



Structure ELW/12, Cae Dyah Lane, Overton

HE Historical Railways Estate

Ecological Survey Report

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ELW/12



Structure ELW/12, Cae Dyah Lane, Overton

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Executive Summary

A preliminary ecological appraisal of structure ELW/12, Cae Dyah Lane, Overton, Wrexham identified potential for the structure and the surrounding area to support protected species including great crested newt (GCN), reptiles, breeding birds, bats and badger. Jacobs was commissioned by HE HRE undertake targeted surveys in 2016 and 2017.

Structural inspections of ELW/12 identified a number of defects in the bridge which show that it is in poor condition and requires remedial measures. These will include the infilling of the structure and burying of the wing walls to prevent further deterioration and to provide ongoing structural support.

Ecological surveys at ELW/12 identified the following ecologically sensitive features:

- A single common pipistrelle (*Pipistrellus pipistrellus*) bat was confirmed roosting within a crevice in the south facing wall of the structure during August 2016. A possible emergence of a single *Myotis* species bat was recorded in July 2016. A single *Pipistrelle species* bat was recorded hibernating in the structure during February 2017. The structure is therefore a confirmed occasional summer day roost and a minor hibernation site;
- a medium population of GCN occur within 250 m of the structure and terrestrial habitat around the structure is suitable for them;
- there is suitable habitat within the footprint of the proposed works to support reptiles;
- habitat suitable for breeding birds within scrub to the north of the structure and nesting potential within the structure; and
- badgers moving through the area underneath the structure.

The following measures are recommended in order to mitigate for potential ecological impacts of the proposed works:

- derogation licenses under the Conservation of Habitats and Species Regulations, 2010 (as amended) are required from Natural Resources Wales (NRW) for GCN and bats, ahead of any proposed work. This would outline proposed mitigation work which would involve a capture and exclusion exercise for GCN and compensation for the loss of terrestrial habitat and the exclusion of bats from potential roost features and providing alternative roost sites;
- no vegetation removal should take place during the bird-nesting period of March to August inclusive. If unavoidable then all potential nest sites will need to be checked by a suitable qualified ecologist before approval for clearance is given;
- suitable areas of vegetation will require strimming out and hand searching for reptiles. This will be done in conjunction with any GCN work and any individuals encountered will be moved out of the GCN exclusion zone; and
- pre-construction inspection for badgers prior to the installation of GCN exclusion fencing to confirm that no new setts have been created within the work footprint.

1. Introduction

1.1 Background

Jacobs UK Ltd. (Jacobs) has been commissioned by Highways England Historical Railways Estate (HRE) to undertake a feasibility study into remedial options for structure ELW/12, Cae Dyah Lane, Overton, Wrexham.

Structure ELW/12 carries an unclassified road, Cae Dyah Lane, over the track bed of the former Ellesmere to Wrexham railway, east of Overton in the county of Wrexham. The OS grid reference for the structure is SJ 395 420. The structure is a single span, brick arch overbridge with brick abutments, spandrels and parapets with stone copings. The substructure comprises brick type abutments, buttresses and wing walls, also with stone copings.

1.2 Site Description

Structure ELW/12 lies within an agricultural landscape dominated by fields used for pasture for sheep and cattle and bordered by hedgerows with small parcels of woodland throughout. The land immediately north of the structure comprises dense scrub phasing into a woodland corridor further north of the structure along the redundant railway line with improved agricultural fields either side. There are numerous ponds throughout the landscape and eight of these lie within 250m of the structure, including an ephemeral pool directly beneath structure ELW/12.

1.3 Proposed Works

Structural inspections undertaken in 2015 have identified a number of defects in the bridge which show that the bridge is in poor condition and requires remedial measures.

Remedial measures will include the infilling of the structure and burying of the wing walls to prevent further deterioration and to provide ongoing structural support to the road it carries. The structure will be infilled with granular fill material and foamed concrete, forming new embankments either side.

A temporary site compound will be set up along the road to the north-west of the structure. Temporary tracks will be installed parallel to Cae Dyah Lane to the north and to the south of the structure. A storage area will also be set up in the area to the north of the structure.

1.4 Aims and Objectives

The purpose of this document is to present the findings of ecological surveys undertaken at the structure in 2016 and 2017 and to assess the impact of the proposed work on ecologically sensitive features. The report is intended to inform the planning application and includes recommendations for mitigation and compensation to maintain the populations of protected species identified on site.

2. Methodology

2.1 Desk Study

A data request was made to the North Wales Environmental Information Service (Cofnod) for all protected sites such as Local Nature Reserves (LNR), National Nature Reserves (NNR), Sites of Special Scientific Interest (SSSI) and protected and notable species data originating from within 2km of the structure.

A search for Special Areas of Conservation (SAC) with bats as a qualifying feature within a 30km radius of the structure was carried out using the following resources:

- **NBN Gateway** <http://data.nbn.org.uk/limt/> accessed 18/03/2016
- **Magic** <http://www.magic.gov.uk/> accessed 18/03/2016

Ordnance Survey (OS) maps were examined to help locate ponds and wet ditches within 250 m of the structure which might provide suitable habitat for amphibians such as great crested newt *Triturus cristatus* (GCN).

The desk study combined with an assessment of habitat suitability was used to determine whether there was likely to be any impacts on protected species for which targeted surveys were not conducted due to the very small area of habitat being affected by the works. These included hazel dormouse (*Muscardinus avellanarius*) and reptile species.

2.2 Phase 1 Habitat Survey

An Extended Phase 1 Habitat survey was undertaken in March 2016 using the standard methodology set out by the Joint Nature Conservation Committee (JNCC, 2010). Habitats within the area beneath the bridge, former track bed and land within a 50m radius of the bridge were identified and mapped. These areas were methodically searched for evidence of, and potential for, protected habitat and species. The Phase 1 habitat map was updated with any new findings from subsequent visits throughout the summer months.

The habitats identified were evaluated for their potential to support legally protected species and other species of conservation concern and compared to published lists of nationally rare or scarce and Biodiversity Action Plan species, such as those found in the:

- Schedules of the Conservation of Habitats and Species Regulations 2010;
- Schedules of the Wildlife and Countryside Act 1981 (as amended);
- UK Red Lists (Eaton *et al.* 2009, Wigginton 1999); and,
- Local (Vale of Glamorgan) and National Biodiversity Action Plans.

2.3 Great Crested Newt Surveys

2.3.1 Habitat Suitability Index (HSI) Assessments

Each waterbody within 250m of the structure was assessed for its suitability to support GCN, according to the evaluation criteria provided by Oldham *et al.* (2000), in June 2016. Environmental parameters used in predicting the likely presence/absence of GCNs for the HSI score included:

- Geographic location;
- pond area;
- pond permanence;
- water quality;
- pond shading;
- presence and density of wildfowl populations;
- presence of fish and density of populations;

- pond density within 1 km;
- suitability and accessibility of adjacent terrestrial habitat; and
- presence and percentage cover of aquatic and emergent macrophytes

Waterbodies were then allocated a HSI score and associated predicted presence class, as shown in Table 1. The HSI score is a measure of habitat suitability and waterbodies with high scores are more likely to support GCN than those with low scores.

Table 1 : HSI Scores (ARG UK, 2010).

HSI Score	Predicted Presence Class
0.00 – 0.49	Poor
0.50 – 0.59	Below average
0.60 – 0.69	Average
0.70 – 0.79	Good
0.80 – 1.00	Excellent

2.3.2 Environmental DNA (eDNA) Sampling

Environmental DNA sampling works on the basis that traces of DNA are deposited in waterbodies which are inhabited by GCN and therefore can be detected in water samples collected from waterbodies. Samples that test positive for GCN eDNA indicate presence of GCN in the waterbody from which the sample was taken. This method indicates GCN presence or likely absence, however it does not allow for the determination of population size. Samples were taken from six water bodies which were assessed as being suitable for GCN (i.e. waterbodies which had a HSI score of 0.5 Below Average or above) within 250m of the structure in June 2016. Samples were taken from each pond and were sent for laboratory analysis using survey methods stated in Biggs et al. (2014). The laboratory analysed the pond samples for GCN DNA presence and reported on which pond samples tested positive, negative or inconclusive for GCN DNA.

