total were subject to population size-class assessment surveys.
- 6.1.2. See table 6.1.2 below for recorded weather conditions for population size-class assessment surveys.

Table 6.1.2 weather conditions for population size-class assessment surveys

Date	Ponds Surveyed	Air Temp. (°C) PM	Rain	Wind Speed	Cloud Cover (%)
08/05/2019	30, 31, 69	9	None - moderate	None	90 - 100
09/05/2019	1, 3, 16	9	Light	Light	100
15/05/2019	1, 3, 16	12	None	None	0
16/05/2019	30, 31, 69	14	None	Light	0
20/05/2019	1, 3, 13b, 16	13	None	Light	0
21/05/2019	30, 31, 69	14.5	None	None	5
22/05/2019	90, 92, 50	14 - 17	None	None	0-5
29/05/2019	1, 3, 13b, 16, 90	12	Light	Light	100
30/05/2019	30, 31, 50, 69, 92	20	None	None	100
05/06/2019	1, 3, 13b, 16, 50, 90, 92	12 – 14.5	None - moderate	None - light	15 - 90
06/06/2019	13b, 30, 31, 50, 69, 90, 92	12 - 16	None	None	0 - 10
12/06/2019	1, 3, 13b, 16, 30, 31, 50, 69, 90, 92	12 - 13	None - light	None - light	90 - 100
13/06/2019	50, 90, 92	14	None	Moderate	60

- 6.1.3. See table 6.1.3 below for the results of each population size-class assessment surveys. Species were sexed where possible, which is shown in the table by an “M” male or “F” female. Otherwise presence was recorded showing only the appropriate number. “J” refers to juvenile individuals and “L” refers to larva, the latter of which was mostly recorded only in terms of presence.
- 6.1.4. Waterbody 50 was not subject to torch surveys on the survey visits undertaken on 30/05/2019, 06/06/2019 and 12/06/2019. On these survey visits constraints such as floating debris, large amounts of least duckweed and high turbidity scores of three prevented surveyors seeing through the surface to undertake torch surveys.
- 6.1.5. On the first survey visit to waterbody 69 on 08/05/2019 a torch survey was attempted, however due to dense algae and least duckweed on the surface of the water, in addition to vegetation debris, it was found a torch survey was not possible due to lack of visibility. No torch survey was attempted on the subsequent five survey visits.

Table 6.1.3 population size-class assessment survey results

Survey visit	Great crested newt		Smooth newt		Palmate newt		Common toad		Common frog	
	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
Waterbody 1	1M									
09/05/2019 (10 traps)		1M	1M	1F						
15/05/2019 ¹ (10 traps)		1M								
20/05/2019 (15 traps)										
29/05/2019 (10 traps)										
05/06/2019 (10 traps)					4F, 2M					
12/06/2019 (10 traps)										
Waterbody 3	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
09/05/2019 (8 traps)										

¹ One unidentified newt was also recorded on this survey visit. The species was unidentified due to poor visibility within submerged vegetation and the individual moving quickly in response to the torch survey.

Survey visit	Great crested newt		Smooth newt		Palmate newt		Common toad		Common frog	
15/05/2019 (8 traps)	1F		5M, 1F							2J
20/05/2019 (10 traps)			1F, 1M	2F						
29/05/2019 (8 traps)										
05/06/2019		DRY								
12/06/2019 (5 traps)				1M, 1F						
Waterbody 13b	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
16/05/2019 (10 traps)										
20/05/2019 (? Traps)				1F						
29/05/2019 (10 traps)							1M			
05/06/2019 (10 traps)			1M							
06/06/2019 (8 traps)										
12/06/2019 (10 traps)										
Waterbody 16	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
09/05/2019 (10 traps)										
15/05/2019 ² (10 traps)	1F			1F						
20/05/2019 (15 traps)			1M							
29/05/2019 (10 traps)										
05/06/2019 (3 traps)										
12/06/2019 (5 traps)										

² One unidentified newt was also recorded on this survey visit. The species was unidentified due to poor visibility within submerged vegetation and the individual moving quickly in response to the torch survey.

Survey visit	Great crested newt		Smooth newt		Palmate newt		Common toad		Common frog	
	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
Waterbody 30	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
08/05/2019 (20 traps)									2L	
16/05/2019 (20 traps)										L
21/05/2019 (20 traps)								1J	L	L
30/05/2019 (20 traps)			2M						L	1F, L
06/06/2019 (20 traps)										
12/06/2019 (20 traps)							L	L		
Waterbody 31	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
08/05/2019 ³ (10 traps)									L	L
16/05/2019 (10 traps)										
21/05/2019 (10 traps)				2F						1J, L
30/05/2019 (10 traps)							L	1J		
06/06/2019 (10 traps)										
12/06/2019 (10 traps)				1F					L	1
Waterbody 50	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
22/05/2019 (8 traps)			1M, 1F							1M
30/05/2019 (10 traps)		N/A		N/A		N/A		N/A		N/A
05/06/2019 (8 traps)			1F							
06/06/2019 (6 traps)		N/A		N/A		N/A		N/A		N/A
12/06/2019 (6 traps)		N/A		N/A		N/A		N/A		N/A

³ Two small fish were also recorded in waterbody 31 during this survey visit.