2.3.3 Population Size Class Assessments

Presence / absence surveys were undertaken from March to May 2017 for all waterbodies that tested positive for GCN eDNA. This was to confirm the results of the eDNA sampling and to provide population estimates for waterbodies containing GCN. The surveys were undertaken following good practice guidelines as set out in the GCN Mitigation Guidelines (English Nature, 2001), using a combination of the following survey techniques:

- bottle Trapping: placing bottle traps in the margins of the ponds/ditches and leaving them overnight to trap newts for identification and release in the morning;
- torching: visually searching for GCN using high powered Clu-light torches around the edges of the ponds/ditches;
- egg Searching: physically and visually searching aquatic vegetation for eggs of newts that can be identified as belonging to GCN; and
- netting: using a net to sweep through vegetation and turbid water in the pond margins to capture and identify newt species.

Each water body was visited on four occasions with details of weather conditions, survey methods employed and results noted. A further two surveys were undertaken on any water bodies where great crested newts were present to provide an estimate of population class size.

2.4 Bat Surveys

2.4.1 Roost Assessment

A visual inspection of the bridge for potential roost features (PRFs) and evidence of bats, such as droppings, was undertaken in March 2016, during which a licensed bat ecologist undertook an endoscope inspection, from ground level, of any reachable PRFs. All PRFs beyond reach were inspected visually, as far as possible, using binoculars and a torch.

2.4.2 Emergence/Re-entry Survey

Dusk emergence and dawn re-entry surveys were carried out by experienced ecologists with reference to the method set out in BCT Bat Survey Good Practice Guidelines 3rd edition (Collins, 2016).

Manual dusk emergence surveys were carried out on the 27 June 2016 and the 12 July 2016 by two bat surveyors positioned north and south of the structure. A dawn re-entry survey was carried out on the 24 August 2016. Survey metadata is given in Table 2.

Table 2 : Details of bat surveys undertaken at ELW/12

Survey	Type	Date	Start Time	Finish Time	Sunrise/Sunset Time	Temp. (°C)	Precipitation	Wind Speed (Beaufort)	Cloud cover (%)
1	Dusk emergence	27/06/2016	21:25	23:10	21:40	15	Dry	1	50
2	Dusk emergence	12/07/2016	21:20	23:00	21:32	13	Dry	0	15
3	Dawn re-entry	24/08/2016	04:40	06:10	06:09	16	Dry	1	100

Surveyors were equipped with Batbox Duet bat detectors or Elekon Batscanner bat detector and Anabat Express recorders.

2.4.3 Winter Hibernation Inspection

A winter bat hibernation survey was undertaken which involved a detailed inspection of the bridge from a tower scaffold to safely access all PRF above head height. The inspection was carried out on February 16th 2017. The survey involved close and systematic inspection of all cracks and crevices using a high powered torch and an endoscope (Rigid CA-300 Inspection Endoscope).

All endoscope inspection surveys were undertaken by a Natural Resources Wales Licensed Bat Ecologist (details can be provided on request).

2.4.4 Bat Call Analysis

Species identification in the field was verified by analysis of bat call sound data. Analook software was used to analyse bat call sound data using Russ (2012) and (Middleton *et al.* 2014) as reference sources.

2.5 Badger Surveys

A search of suitable habitat within 100m of the bridge for setts and other evidence of badger including badger paths, latrines, badger hairs on fences, bushes etc., scratching posts and evidence of digging for food, was undertaken in August 2016.

A motion activated, infrared camera was deployed on the southern edge of the bridge, facing north-east underneath the structure. The camera remained in place from 27th June to 24th August 2016. This was to capture images of badger commuting beneath the bridge.

2.6 Limitations

2.6.1 General

It should be borne in mind that the behaviour of animals can be unpredictable and may not conform to standard patterns recorded in scientific literature. Therefore, this report cannot predict with absolute certainty that animal species will occur in apparently suitable locations or habitats, or that they will not occur in locations or habitats that appear unsuitable. In order to minimise the likelihood of adverse effects on protected animal species, it is accepted good practice to consult an Ecological Consultant should development be deferred for over 12 months from the date of last survey.

2.6.2 Desk Study

With regard to the results of the data request, the absence of a species record within an area does not necessarily indicate the absence of that species, it could be present but unrecorded. Similarly, the distribution of species records may reflect survey effort rather than the distribution of that species. As such historic records have been considered within the assessment with caution.

2.6.3 Great Crested Newt Surveys

Limitations specific to each pond are set out in Table 3.

Table 3 : Summary GCN survey limitations

Pond Number	Limitations
1	Substantial drying by the fourth visit; bottle trapping could not be used during this visit; netting used instead.
2	Dry during presence/absence surveys.
3	Increased turbidity on fourth visit likely due to poaching by cows. Netting used as fourth method.
4	Increased turbidity on fourth visit likely due to poaching by cows. Netting used as fourth method.
5	Torching not used as a method due to high vegetation cover, which also made egg searching difficult. Assumed breeding pond as male and female newts captured.
6	Access not permitted by landowner - not assessed or sampled for GCN.
7	No landowner information - not assessed or sampled for GCN on health and safety grounds.
8	Unsuitable for GCN. Dry during presence/absence surveys.

Where the high turbidity values at Ponds 3 and 4 might have reduced the number of newts seen during torching surveys, it is unlikely that a significantly higher number of individuals might have been observed in less turbid water leading to a higher population size class, especially as the peak number captured in traps was at the lower end of the range for medium (between 10 and 100 newts). Disturbance by cattle in ponds 3 and 4 might have reduced newt activity or catchability during the fourth visit although numbers were similar to those caught during visits where cattle was not present.

Access could not be obtained for Ponds 6 and 7 (see Figure 5 for locations) and therefore these ponds were not surveyed. However, the 5 other ponds within 250m of the structure were subject to surveys, although it is acknowledged that most of these dried out. From aerial imagery, the omitted ponds appear to be comparable with the surveyed ponds; Pond 7 appears to be similar in terms size and surrounding habitat to Ponds 3 and 4 and is likely to hold water all year round whereas Pond 6 appears similar to Pond 2 which dries annually. On

this basis, it is unlikely that they would support more GCN than the surveyed ponds due to the absence of significant barriers separating these ponds, it is likely that GCN move between the ponds.

It is considered that the results provide a reliable indication of GCN presence and population size class within this area.

2.6.4 Bat Surveys

One Anabat Express recorder failed to record during the second emergence/re-entry survey. No bats were observed emerging from potential roost features on the north side and it is likely that calls from bats commuting beneath the structure were recorded on the south side.

3. Results

3.1 Data Search

3.1.1 Statutory and Non-Statutory Designated Sites

A plan showing statutory and non-statutory sites designated for ecological interest within 2 km of the bridge is presented as Figure 1, Appendix A.

There are three statutory sites within 2 km of the structure; two Sites of Special Scientific Interest (SSSI) and one SAC. Details of the sites are presented in Table 4 below.

Table 4 : Designated sites within 2km of structure ELW/12

Site Name	Approximate Distance from Structure	Designation	Reason for Designation
Cloy Brook Pastures	0.2km west	SSSI	Unimproved calcareous clay pastures on valley sides of the Cloy Brook and its tributaries, representing one of the best examples of this type of habitat that survives only as isolated fragments
Afon Dyfrdwy (River Dee)	1.8km north west	SSSI	Annex I habitats that are a primary reason for selection of this site: - Watercourse of plain to montane levels with the river water-crowfoot (<i>Ranunculin fluitans</i>) and water-starwort (<i>Callitriche sp.</i>) water-crowfoot (<i>Batrachian</i> sp.) vegetation. Annex II species that are a primary reason for selection of this site: - Atlantic salmon (<i>Salmon salar</i>) - Floating water-plantain (<i>Luronium natans</i>) Annex II species present as a qualifying feature, but not a primary reason for site selection: - Sea lamprey (<i>Petromyzon marinus</i>) - Brook lamprey (<i>Lampetra planeri</i>) - River lamprey (<i>Lampetra fluviatilis</i>) - Bullhead (<i>Ameiurus nebulosus</i>) - Otter (<i>Lutra lutra</i>)
River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid (Wales)	1.8km north west	SAC	Annex I habitats that are a primary reason for selection of this site: Watercourse of plain to montane levels with the <i>Ranunculin fluitans</i> and <i>Callitriche</i> <i>Batrachian</i> vegetation

Site Name	Approximate Distance from Structure	Designation	Reason for Designation
			Annex II species that are a primary reason for selection of this site: - Atlantic salmon - Floating water-plantain Annex II species present as a qualifying feature, but not a primary reason for site selection: - Sea lamprey - Brook lamprey - River lamprey - Bullhead - Otter

There are 14 non-statutory Wildlife Sites (WS) located within 2km of the structure, as detailed in Table 5.

Table 5 : Non-statutory designated sites within 2km of the structure

Site Name	Approximate Distance from Structure	Reason for Designation
The Nant	0.46km north west	Semi-improved grassland between Cloy Brook Pastures SSSI
Cae Drinions Grassland	0.63km south east	Semi-improved neutral grassland and dense/continuous scrub
Caerowlin Wood and Meadows	0.68km south west	Semi-improved neutral grassland and semi-natural broad-leaved woodland
Rhyd y Cyffn	1.52km east	Marshy and semi-improved neutral grassland
Firs Farm	1.14km north west	Semi-improved neutral grassland and semi-natural broad-leaved woodland
Kitchen Wood	1.89km north east	Medium-aged conifer plantation along the flood bank of a stream
Dee Banks Wood	1.77km north west	Broad-leaved and coniferous plantation
Toft's Dingle and Rough	1.95km north	Semi-natural broadleaved woodland and semi-improved neutral grassland

Site Name	Approximate Distance from Structure	Reason for Designation
Lightwood and Queensbury Dingle	1.94km south west	Semi-natural broad-leaved woodland and coniferous plantation
Coed Tre-a-peni and Campbell's Gorse	1.43km north	Oak woodland with semi-natural broad-leaved woodland and semi-improved neutral grassland
Penley Wood and Lee's Wood	1.89km east	Ancient woodland along two stream valleys and unimproved grassland
Cross Mill Wood	1.37km south east	Ash/oak woodland
Coed Cae Howell	1.73km south east	Semi-natural broad-leaved woodland
Black Wood	1.39km south east	Semi-improved neutral grassland, semi-natural broad-leaved woodland

A review of readily available on-line aerial imagery, suggests that the disused railway line is vegetated with continuous scrub and woodland which extends for several hundred metres to the north. Habitat connectivity across the local landscape is good, due to the matrix of hedgerows that links patches of woodland and botanically diverse sites such as Cloy Brook Pastures (SSSI), located approximately 0.2 km to the west of the bridge.

3.1.2 Protected Species

Cofnod provided numerous records of protected and notable species within 2km of the site. Those associated with the habitats recorded around the bridge are detailed in Table 6 below.

Table 6 : Biological records within 2km of the structure

Species	Approximate Distance from Structure	Date of Record
Great crested newt	0.15km north east, 0.16km north, 0.25km north, 0.4km north-west	2004
Grass snake (<i>Natrix natrix</i>)	0.46km east	2003
Unknown bat (<i>Chiroptera</i>)	0.75km south-east	2005
European badger (<i>Meles meles</i>)	0.56km south-west, 1.22km south-west, 1.8km south	2003, 2006
European otter	1.11km south east, 1.4km east	1996, 2009
Brown hare (<i>Lepus europaeus</i>)	0.46km east, 0.75km south-east, 0.77km east	2003, 2005, 2007
Water vole (<i>Arvicola amphibius</i>)	1.55km south	2002

Species	Approximate Distance from Structure	Date of Record
Barn owl (<i>Tyto alba</i>)	0.16km south-east, 0.33km north-east	2012

No SACs with bats as a qualifying feature were identified within 30km of the structure.

Eight bird species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) have been recorded within 2km of the structure. Birds listed on Schedule 1 are afforded extra protection in addition to the general protection afforded to all wild birds which prohibits intentional killing, injuring, taking or selling of any wild bird or their nests or eggs. For bird species listed on Schedule 1, it is an offence to intentionally or recklessly disturb the active nests of these species, adult birds whilst nesting and their dependent young. The species are as follows:

- Barn owl;
- Curlew (*Numenius arquata*);
- Skylark (*Alauda arvensis*);
- Lapwing (*Vanellus vanellus*);
- Fieldfare (*Turdus pilaris*);
- Redwing (*Turdus iliacus*); and
- Brambling (*Fringilla montifringilla*).

The records of fieldfare, redwing and brambling originated from the winter and as such the breeding season protection is unlikely to be relevant.

3.2 Phase 1 Habitat Survey

The Phase 1 Habitat map of the bridge and surrounding habitats is presented as Figure 2, Appendix A and the accompanying Target Notes and photographs are presented as Appendix B.

3.2.1 Habitats within 50m radius

The habitats along the redundant railway line due north of the bridge comprised conifer plantation woodland along the embankments (TN 1) with a dense scrub understorey thinning on the track bed and forming a scrub corridor to the north of the structure. Ground flora was sparse with some ivy (*Hedera helix*) extending up a number of trees and shrubs.

The track bed boundary was demarcated on both sides by remnant hedgerow and wire fence (TN1). Adjoining the track bed to the northwest was an area of broadleaved plantation woodland with no understorey and a ground flora dominated by grasses.

Badger field signs (TN5 and TN6) including foraging holes and disused setts, were found within the scrub habitat within 50m of the structure. Old bird nests were also identified within this area (TN7 and TN8).

An ephemeral pond was present underneath the structure with a depth of approximately 20 cm and 20 m² in size extending from under the bridge along the track bed (TN1).

A pile of rubble/stone and scattered scrub dominated by bramble (*Rubus fruticosus* agg.) was also present underneath the bridge.

The habitat to the south of the structure was dominated by improved grassland bounded by intact species-poor hedgerow.

3.2.2 Habitats beyond 50m radius

Habitats beyond the 50 m survey radius were not surveyed in detail but it was noted that the habitats to the northwest comprised semi-improved grassland grazed by cattle, residential buildings and gardens, and an area of semi-natural broadleaved woodland extending north from the scrub corridor. Additional badger outlier setts were found within this habitat up to 110m from the structure (TN2 to TN4). Two further ponds were accessible from the track bed to the north (TN9 and TN10).

The habitats to the north-east and south of the bridge were dominated by improved grassland bounded by intact species poor hedgerows with occasional hedgerow trees.

A small structure to the north of the bridge, approximately 200 m along the track bed, was found to be a remnant chimney stack forming part of a collapsed building (TN 11).

3.3 Protected Species

3.3.1 Birds

No evidence of bird nesting was noted on or within the bridge, but opportunities were present for ledge and hole nesting species. A small area of scrub underneath the bridge was also inspected, but no nests or nesting activity were identified.

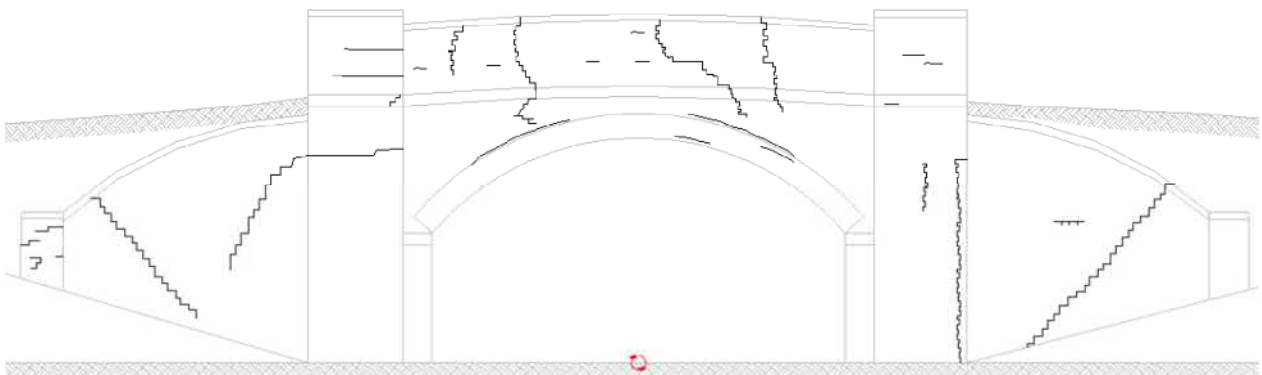
Two old nests were observed on the track bed at TN7 and TN8, both within 100m of the structure. It is considered likely that the bridge and the habitat within the study area offer suitable opportunities for nesting birds.