Survey visit	Great crested newt		Smooth newt		Palmate newt		Common toad		Common frog	
13/06/2019 (6 Traps)										
Waterbody 69	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
08/05/2019 (5 traps)										
16/05/2019 (5 traps)		N/A		N/A		N/A		N/A		N/A
21/05/2019 (5 traps)		N/A		N/A		N/A		N/A		N/A
30/05/2019 (5 traps)		N/A		N/A		N/A		N/A		N/A
06/05/2019 (5 traps)		N/A		N/A		N/A		N/A		N/A
12/06/2019 (5 traps)		N/A		N/A		N/A		N/A		N/A
Waterbody 90	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
22/05/2019 (8 traps)										L
29/05/2019 (5 traps)										
05/06/2019 (10 traps)										
06/06/2019 (8 traps)								1		
12/06/2019 (8 Traps)										
13/06/2019 (8 Traps)										
Waterbody 92	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch	Bottle trap	Torch
22/05/2019 (27 traps)			1M				L			
30/05/2019 (30 traps)							L			
05/06/2019 (28 Traps)									2J	
06/06/2019 (28 traps)			1M						1L	
12/06/2019 (28 Traps)										

Survey visit	Great crested newt		Smooth newt		Palmate newt		Common toad		Common frog	
13/06/2019 (28 Traps)										

6.1.6. The peak counts for great crested newts in each of the 10 waterbodies surveyed are as follows:

- Waterbody one– one
- Waterbody three– one
- Waterbody 13b – none
- Waterbody 16 – one
- Waterbody 30 – none
- Waterbody 31 – none
- Waterbody 50 – none
- Waterbody 69 – none
- Waterbody 90 – none
- Waterbody 92 - none

6.1.7. To determine a population size class the maximum population counts of great crested newts by one survey method on one survey visit is used to determine the following population size classes: 0 – 10 maximum count equals a ‘small’ population, 11 – 100 maximum count equals a ‘medium’ and 100+ maximum count equals a ‘large’ population (English Nature, 2001).

6.1.8. As such waterbodies one, three and 16 are classed as having ‘small’ great crested newt populations (English Nature, 2001). The populations for the remaining seven waterbodies subject to population size-class assessments were not found.

6.1.9. The great crested newt populations in waterbodies one and three are likely to not be isolated populations as the waterbodies are within 250m of each other (approximately 166m apart) with no barriers to dispersal between them. As such the populations in these two waterbodies are considered likely to be a metapopulation. The metapopulation of these two waterbodies has a maximum peak count of two great crested newts on 20/05/2019 equalling a ‘small’ overall population size class.

6.1.10. See Appendix D for locations of the waterbodies subject to population size-class assessment surveys and results (**TR010038/APP/6.3**).

7. Impact assessment and conclusions

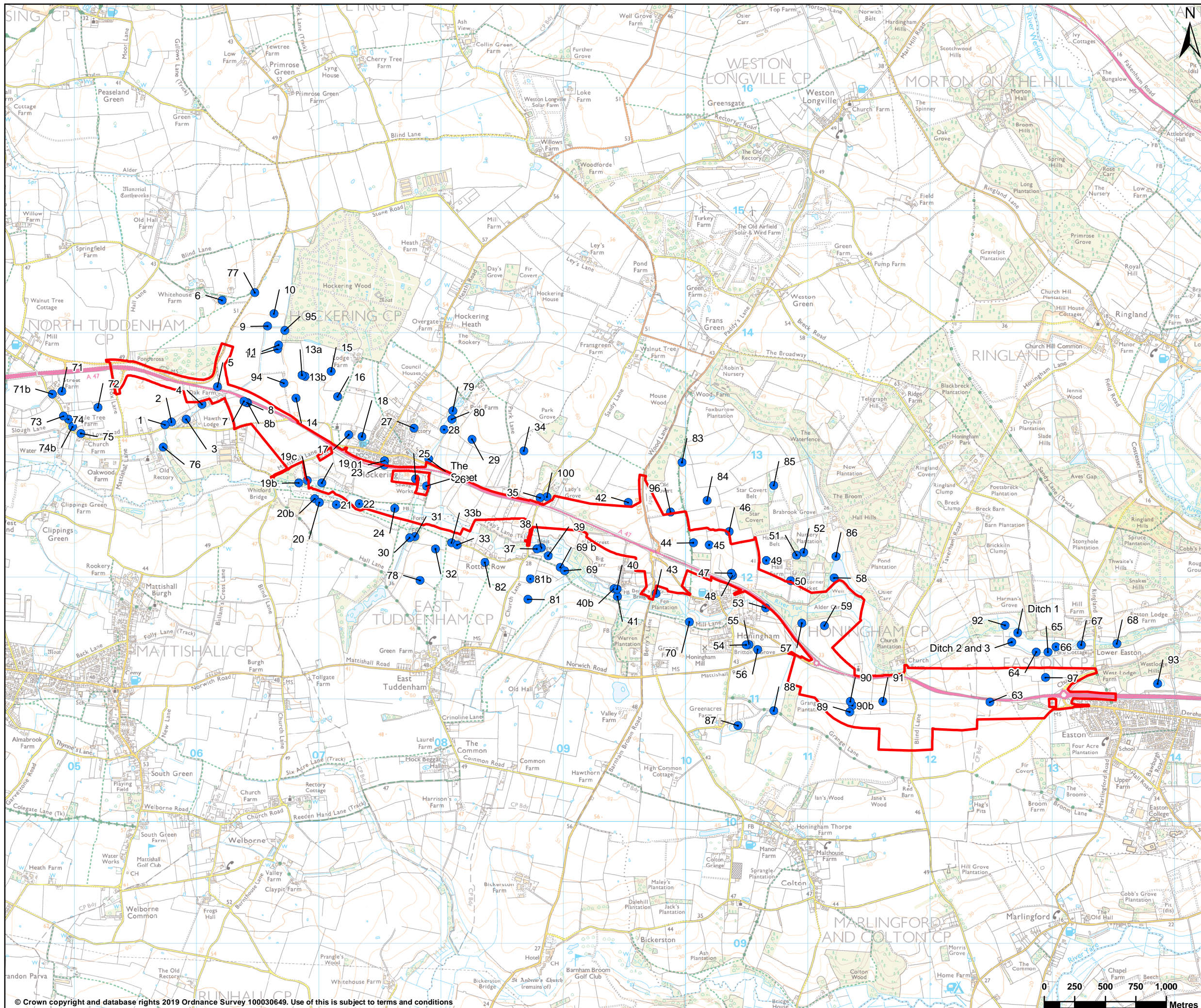
- 7.1.1. No direct impacts upon waterbodies one, three, 13b, 16, 30, 31, 69 and 92 are anticipated as these waterbodies are outside of the Proposed Scheme scoping boundary. As waterbodies 50 and 90 are on the edge of the Proposed Scheme scoping boundary and within the Proposed Scheme scoping boundary respectively, the possibility of direct impacts upon these waterbodies cannot be ruled out at this stage. Anticipated impacts upon great crested newt as a result of the Proposed Scheme include the potential killing/injuring of individuals and damage and/or destruction and/or obstruction of a resting place used by great crested newt in their terrestrial habitat and potential disturbance to great crested newt whilst they are occupying a resting place.
- 7.1.2. Due to the above anticipated impacts upon great crested newts and their habitats within the Proposed Scheme scoping boundary a European Protected Species (EPS) mitigation licence from Natural England will be required for the Proposed Scheme.
- 7.1.3. A method statement will be required for the licence application, detailing the mitigation which shall be undertaken to reduce impacts upon great crested newt as a result of the Proposed Scheme. Mitigation will include the trapping and translocation of great crested newts out of the works area to a suitable receptor site under licence and consultation with Natural England. The receptor site should be sourced and may involve enhancement for great crested newts with hibernacula, planting or new breeding ponds. Trapping must be undertaken for a minimum of 30 days, with no great crested newts captured for a minimum of five days (which can include the last five days of the minimum 30-day trapping period). Trapping and translocation can be undertaken between March and October when temperatures are higher than 5°C. Newts will be captured from the zone of impact and relocated in the receptor area during the newts' active season. Fencing will be used to prevent newts from re-entering the works area. Once works have finished, the fencing will be removed and the newts will be free to disperse.
- 7.1.4. General mitigation measures should be detailed in the method statement and will include, as good practice, the covering of trenches/excavations overnight to prevent harm to any animals, or if this is not possible a means of escape, such as an exit ramp, inserted into trenches/excavations overnight and the application of pollution prevention measures (GOV.UK, 2019) during and post-construction.