3.3.2 Bats

Roost Assessment

There were a number of roosting opportunities for bats in suitable crevices on both the northern and southern elevations of the bridge. On the south elevation, horizontal and diagonal fractures in the brickwork were noted to the east and west spandrels, wing walls and parapet sections (Figure 3.1). On the northern arch face, a number of the cut bricks appear loose around the arch extrados with deep open joints to the spandrel area and collar joint. A fracture extends transversely into the soffit where the bricks are displaced. The north arch face first ring crown area has six bricks that have dropped by 15 mm creating a narrow void.

Figure 3.1 : South elevation showing locations of the main fractures providing potential roost features



For those PRFs which were accessible for endoscope inspection from the ground, no evidence of bat use was recorded (Photos 9 and 10). However, a number of PRFs were located on both the south and north elevations above head height and could not be inspected with use of an endoscope.

The underside of the bridge deck provided a limited number of crevices which when examined with a high powered torch and binoculars were found to be shallow and unsuitable for crevice roosting bats. No free hanging bats were recorded.

The surrounding habitat, including woodland and scrub, hedgerows and waterbodies, offered high quality habitat for commuting and foraging. There were no features suitable for use by bats in the trees within 50 m of structure ELW/12.

The structure was assessed as having high suitability to support roosting bats based on the number of potential roost features within the structure and the good quality surrounding habitat which was well connected to the wider landscape.

Emergence/Re-entry Surveys

A common pipistrelle (*Pipistrellus pipistrellus*), which had been foraging around the bridge throughout the majority of the dawn re-entry survey on 24 August 2016, was observed re-entering a cavity on the south side of the structure at about 15 minutes before sunrise.

There was also a possible emergence from the south of the structure during the second dusk emergence survey on 12 July 2016. Calls from two species were recorded at the time of emergence; common pipistrelle and a *Myotis* species. The area of the structure that the bat was observed flying from was obscured by dense vegetation but there were crevices extending into the structure here.

During the surveys, at least four bat species were identified flying within detectable range of the structure; common pipistrelle, soprano pipistrelle (*Pipistrellus pygmaeus*), pipistrelle (*Pipistrellus* sp.), whiskered/Brandt's/Alcathoe (*Myotis* sp.) and noctule (*Nyctalus noctula*). These results are summarised in Table 7 and full survey data is given in Appendix D.

Table 7 : Summary of bat survey results

Species	Survey 1 – Dusk		Survey 2 – Dusk		Survey 3 – Dawn	
	Emergence/re-entry		Emergence/re-entry		Emergence/re-entry	
	North Side	South Side	North Side	South Side	North Side	South Side
Common pipistrelle	-	-	-	Possible	-	Yes
Soprano Pipistrelle	-	-	-	-	-	-
<i>Pipistrellus</i> sp.	-	-	-	-	-	-
<i>Myotis</i> sp.	-	-	-	Possible	-	-
Noctule	-	-	-	-	-	-

Most of the activity was observed on the south side; mainly foraging activity by pipistrelle and *Myotis* bat species, with some passes underneath the structure. The bat activity observed during the dusk emergence and dawn re-entry surveys, including locations of the emergence and re-entry described above, are shown in **Error! Reference source not found.**4, Appendix A.

Winter hibernation inspection

There were a number of roosting opportunities for bats in suitable crevices on both the northern and southern elevations of the bridge. Full details about each roost feature and photographs are given in Appendix D.

A confirmed hibernation roost of a single *Pipistrelle* species bat was found within a vertical crack in the south parapet which is in the same area as where a summer emergence was observed.

A large diagonal crack in the south east wing wall was identified as providing moderate potential for roosting bats.

All other cracks and cavities were assessed and found to be of low or negligible potential for summer and winter roosting bats.

3.3.3 Dormouse

The hedgerows, scrub and coniferous plantation woodland immediately north of the structure offer sub-optimal habitat for dormice however, although generally lacking the size and structure typically required by dormice. This habitat is well connected to woodland habitat in the wider landscape via a network of hedges and patches of woodland.

3.3.4 Great Crested Newt

HSI Assessments

Eight waterbodies were identified within 250 m of the structure. Full descriptions and photographs are given in Appendix C. Access could not be obtained for two of these waterbodies but the remaining six waterbodies were subjected to HSI assessments.

eDNA Surveys

Four waterbodies including the flooded area beneath the structure tested positive for GCN eDNA. The remaining two waterbody samples tested negative for eDNA. The results are summarised in Table 8 and in Figure 3, Appendix A. Full HSI data is given in Appendix D.

Table 8 : Summary of HSI and eDNA survey results

Waterbody ID	HSI Score	Suitability for GCN	eDNA Sample Taken?	eDNA Result
1	0.51	Below Average	Yes	Positive
2	0.55	Below Average	Yes	Positive
3	0.78	Good	Yes	Positive
4	0.79	Good	Yes	Inconclusive
5	0.81	Excellent	Yes	Positive
8	0.41	Poor	Yes	Negative

Presence/Absence Surveys

The four ponds that tested positive for eDNA were surveyed for presence/absence. GCN were found to be present in three of these, as detailed in Table 9 and as shown in Figure 3, Appendix A. Full survey data and results are given in Appendix D

Table 9 : Summary of presence/absence surveys

Waterbody ID	Number of visits	GCN recorded	Population Size Class (Peak count per pond)	Other Species Recorded	Use and justification
1	4 visits	No	N/A	None	Positive eDNA result indicates possible use by foraging and commuting newts.
3	6 visits	Yes	Medium (individuals)	Smooth newt	Main breeding pond – highest number of adults recorded and eggs present.
4	6 visits	Yes	Small (individuals)	Smooth newt; common frog	Breeding pond – adults found and eggs present.
5	6 visits	Yes	Small (individuals)	Smooth newt	Breeding pond –, male and female adults found.

It is reasonable to assume that there is regular interchange of animals between these ponds since there are no significant barriers to dispersal and as such the peak counts can be summed across all three ponds in which newts were found which gives a total site count of 28 which equates to a medium population of GCN in the area.

Terrestrial habitat

Brash piles, loose ballast, abandoned mammal holes and woodland debris recorded in the vicinity of the bridge offered suitable refugia/hibernacula for great crested newts.

3.3.5 Badger

Badger signs had been noted during the Phase 1 Habitat survey in the east and west embankments of the former trackbed to the north of the structure. Along the length of the track bed up to 250m to the north of the structure, badger snuffle holes and pathways were identified, indicating that badgers use the area to forage and commute.

Three outlier setts were identified along the track bed to the north of the structure. An outlier sett (TN4) with two holes approximately 60 m from the structure and a single hole outlier sett (TN3) approximately 70 m from the structure were identified. Both setts appeared to be active but no field signs indicative of badger were found nearby and as such it was difficult to determine their status. It is likely that both of the outlier setts were disused or rarely used by badger and were currently being utilised by rabbits. A single hole outlier sett (TN2) approximately 109 m from the structure was classified as actively used by badgers.

No active setts or recent field signs of badger were recorded within a 100 m radius of the bridge in August 2016. The camera recorded badger commuting beneath the bridge on four occasions during the month of July.

3.3.6 Reptiles

No reptiles were noted during the survey although targeted surveys were not undertaken for this species group.

The site and adjacent areas were recorded as having potential to support reptiles, notably common lizard (*Zootoca vivipara*), slow worm (*Anguis fragilis*) and grass snake.

Habitats that were considered to have potential to support reptiles including brash piles, areas of scrub and open habitat, exposed ballast along the embankments and numerous small mammal holes were present within the study area.

3.3.7 Non-Native Invasive Species

No invasive species were identified within the study area during any of the surveys undertaken.

4. Discussion

4.1 Protected Species

4.1.1 Amphibians

The data search indicated that GCN had been recorded in ponds approximately 150m to the north-east of the study area. The surveys confirmed the presence of a medium population of GCN within 250 m of the bridge and that there is suitable terrestrial habitat directly within the work footprint, notably for hibernation and foraging.

There is a risk that GCN could be injured or killed during the proposed works through activities such as site clearance, dismantling of rubble/log piles and through setting up access tracks for small plant, site compounds and storage areas. GCN terrestrial habitat will also be subjected to damage and some habitat (less than 0.1ha) would be permanently lost as part of the infill works. The non-breeding, ephemeral pool beneath the structure would also be permanently lost.