8. References

- 8.1.1. Amey (2017). Road Investment Strategy East Area 6 A47 North Tuddenham to Easton Interim Environmental Assessment Report (A47IMPS2-AMY-TE-ZZ-DO-J0024).
- 8.1.2. Amey ((a) 2017). A47 Schemes North Tuddenham to Easton Great Crested Newt Survey Results. A47 Corridor – Stage 2. Figure 9.5. Drawing number: HE551489-AMY-EBDTE_STG2-DR-EN-0005.
- 8.1.3. ARG UK, (2010). ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index. Amphibian and Reptile Groups of the United Kingdom.
- 8.1.4. Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., Griffiths, R.A., Foster, J., Wilkinson, J., Arnett, A., Williams, P. and Dunn, F. (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5 (**TR010038/APP/6.3**). Technical advice note for field and laboratory sampling of great crested newt (*Triturus cristatus*) environmental DNA. Freshwater Habitats Trust, Oxford.
- 8.1.5. CIEEM (2019). Advice Note on the Lifespan of Ecological Reports and Surveys. Available online at: <https://cieem.net/resource/advice-note-on-the-lifespan-of-ecological-reports-and-surveys/> (Accessed 13/01/2020).
- 8.1.6. English Nature (2001). Great Crested Newt Mitigation Guidelines. Peterborough.
- 8.1.7. Gent, T. & Gibson, S. (2003) Herpetofauna Workers' Manual. JNCC, Peterborough.
- 8.1.8. GOV.UK (2019). Guidance: Pollution Prevention for Businesses. Available online at: <https://www.gov.uk/guidance/pollution-prevention-for-businesses> (Accessed 13/01/2020).
- 8.1.9. Langton, T.E.S., Beckett, C.L., & Foster, J.P. (2003) Great Crested Newt Conservation Handbook. Froglife, Halesworth, Suffolk.
- 8.1.10. Multi-Agency Geographical Information for the Countryside. Available online at: <http://magic.defra.gov.uk/> (Accessed 13/01/2020).
- 8.1.11. Natural England (2019). Method Statement Template for Great Crested Newt Mitigation Licence. Available online at: <https://www.gov.uk/government/publications/great-crested-newts-apply-for-a-mitigation-licence> (Accessed 13/01/2020).

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- 8.1.12. Oldham, R.S.; Keeble, J.; Swan, M.J.S. & Jeffcote M. (2001) Evaluating the suitability of habitat for the great crested newt (*Triturus cristatus*). The Herpetological Journal 10 (4), 143-155.

Appendix A. Waterbody Locations



LEGEND

- Scoping Boundary
- Waterbodies

REFERENCE MAP

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P02	31/01/2020	First Edition	AC	BM	FB
REV	DATE	REVISION NOTE	ORG	CHKD	APPD

DESIGNER

CONTRACTOR

CLIENT

PROJECT TITLE
A47 NORTH TUDDENHAM TO EASTON
TR010038/APP/6.2

PROJECT STAGE
PCF STAGE 3

DRAWING TITLE
ANNEX A GREAT CRESTED NEWT SURVEY:
WATERBODY LOCATIONS MAP

SUITABILITY
FOR INFORMATION

SHEET SIZE	SCALE	STATUS
A3	1:30,000	S0

DRAWING NUMBER
HE551489-GTY-EBD-000-DR-LB-30018

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Appendix B. Full habitat suitability index (HSI) assessment results