GCN are afforded complete protection under the Wildlife and Countryside Act (Wildlife and Countryside Act, 1981) and the Conservation of Habitats and Species Regulations (The Conservation of Habitats and Species Regulations, 2010 (as amended)). It is therefore a European Protected Species and it is an offence to:

- Deliberately capture or kill any wild animal of a European protected species;
- Deliberately disturb any such animal (defined as reduce their ability to survive or reproduce);
- Damage or destroy a breeding site or resting place of such a wild animal

Based on the assessment of potential impacts, the proposed works could lead to an offence under the above legislation.

4.1.2 Reptiles

Although targeted surveys have not been undertaken, no reptiles were seen during any of the surveys undertaken around the structure. The site and adjacent areas support suitable habitat including areas of scrub and open habitat with brash piles on the trackbed, exposed ballast along the embankments and numerous small mammal holes. There is potential for common lizard, slow worm and grass snake to be present within the footprint of the works.

Therefore, there is a risk that reptiles could be injured or killed during the site investigation and main infilling works through activities such as site clearance including removal of vegetation and dismantling of log piles and through setting up access tracks for small plant, site compounds and storage areas.

The Wildlife and Countryside Act (Wildlife and Countryside Act, 1981) makes it an offence to intentionally or recklessly kill, injure or trade all native British reptile species. Slow worms, grass snake and common lizard are all priority species for conservation under section 7 of the Environment (Wales) Act (2016).

Based on the assessment of potential impacts, the proposed works could lead to an offence under the above legislation.

4.1.3 Birds

No evidence of bird nesting was noted in or on the structure, but the structure does have suitable locations for bird nesting by ledge and hole nesting species. A small area of scrub underneath the bridge was also inspected, but no nesting activity was identified. However, two old nests were observed on the track bed within 100m of the structure. Given the suitability of the habitat within the study area it can be assumed that there were additional nests not identified from the ground. The bridge and the habitat within the study area offer suitable opportunities for nesting birds.

Therefore, there is a risk that nesting birds and their chicks could be injured or killed or their eggs destroyed during vegetation clearance activities ahead of the site investigation and main infilling works.

All species of bird and their nests are afforded legal protection under the Wildlife and Countryside Act 1981 (as amended) while they are breeding. Additional protection (special penalties and additional constraints) is given to species listed on Schedule 1 of the Act, although the site was considered to offer suitable habitat any of the species listed in the data search results.

Based on the assessment of potential impacts, the proposed works could lead to an offence under the above legislation.

4.1.4 Bats

The structure was considered to offer high suitability for roosting bats from the initial assessment. The bat emergence/re-entry surveys in 2016 concluded that the structure supported a small bat roost (peak count of one) of common pipistrelle and possibly a *Myotis* species which are likely to use the structure as an occasional day roost. The roosting position for the common pipistrelle bat was located on the south side of the structure just above the arch. The winter hibernation inspection in 2017 recorded a single roosting pipistrelle bat near this location confirming it as a minor hibernation roost too.

The underside of the bridge was found to have a limited number of crevices which were deemed unsuitable for crevice roosting bats during the initial inspection in March 2016 therefore the risk of blocking features underneath the bridge through infilling is unlikely.

The structure and its immediate surroundings, including the ephemeral pool underneath it, also provide a valuable foraging site for bats. The scrub around the structure and connecting hedgerows to the south of the structure were found to be used regularly throughout the surveys by foraging bats, with several passes noted underneath the structure. The areas north of the bridge provide high-quality habitat that is well connected to the wider landscape. Woodland, intact hedgerows, semi-improved grassland and waterbodies provide high quality foraging and commuting habitats for bats. To the south is predominately improved grassland, but with a network of intact hedgerows. Infilling the bridge structure could sever access between these areas. At present the route beneath the structure is the only commuting route bats could use that would not require flying over the road above.

The infilling of the bridge void and repair works will cause the permanent loss of the occasional day roost and minor hibernation roost for common pipistrelle bat and possible *Myotis* occasional day roost. There is a risk that bats could be injured or killed during this work if present in the structure at the time.

All British bats are listed on annexe IV of the EC Habitats Directive. This means they receive full protection under regulation 41 of the Conservation of Habitats and Species Regulations (The Conservation of Habitats and Species Regulations, 2010 (as amended) and full protection under the Wildlife and Countryside Act (Wildlife and Countryside Act, 1981). It is therefore an offence to deliberately:

- Kill, capture or handle a bat;
- Damage, destroy or obstruct their breeding or resting places whether bats are present or not;
- Disturb a bat when it is using such a place.

Based on the assessment of potential impacts, the proposed works could lead to an offence under the above legislation.

4.1.5 Badger

The badger survey concluded that there were no setts or recent field signs within 50 m of the structure. Badger signs including outlier setts were noted within the scrub and woodland corridor outside of the study area. The trail camera showed that commuting badgers were crossing underneath the structure between the land to the north and to the south of the structure.

There is a risk that badgers could become trapped or injured during the proposed work should they fall into area that have been excavated.

Badgers and their setts are legally protected under The Protection of Badgers Act (Protection of Badgers Act, 1992). It is therefore an offence to:

- intentionally kill, injure, take, possess or cruelly ill-treat a badger, or attempt to do so;
- disturb a badger when it is occupying a sett; or
- intentionally or recklessly damage, destroy or block access to a badger sett.

Based on the assessment of potential impacts, the proposed works could lead to an offence under the above legislation.

4.1.6 Dormice

The background data search did not return any records of dormice within 2km of the study area and while there is some habitat superficially suitable for dormice within the study area, it is typically sub-optimal and lacks the size and structure which this species typically favours. The landscape associated with the survey area is dominated by arable fields with small scattered areas of woodland and intensively managed hedgerows. This, along with a lack of background data search records, suggests there is a low likelihood that dormice are present within the landscape. As such, this species is not expected to be affected by the proposed work and will not be considered any further.

4.1.7 Non-native invasive species

No non-native invasive species were recorded on site and as such it is not considered that there would be a risk of spreading invasive species as a result of the works.

5. Conclusions and Recommendations

5.1 European Protected Species Licence Information

The following information can be used when considering the three tests that will apply to the issuing of a derogation licence in respect of the Conservation of Habitats and Species Regulations 2017.

When assessing the need, the accompanying engineering documents show that the bridge wing walls are failing which could affect the stability of the public road it carries. Therefore, the need for this licence is in the interests of preserving public safety.

Infilling of the bridge is proposed given that it is a cost effective and historically proven solution to the long term support of the arch/road, ensuring the safety of the public utilising the potentially understrength bridge. Infilling is proposed over brickwork repairs, whereby it is anticipated that further deterioration would quickly re-establish itself. Similarly, the erection of a new arch under the existing structure is not considered to be a cost effective long term solution as it would leave a significant future maintenance liability relative to the infilling scheme proposed.

The favourable conservation status of the bat species impacted and the great crested newts will be maintained through the exclusion procedures (detailed below), ensuring no animals will be injured, along with measures to replace habitat (detailed below). Overall, the resulting minor loss of habitat under the footprint is negligible to the maintenance of the FCS.

5.2 Great Crested Newt

There is a risk that GCN could be injured or killed during the works, and that GCN habitat could be obstructed, damaged or destroyed, resulting in an offence. Therefore, a derogation licence under the Conservation of Habitats and Species Regulations, 2017 is obtained from NRW prior to the works in order for the works to proceed legally. GCN survey data will be sufficient to accurately reflect the status of the site at the time the licence application is submitted. For permanent habitat loss, the maximum age of survey data accepted by NRW in support of a licence application is two breeding seasons. The data collected in 2017 is therefore valid until 2019 unless any significant habitat changes occur on or adjacent to the site since the last survey, and a licence application after that will require updated survey data.

5.2.1 Capture Methodology

The licence will cover a capture and exclusion exercise in order to minimise the risk of killing or injuring GCN present within the footprint of the works. This will take place between April and October 2018 and the entire footprint of the works will be fenced off with exclusion fencing to enable the pitfall trapping and translocation of GCN ahead of the proposed works. Prior to this, the adjacent receptor habitat to the north of the structure will be enhanced with hibernacula. The above work will be undertaken in accordance with the GCN Mitigation Guidelines (English Nature, 2001).

A semi-permanent fence will be installed around the site perimeter and temporary drift fencing will be used inside to create compartments to increase capture efficiency. The attached figure provides an example of the fencing and trap design. Given the GCN population has been assessed to be borderline small to medium, trapping will occur over 30 nights. However, there will be an increased trap density to be used in conjunction with the fence design detailed to increase capture efficiency (English Nature, 2001). The translocation will follow the methods set out in the GCN Mitigation Guidelines with all individuals caught being moved to retained terrestrial habitat out of the work area to the north. See Figure 5 for an indication of the fence and trap layout.