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
1	Zone A	300	Rarely dries	Moderate	60	Absent	Possible	19	Moderate	30	Excellent
	1.00	0.60	1.00	0.67	1.00	1.00	0.67	1.00	0.67	0.60	0.80
2	Zone A	100	Sometimes dries	Poor	90	Minor	Possible	19	Poor	0	Poor
	1.00	0.20	0.50	0.33	0.40	0.67	0.67	1.00	0.33	0.30	0.48
3	Zone A	100	Rarely dries	Moderate	50	Minor	Possible	16	Poor	15	Average
	1.00	0.20	1.00	0.67	1.00	0.67	0.67	1.00	0.33	0.45	0.62
4	Zone A	400	Never dries	Moderate	5	Minor	Possible	11	Moderate	0	Good
	1.00	0.80	0.90	0.67	1.00	0.67	0.67	0.95	0.67	0.30	0.73
5	Zone A	650	Sometimes dries	Poor	45	Absent	Absent	18	Moderate	0	Good
	1.00	1.00	0.50	0.33	1.00	1.00	1.00	1.00	0.67	0.30	0.71
7	Zone A	50	Dries annually	Moderate	100	Minor	Possible	9	Good	0	Poor
	1.00	0.10	0.10	0.67	0.20	0.67	0.67	0.95	1.00	0.30	0.42
8	Zone A	50	Dries annually	Poor	100	Minor	Possible	9	Good	0	Poor
	1.00	0.10	0.10	0.33	0.20	0.67	0.67	0.95	1.00	0.30	0.39
8b	Zone A	50	Dries annually	Poor	100	Absent	Absent	9	Good	0	Poor
	1.00	0.10	0.10	0.33	0.20	1.00	1.00	0.95	1.00	0.30	0.42

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
9	Zone A	100	Dries annually	Moderate	100	Absent	Absent	37	Poor	0	Poor
	1.00	0.20	0.10	0.67	0.20	1.00	1.00	1.00	0.33	0.30	0.44
10	Zone A	200	Sometimes dries	Moderate	90	Absent	Possible	38	Poor	0	Below Average
	1.00	0.40	0.50	0.67	0.40	1.00	0.67	1.00	0.33	0.30	0.57
13a	Zone A	500	Rarely dries	Moderate	95	Absent	Possible	36	Poor	0	Average
	1.00	1.00	1.00	0.67	0.30	1.00	0.67	1.00	0.33	0.30	0.65
13b	Zone A	150	Sometimes dries	Moderate	95	Absent	Possible	36	Poor	0	Below average
	1.00	0.30	0.50	0.67	0.30	1.00	0.67	1.00	0.33	0.30	0.54
14	Zone A	250	Sometimes dries	Moderate	75	Absent	Possible	27	Poor	5	Average
	1.00	0.30	0.50	0.67	0.70	1.00	0.67	1.00	0.33	0.35	0.67
15	Zone A	350	Sometimes dries	Moderate	90	Absent	Possible	41	Poor	0	Average
	1.00	0.70	0.50	0.67	0.40	1.00	0.67	1.00	0.33	0.30	0.62
16	Zone A	700	Never dries	Moderate	75	Minor	Possible	39	Poor	30	Good
	1.00	1.00	0.90	0.67	0.70	0.67	0.67	1.00	0.33	0.60	0.72

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
17	Zone A	750	Never dries	Moderate	40	Major	Possible	26	Poor	15	Poor
	1.00	1.00	0.90	0.67	1.00	0.01	0.67	1.00	0.33	0.45	0.48
19	Zone A	750	Sometimes dries	Moderate	100	Absent	Possible	6	Good	10	Average
	1.00	1.00	0.50	0.67	0.20	1.00	0.67	0.83	1.00	0.40	0.66
19b	Zone A	<50	Never dries	Good	25	Minor	Possible	6	Good	95	Average
	1.00	0.05	0.90	1.00	1.00	0.67	0.67	0.83	1.00	0.85	0.65
19c	Zone A	50	Never dries	Good	50	Absent	Possible	7	Moderate	95	Good
	1.00	0.10	0.90	1.00	1.00	1.00	0.67	0.83	0.67	0.85	0.700630297
20b	Zone A	<50	Dries annually	Good	25	Absent	Absent	9	Moderate	25	Below average
	1.00	0.05	0.10	1.00	1.00	1.00	1.00	0.95	0.67	0.55	0.53
21	Zone A	400	Rarely dries	Moderate	90	Absent	Possible	12	Good	30	Good
	1.00	0.80	1.00	0.67	0.40	1.00	0.67	1.00	1.00	0.60	0.78
22	Zone A	1900	Never dries	Poor	50	Minor	Possible	4	Poor	5	Average
	1.00	0.82	0.90	0.33	1.00	0.67	0.67	0.70	0.33	0.35	0.62
24	Zone A	100	Sometimes dries	Poor		Absent	Absent	4	Poor	0	Poor

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
25	1.00	0.20	0.50	0.33	0.20	1.00	1.00	0.70	0.33	0.30	0.463476498
	Zone A	2	Dries annually	Poor	50	Absent	Absent	4	Good	0	Poor
26	1.00	0.05	0.10	0.33	1.00	1.00	1.00	0.70	1.00	0.30	0.4507859
	Zone A	100	Never dries	Poor	25	Absent	Possible	4	Good	10	Average
27	1.00	0.20	0.90	0.33	1.00	1.00	0.67	0.70	1.00	0.40	0.637825573
	Zone A	800	Rarely dries	Poor	70	Minor	Possible	25	Moderate	5	Average
28	1.00	0.98	1.00	0.33	0.80	0.67	0.67	1.00	0.67	0.35	0.697448662
	Zone A	>2000	Never dries	Moderate	15	Minor	Possible	24	Poor	5	Average
29	1.00	N/A	0.90	0.67	1.00	0.67	0.67	1.00	0.33	0.35	0.680429621
	Zone A	100	Sometimes dries	Poor	95	Absent	Possible	16	Poor	0	Poor 0.48
30	1.00	0.20	0.50	0.33	0.30	1.00	0.67	1.00	0.33	0.30	
	Zone A	850	Never dries	Good	10	Absent	Possible	15	Good	90	Excellent
31	1.00	0.98	0.90	1.00	1.00	1.00	0.67	1.00	1.00	0.90	0.94
	Zone A	150	Never dries	Good	25	Absent	Possible	17	Good	20	Good
32	1.00	0.30	0.90	1.00	1.00	1.00	0.67	1.00	1.00	0.50	0.79
	Zone A	50	Dries annually	Moderate	100	Absent	Possible	17	Good	0	Poor