On completion of the capture and exclusion exercise, a destructive search will be undertaken within the exclusion zone and semi-permanent fencing will remain in place until all works are complete on site. A Method Statement will be produced as part of the licence application which will include a methodology for GCN capture and exclusion from the works area, and the creation of terrestrial and aquatic habitat to compensate for these

habitats being lost from beneath the structure during the main infilling works. The proposed mitigation will ensure that there is no detriment to the favourable conservation status of this species.

Site clearance including removal of vegetation and dismantling of rubble/log piles will be supervised by a suitably qualified ecologist. The installation of newt fencing will also be supervised.

Welfare facilities and all equipment will be stored within a designated works compound within the exclusion zone.

5.2.2 Biosecurity

Biosecurity measures will be adhered to in order to reduce the risk of transmission of disease and invasive non-native species (INNS). All materials used during the translocation will be new and not previously used. Footwear will be thoroughly cleaned and dried or cleaned and treated with an approved disinfectant to avoid the spread of Chytrid fungus. The receptor area is adjacent to the area of translocation and are considered to be habitats used by the same population of great crested newt.

During construction, the site and construction methods will be appraised, to review the biosecurity risk. Vehicles will be cleaned before arriving at site, particularly those that may be contaminated with wet or damp materials.

5.2.3 Compliance audit

It is anticipated that the scale of impact that would be licensed is small and therefore basic compliance auditing with NRW would be required (licence return form at the end of works). However, this is determined by NRW during the licence application so cannot be confirmed until this time.

A detailed site diary will be kept by the supervising ecologist to record the activities on site and will be available for NRW review if required. The site ecologist will monitor the works for compliance with the issued licence to ensure compliance e.g. materials are installed correctly and to the correct specifications, that detailed notes on all sightings, captures and releases are kept and that the captures for each enclosed compartment are kept to identify when they can be declared free of newts.

Due to the low level of impact expected, no post-construction monitoring of the meta-population will be proposed. If NRW require monitoring and it is not proposed in the licence application, it will be added as a condition of the licence when it is granted.

Should additional works or changes in working methods be required at a later stage, then the on-site ecologist will be contacted for advice in order to re-assess the risk to GCN and suitable measures be put in place to ensure legislative compliance. This may require an alteration to the derogation licence and could take up to 30 days for approval.

5.2.4 Severance mitigation in design

There are not considered to be any severance impacts associated with the infilling of the bridge as the road over the top of the structure is not thought to pose a barrier to newt movement given it is approximately 4m wide and not heavily trafficked. However, a modification to the existing design would create a route for the GCN through the infilled structure. The three drainage pipes included in the existing design, and which lead straight through the infilled structure, are to prevent it having a dam effect and holding back water. These pipes were to be fitted with geomembrane to prevent sediments from entering the pipe but the design can be modified and the membranes removed. They would be gridded with 50mmx50mm mesh (or similar) that will allow GCN to move through them.

5.3 Reptiles

The proposed works were deemed likely to lead to a contravention of legislation relating to reptiles. Construction mitigation including vegetation strimming and hand searching will be used assuming these species are present. The development footprint would be fenced off with exclusion fencing as part of the GCN mitigation. Any reptiles

found within the exclusion fencing would be removed by hand and placed in log pile refugia and vegetation cover in suitable locations outside of the exclusion zone. Reptiles are most vulnerable to disturbance and/or injury during the hibernation period, which typically lasts from late October to early March (depending on weather conditions). The reptiles will be moved as part of the translocation exercise for GCN, therefore the area will be cleared during the active season. All reptile mitigation measures will be carried out in conjunction with the GCN licensed work as the methods are so similar.

5.4 Breeding Birds

The proposed works were deemed likely to lead to a contravention of legislation relating to breeding birds. It is recommended that vegetation removal is undertaken outside of the breeding bird season, which generally runs from March to August inclusive. Vegetation clearance will take place in staged cuts prior to the nesting season so that no nesting substrate is available, i.e. vegetation cut to 10cm above ground level using hand tools. If works cannot be avoided during the breeding bird season, an inspection would be undertaken by a suitably experienced ecologist immediately prior to works commencing to ensure that there are no active birds' nests present in the vicinity of the proposed works. Should an active bird nest be found, it would be necessary to establish a buffer zone around the nest and leave it undisturbed until the chicks have fledged.

5.5 Bats

Due to the presence of a bat roost, a derogation license under the Conservation of Habitats and Species Regulations, 2010 (as amended) would be required from NRW for the works to proceed legally. The infilling of the bridge void and repair works will cause the permanent loss of the occasional day and hibernation roost for common pipistrelle and possible *Myotis* occasional day roost.

Infilling the bridge structure would remove one of the potential routes that bats use to commute between the woodland to the north and connecting hedgerows to the south, which would force bats to fly over the lane above. Bats were also observed foraging beneath the structure during activity surveys. The lane is narrow (approx. 4 m wide) with tall hedgerows on both sides and no lighting. The lane also experiences light traffic and so no effects on commuting and foraging are predicted.

The winter inspection, undertaken from a tower scaffold height, confirmed a single pipistrelle hibernation roost in the same feature used as a day roost. The diagonal fracture in the south east wing wall, where there was a possible emergence of a pipistrelle or myotis during the summer emergence surveys, was assessed to have moderate potential. All other features were of low or negligible potential. The comprehensive nature of the winter inspection superseded the initial roost assessment.

5.5.1 Mitigation and exclusion

The named bat ecologist will be retained for the duration of the project and will supervise all licensable works. One hibernation bat box (Schwegler 1FW), one crevice type box (Schwegler 1FF) and a Schwegler type 2FN bat box will be deployed on the trees around the structure. These bat boxes have been chosen for their suitability for the species found. They will be installed on trees located adjacent to the bridge on the south side ahead of the exclusion exercise which will serve as a compensation for the permanent loss of the roost.

Prior to the works to the bridge, under the bat licence all suitable features would be inspected and where the features can be fully inspected, they will be filled to prevent any bat entry. Where features cannot be fully examined, a one-way excluder will be fitted to allow any bat out of sight to leave but not re-enter the feature. This will be undertaken during the bat active season under suitable conditions and will ensure no roosting bats are present at the time of the works. Prior to works commencing the licenced bat ecologist would provide a toolbox talk to all site staff to discuss the potential presence of bats, measures to minimise impacts on bats and the action to be taken in the event that bats are discovered during the works.

The confirmed hibernation and day roost feature is within the parapet wall of the structure. This wall will be repaired and retained following the infill of the structure. Therefore, as an enhancement measure, part of the existing roost feature will be retained in this wall. The fracture will be repaired leaving a cavity suitable for roosting. The opening would be partially repointed to prevent water ingress but a suitable entry point retained.

5.5.2 Biosecurity Measures

There are unlikely to be any biosecurity risks to bats as part of the works. Any bat worker who has previously been into an underground hibernation site should follow the BCT White-nose syndrome: Guidance for bat workers in the UK and Isle of Man, and decontaminate their equipment after leaving such a place.

5.5.3 Compliance Audit

As above, it is anticipated that the scale of impact that would be licensed is small and therefore basic compliance auditing with NRW would be required (licence return form at the end of works). However, this is determined by NRW during the licence application so cannot be confirmed until this time.

A detailed site diary will be kept by the supervising ecologist to record the activities on site and will be available for NRW review if required. The site ecologist will monitor the works for compliance with the issued licence to ensure compliance e.g. materials are installed correctly and to the correct specifications, that the replacement roost boxes are installed correctly and a suitable roost feature is retained in the parapet wall following its repair.

Due to the low level of impact expected, no post-construction monitoring of the bat boxes will be proposed. If NRW require monitoring and it is not proposed in the licence application, it will be added as a condition of the licence when it is granted.

5.6 Badger

Infilling the void beneath the structure would force the badgers to cross the lane above. The lane is narrow (approx. 3 m wide) and experiences light traffic. Therefore, the likelihood of mortalities from traffic is assessed as being low.

A pre-construction inspection for badgers should be undertaken prior to the installation of exclusion fencing to confirm that no new setts have been created within the work footprint. The holes previously identified close to site will be re-inspected for recent signs of badger activity.