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
33	1.00	0.10	0.10	0.67	0.20	1.00	0.67	1.00	1.00	0.30	0.44
	Zone A	100	Never dries	Moderate	40	Major	Possible	14	Poor	0	Poor
33b	1.00	0.20	0.90	0.67	1.00	0.01	0.67	1.00	0.33	0.30	0.39
	Zone A	100	Never dries	Poor	0	Absent	Major	17	Poor	0	Poor
39	1.00	0.20	0.90	0.33	1.00	1.00	0.01	1.00	0.33	0.30	0.377521912
	Zone A	400	Rarely dries	Good	80	Minor	Possible	12	Moderate	70	Excellent
40b	1.00	0.80	0.90	1.00	1.00	0.67	0.67	1.00	0.67	1.00	0.86
	Zone A	250	Never dries	Good	50	Absent	Possible	2	Good	25	Good
41	1.00	0.30	0.90	1.00	1.00	1.00	0.67	0.55	1.00	0.55	0.75
	Zone A	50	Never dries	Moderate	80	Absent	Possible	15	Good	10	Average
42	1.00	0.10	1.00	0.67	0.60	1.00	0.67	1.00	1.00	0.40	0.64
	Zone A	15	Dries annually	Moderate	100	Absent	Absent	8	Good	0	Poor
43	1.00	0.05	0.10	0.67	0.20	1.00	1.00	0.88	1.00	0.30	0.42
	Zone A	250	Never dries	Moderate	0	Absent	Minor	1	Poor	25	Below Average
44	1.00	0.30	0.90	0.67	1.00	1.00	0.33	0.38	0.33	0.55	0.58
	Zone A	550	Never dries	Moderate	50	Minor	Possible	10	Poor	75	Good

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
45	1.00	1.00	1.00	0.67	1.00	0.67	0.67	0.96	0.33	1.00	0.79
	Zone A	50	Sometimes dries	Poor	95	Absent	Possible	9	Poor	0	Poor 0.45
	1.00	0.10	0.50	0.33	0.30	1.00	0.67	0.95	0.33	0.30	
46	Zone A	100	Rarely dries	Moderate	80	Absent	Possible	14	Poor	40	Average 0.64
	1.00	0.20	1.00	0.67	0.60	1.00	0.67	1.00	0.33	0.70	
47	Zone A	>50	Sometimes dries	Poor	80	Absent	Possible	12	Moderate	0	Poor 0.48
	1.00	0.05	0.50	0.33	0.60	1.00	0.67	1.00	0.67	0.30	
48	Zone A	50	Sometimes dries	Moderate	85	Absent	Possible	11	Moderate	0	Below average 0.54
	1.00	0.10	0.50	0.67	0.50	1.00	0.67	0.95	0.67	0.30	
49	Zone A	250	Never dries	Moderate	65	Absent	Possible	10	Poor	0	Average 0.63
	1.00	0.30	0.90	0.67	0.90	1.00	0.67	0.96	0.33	0.30	
50	Zone A	100	Sometimes dries	Poor	60	Absent	Possible	10	Moderate	0	Below average 0.58
	1.00	0.20	0.50	0.33	1.00	1.00	0.67	0.96	0.67	0.30	

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
51	Zone A	150	Sometimes dries	Poor	70	Absent	Possible	12	Moderate	0	Below Average
	1.00	0.30	0.50	0.33	0.80	1.00	0.67	1.00	0.67	0.30	0.59
52	Zone A	150	Dries annually	Moderate	75	Absent	Absent	12	Moderate	0	Below average
	1.00	0.30	0.10	0.67	0.70	1.00	1.00	1.00	0.67	0.30	0.56
53	Zone A	200	Never dries	Poor	30	Minor	Possible	6	Moderate	50	Average
	1.00	0.40	0.90	0.33	1.00	0.67	0.67	0.83	0.67	0.80	0.69
55	Zone A	1000	Sometimes dries	Moderate	90	Absent	Possible	11	Good	0	Average
	1.00	0.95	0.50	0.67	0.40	1.00	0.67	0.95	1.00	0.30	0.69
56	Zone A	500	Sometimes dries	Poor	100	Absent	Possible	11	Good	0	Average
	1.00	1.00	0.50	0.33	0.20	1.00	0.67	0.95	1.00	0.30	0.60
57	Zone A	250	Rarely dries	Moderate	20	Absent	Possible	1	Good	50	Good
	1.00	0.30	1.00	0.67	1.00	1.00	0.67	0.38	1.00	0.80	0.73
59	Zone A	250	Sometimes dries	Poor	80	Absent	Possible	1	Moderate	0	Below average
	1.00	0.30	0.50	0.33	0.60	1.00	0.67	0.38	0.67	0.30	0.52

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
64	Zone A	50	Sometimes dries	Good	15	Absent	Possible	4	Good	10	Average 0.63
	1.00	0.10	0.50	1.00	1.00	1.00	0.67	0.70	1.00	0.40	
65	Zone A	50	Sometimes dries	Good	20	Absent	Possible	5	Moderate	90	Average 0.66
	1.00	0.10	0.50	1.00	1.00	1.00	0.67	0.75	0.67	0.90	
66	Zone A	200	Rarely dries	Moderate	10	Absent	Possible	8	Moderate	20	Good 0.75
	1.00	0.40	1.00	0.67	1.00	1.00	0.67	0.88	0.67	0.50	
67	Zone A	1600	Never dries	Moderate	60	Minor	Major	5	Good	10	Below average 0.50
	1.00	0.86	0.90	0.67	1.00	0.67	0.01	0.75	1.00	0.40	
68	Zone A	100	Sometimes dries	Moderate	60	Absent	Possible	5	Good	0	Average 0.63
	1.00	0.20	0.50	0.67	1.00	1.00	0.67	0.75	1.00	0.30	
69	Zone A	50	Sometimes dries	Poor	100	Absent	Possible	16	Moderate	0	Poor 0.46
	1.00	0.10	0.50	0.33	0.20	1.00	0.67	1.00	0.67	0.30	
69b	Zone A	<50	Sometimes dries	Poor	100	Absent	Possible	13	Moderate	0	Poor

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
70	1.00	0.05	0.50	0.33	0.20	1.00	0.67	1.00	0.67	0.30	0.43
	Zone A	150	Dries annually	Moderate	50	Absent	Possible	12	Good	50	Average
71	1.00	0.30	0.10	0.67	1.00	1.00	0.67	1.00	1.00	0.80	0.64
	Zone A	3050	Never dries	Good	10	Minor	Possible	21	Moderate	0	Good
71b	1.00	N/A	0.90	1.00	1.00	0.67	0.67	1.00	0.67	0.30	0.76
	Zone A	<50	Dries annually	Moderate	70	Absent	Absent	21	Good	0	Poor
72	1.00	0.05	0.10	0.67	0.80	1.00	1.00	1.00	1.00	0.30	0.490371933
	Zone A	200	Never dries	Moderate	80	Minor	Possible	23	Poor	0	Average
73	1.00	0.40	0.90	0.67	0.60	0.67	0.67	1.00	0.33	0.30	0.60
	Zone A	21	Dries annually	Poor	100	Absent	Possible	21	Moderate	0	Poor
74	1.00	0.05	0.10	0.33	0.20	1.00	0.67	1.00	0.67	0.30	0.37
	Zone A	25	Sometimes dries	Moderate	50	Absent	Possible	21	Poor	10	Below average
74b	1.00	0.05	0.50	0.67	1.00	1.00	0.67	1.00	0.33	0.40	0.52
	Zone A	<50	Never dries	Poor	0	Absent	Possible	21	Poor	5	Poor
75	1.00	0.05	0.90	0.33	1.00	1.00	0.67	1.00	0.33	0.35	0.508204287
	Zone A	50	Sometimes dries	Moderate	25	Absent	Possible	25	Good	25	Average

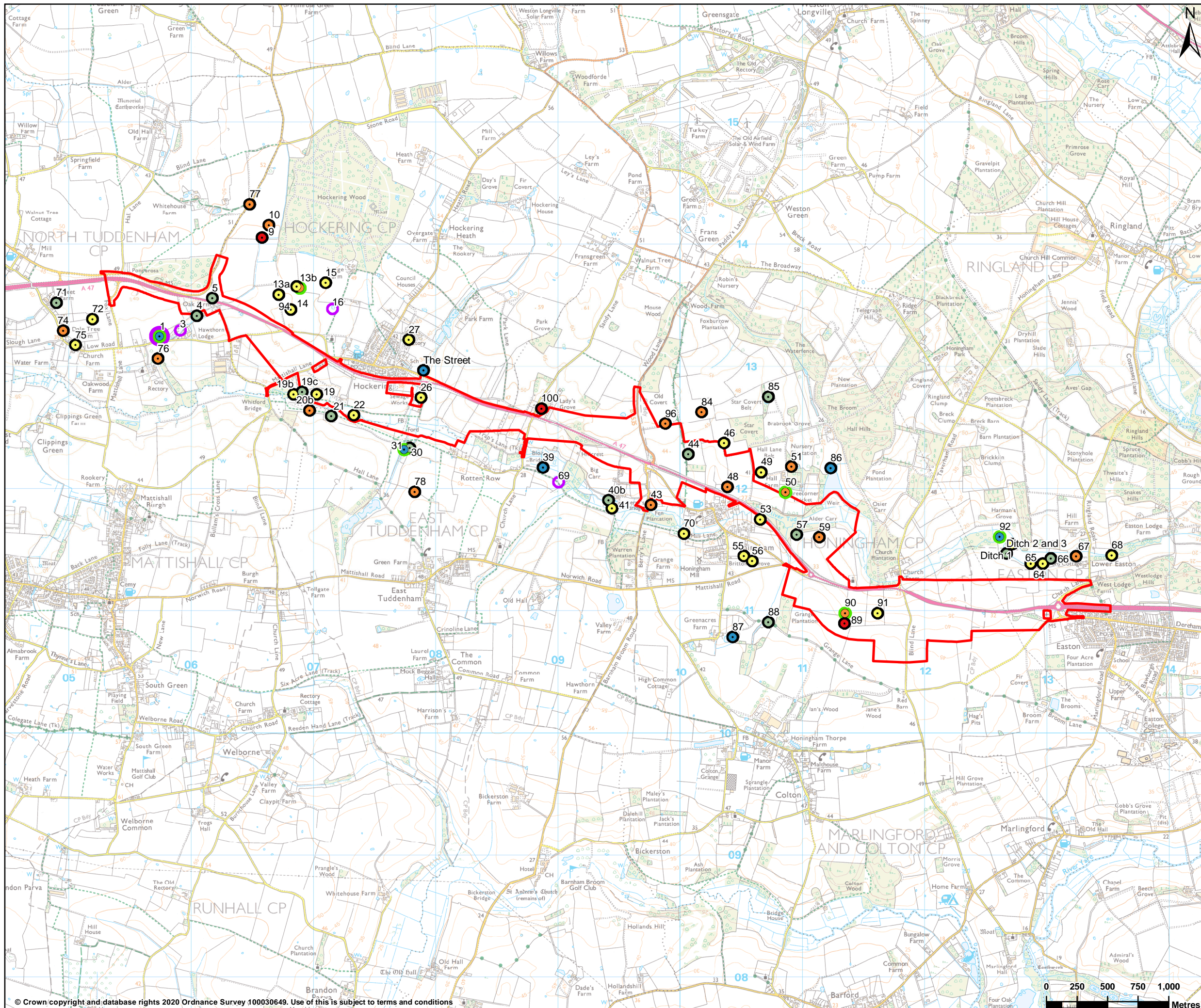
Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
76	1.00	0.10	0.50	0.67	1.00	1.00	0.67	1.00	1.00	0.55	0.64
	Zone A	100	Sometimes dries	Moderate	100	Absent	Possible	20	Good	25	Below average
77	1.00	0.20	0.50	0.67	0.20	1.00	0.67	1.00	1.00	0.55	0.59
	Zone A	>50	Sometimes dries	Moderate	50	Absent	Possible	43	Poor	80	Below average
78	1.00	0.05	0.50	0.67	1.00	1.00	0.67	1.00	0.33	1.00	0.57
	Zone A	100	Sometimes dries	Moderate	80	Absent	Possible	15	Poor	0	Below average
81	1.00	0.20	0.50	0.67	0.60	1.00	0.67	1.00	0.33	0.30	0.55
	Zone A	50	Sometimes dries	Moderate	100	Absent	Possible	22	Poor	0	Poor 0.46
81b	1.00	0.10	0.50	0.67	0.20	1.00	0.67	1.00	0.33	0.30	
	Zone A	<50	Dries annually	Moderate	100	Absent	Possible	16	Poor	0	Poor
84	1.00	0.05	0.10	0.67	0.20	1.00	0.67	1.00	0.33	0.30	0.367095009
	Zone A	150	Sometimes dries	Moderate	70	Absent	Possible	15	Poor	0	Below average
85	1.00	0.30	0.50	0.67	0.80	1.00	0.67	1.00	0.33	0.30	0.59
	Zone A	1200	Rarely dries	Moderate	40	Absent	Possible	16	Moderate	5	Good