Badgers should be considered during the works as there is potential for badger to be injured. Any excavations would need to be fenced off or fitted with a mammal ladder to prevent badgers becoming trapped, no heavy objects should be left propped against trees or other structures outside of the exclusion zone overnight and all materials badgers could become entangled in should be stored securely within the works compound. The development footprint would be fenced off with exclusion fencing as part of the GCN mitigation and should there be any signs of damage to the fencing by badgers during checks, further measures would be taken to prevent this, for example, installing a badger gate within the fence line.

6. References

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Appendix A. Figures

Figure 1: Statutory and non-statutory designated sites

Figure 2: Phase 1 Habitat map

Figure 3: Pond locations and GCN presence/absence results

Figure 4: Bat roost location and activity

Figure 5: Example of potential GCN fence and pitfall trap layout

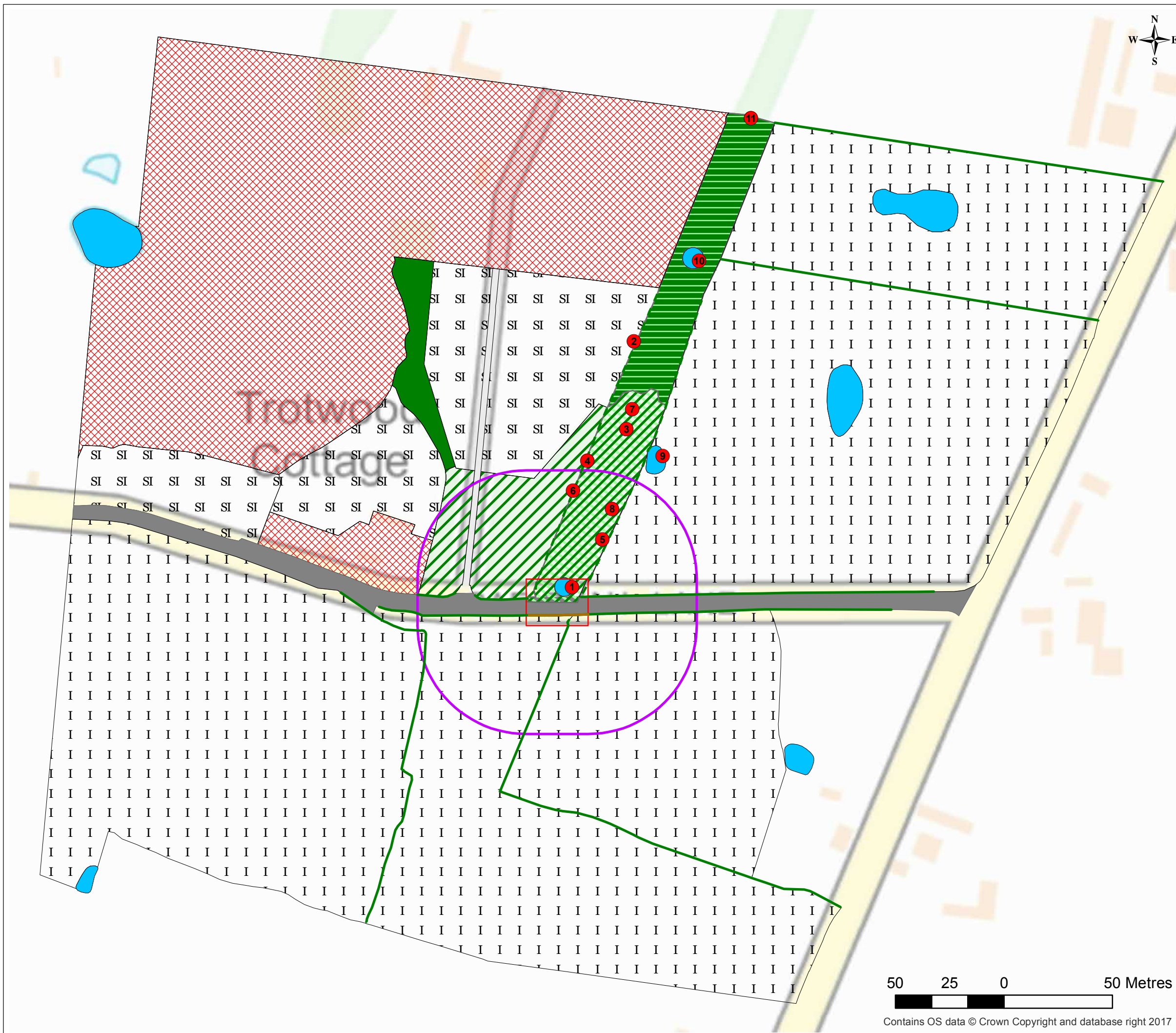
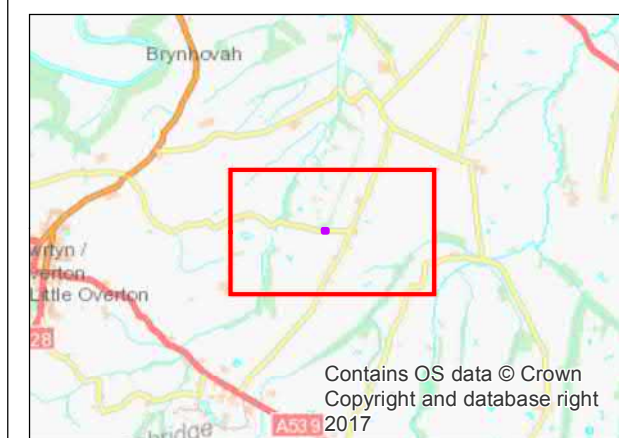


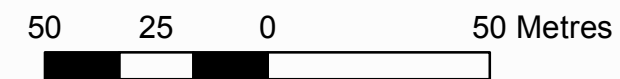
FIGURE 2

Legend

- Location of bridge
- 50m around bridge
- Target note
- Species-poor intact hedge
- Species-poor defunct hedge
- Wall
- Semi-natural broadleaved woodland
- Semi-natural broadleaved woodland and coniferous plantation woodland
- Broadleaved plantation woodland
- Dense scrub and coniferous plantation woodland
- Improved grassland
- Poor semi-improved grassland
- Standing water
- Hard standing
- No access