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
86	1.00	0.92	1.00	0.67	1.00	1.00	0.67	1.00	0.67	0.35	0.79
	Zone A	≥2000	Never dries	Moderate	10	Absent	Possible	9	Good	20	Excellent
87	1.00	N/A	0.90	0.67	1.00	1.00	0.67	0.90	1.00	0.50	0.83
	Zone A	≥2000	Never dries	Good	10	Minor	Possible	30	Good	30	Excellent
88	1.00	N/A	0.90	1.00	1.00	0.67	0.67	1.00	1.00	0.60	0.85
	Zone A	600	Never dries	Poor	40	Minor	Possible	23	Good	10	Good
89	1.00	1.00	0.90	0.33	1.00	0.67	0.67	1.00	1.00	0.40	0.75
	Zone A	<50	Dries annually	Moderate	50	Absent	Absent	13	Poor	50	Poor
90	1.00	0.05	0.10	0.67	1.00	1.00	1.00	1.00	0.33	0.80	0.50
	Zone A	50	Sometimes dries	Moderate	60	Absent	Possible	11	Moderate	0	Below average
91	1.00	0.10	0.50	0.67	1.00	1.00	0.67	0.95	0.67	0.30	0.58
	Zone A	100	Rarely dries	Moderate	0	Absent	Possible	7	Poor	60	Average
92	1.00	0.20	1.00	0.67	1.00	1.00	0.67	0.83	0.33	0.90	0.68
	Zone A	1750	Never dries	Moderate	40	Minor	Possible	2	Good	50	Excellent
94	1.00	0.85	0.90	0.67	1.00	0.67	0.67	0.75	1.00	0.80	0.82
	Zone A	50	Sometimes dries	Moderate	15	Absent	Possible	32	Poor	85	Average

Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
	1.00	0.10	0.50	0.67	1.00	1.00	0.67	1.00	0.33	0.95	0.609166084
95	Zone A	50	Dries annually	Moderate	95	Absent	Absent	41	Moderate	0	Poor
	1.00	0.10	0.10	0.67	0.30	1.00	1.00	1.00	0.67	0.30	0.457761445
96	Zone A	250	Sometimes dries	Poor	60	Absent	Possible	13	Poor	0	Below average
	1.00	0.30	0.50	0.33	1.00	1.00	0.67	1.00	0.33	0.30	0.564457853
100	Zone A	50	Never dries	Poor	0	Major	Possible	7	Moderate	0	Poor
	1.00	0.10	0.90	0.33	1.00	0.01	0.67	0.85	0.67	0.30	0.36
101	Zone A	<50	Never dries	Poor	50	Absent	Possible	17	Moderate	0	Below average
	1.00	0.05	0.90	0.33	1.00	1.00	0.67	1.00	0.67	0.30	0.537155135
Ditch 1	Zone A	50	Sometimes dries	Moderate	50	Absent	Possible	3	Good	70	Average
	1.00	0.10	0.50	0.67	1.00	1.00	0.67	0.68	1.00	1.00	0.658207539
Ditches 2 and 3	Zone A	150	Sometimes dries	Good	70	Absent	Possible	5	Good	80	Good
	1.00	0.30	0.50	1.00	0.80	1.00	0.67	0.75	1.00	1.00	0.7551474
The	Zone A	1000	Never dries	Moderate	0	Absent	Possible	14	Moderate	30	Excellent

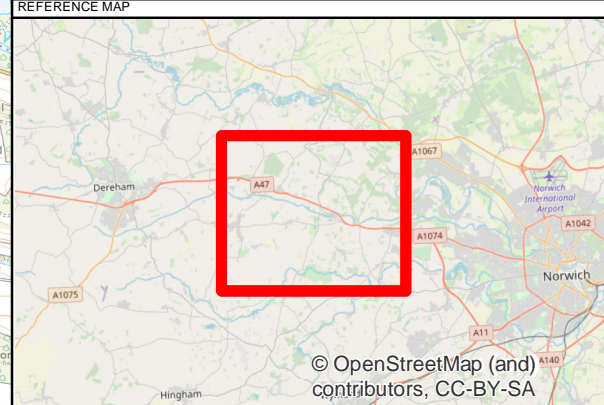
Ref	Geographic location	Surface area (m2)	Waterbody permanence	Water quality	Shading (%)	Impact of waterfowl	Fish	No of waterbodies within 1km	Terrestrial habitat quality	Macrophyte cover (%)	HSI score Total
Street	1.00	0.95	0.90	0.67	1.00	1.00	0.67	1.00	0.67	0.60	0.829533974

Appendix C. eDNA survey results map



LEGEND

- Scoping Boundary
- Habitat suitability index**
 - Excellent
 - Good
 - Average
 - Below average
 - Poor
- Great Crested Newt eDNA results**
 - Positive
 - Negative
 - GCN presence found in 2017



P02	31/01/2020	First Edition	AC	MY	FB
REV	DATE	REVISION NOTE	ORG	CHKD	APPD

DESIGNER
SWECO

CONTRACTOR
GallifordTry

CLIENT
**highways
england**

PROJECT TITLE
A47 NORTH TUDDENHAM TO EASTON
TR010038/APP/6.2

PROJECT STAGE
PCF STAGE 3

DRAWING TITLE
ANNEX C GREAT CRESTED NEWT SURVEY: eDNA
SURVEY RESULTS MAP

SUITABILITY
FOR INFORMATION

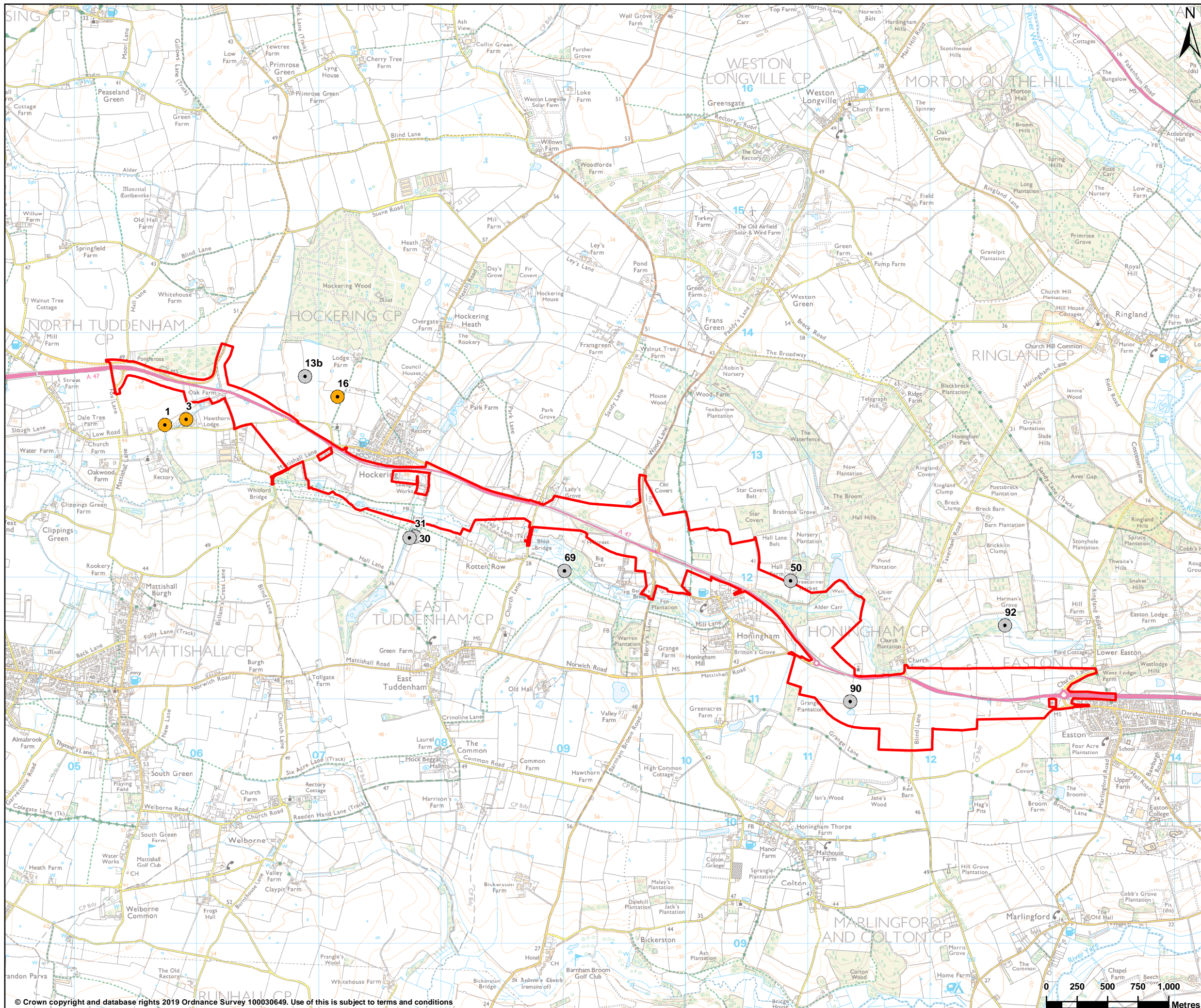
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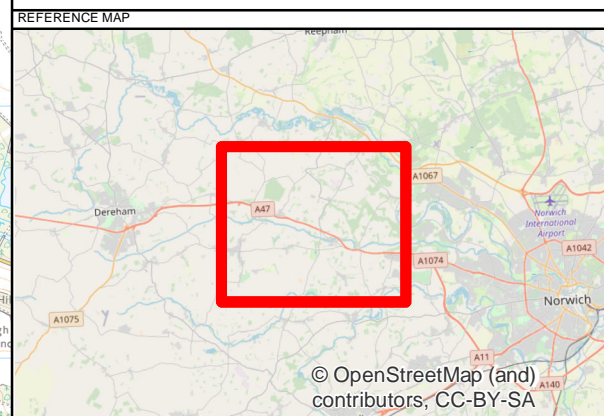
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Appendix D. Population size-class assessment results map



LEGEND

- Scoping Boundary
- Population size class**
- Small (0-10 Great Crested Newts recorded)
- eDNA positive but no population recorded



P02	31/01/2020	First Edition	AC	MY	FB
REV	DATE	REVISION NOTE	ORG	CHKD	APPD

DESIGNER

SWECO

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GallifordTry

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england**

PROJECT TITLE

A47 NORTH TUDDENHAM TO EASTON
TR010038/APP/6.2

PROJECT STAGE

PFC STAGE 3

DRAWING TITLE

ANNEX D GREAT CRESTED NEWT SURVEY:
POPULATION SIZE-CLASS RESULTS

SUITABILITY

FOR INFORMATION

SHEET SIZE	SCALE	STATUS
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DRAWING NUMBER

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