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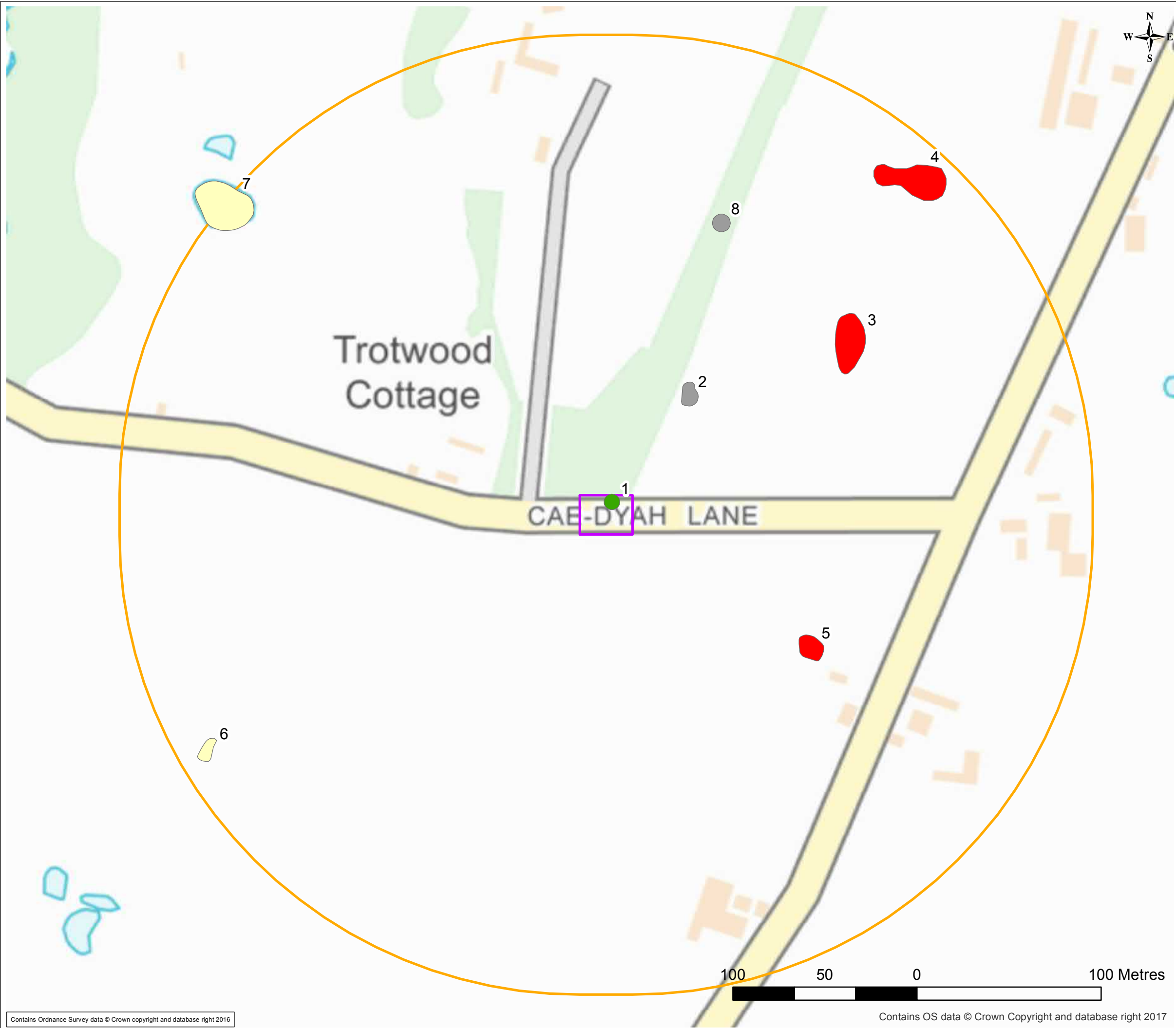
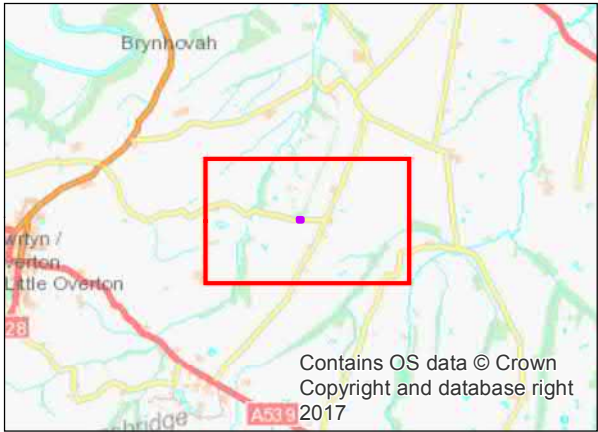


FIGURE 3

Legend

- Location of bridge
- 250m study area
- GCN Results**
- GCN present
- GCN presumed absent
- Dry
- No access
- # Waterbody ID



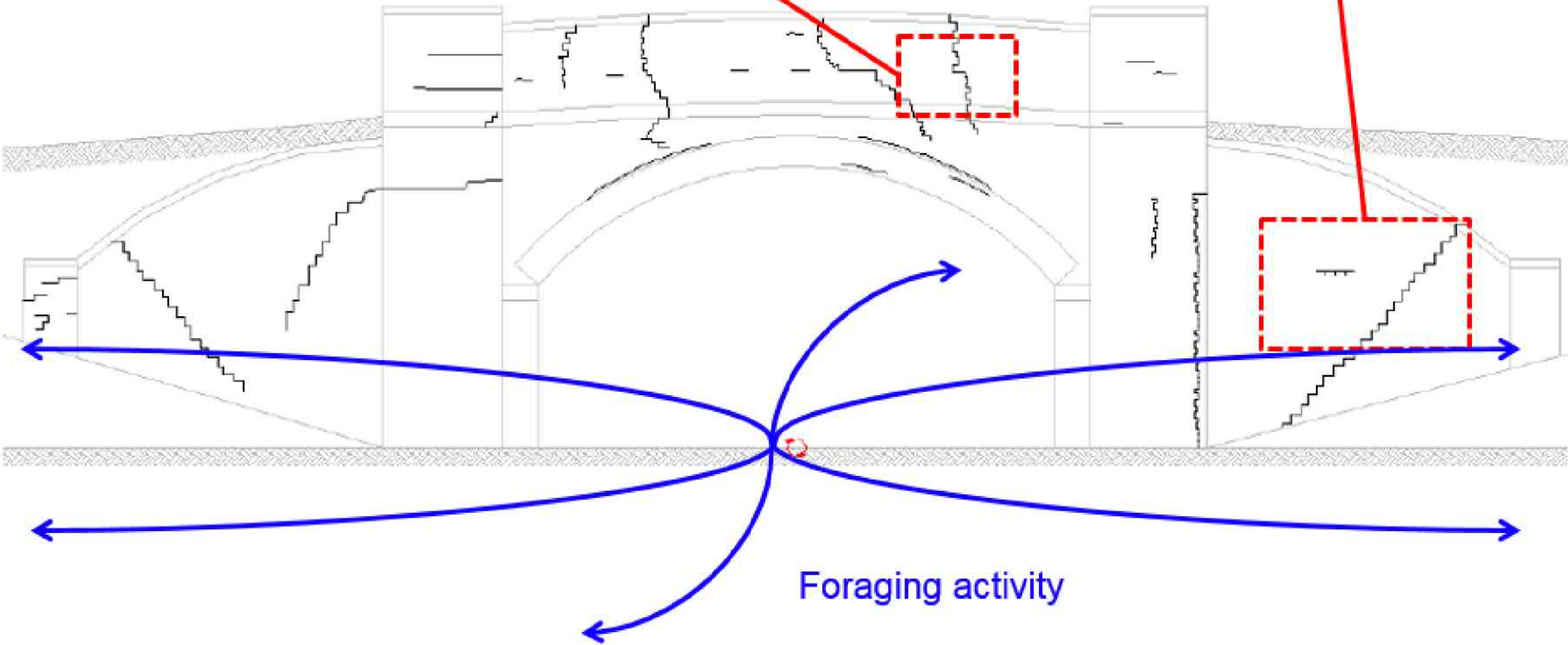
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FIGURE 4

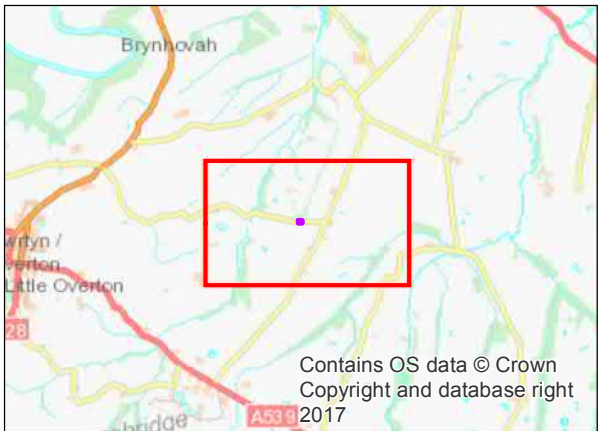
Dawn re-entry on 24/08/2016



Possible emergence on 12/07/2016



Foraging activity



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Client No.							
Drawing No. ELW12_004_BatSurveyResults							

This drawing is not to be used in whole in or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.



Figure 5

Legend

- * Refugia/carpet tiles
- Pitfall traps
- Area to be hand searched
- Drift/temporary fencing
- Semi-permanent fencing
- Exclusion zone
- Receptor site

FOR INFORMATION ONLY



0	26/07/2018	ISSUE	FL	AD	CK	CK
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
JACOBS Churchill House, Churchill Way, Cardiff, CF10 2HH, UK. Tel: +44(0)29 2035 3200 Fax:+44(0)29 2035 3222 www.jacobs.com						
Client			highways england driving forward			
Project			ELW/12			
Drawing Title			EXAMPLE OF POTENTIAL GCN FENCE AND PITFALL TRAP LAYOUT			
Drawing Status			DRAFT			
Scale @A3		1:400	DO NOT SCALE			
Jacobs No.		B28280BE				
Client No.						
Drawing No.			ELW12_05_FencePitfallTrapLayout			
This drawing is not to be used in whole in or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.						

Appendix B. Phase 1 Target Notes

Target Note Number	Description	
TN1	Ephemeral pond underneath structure extending from under the bridge along the track bed.	
		
	Remnant hedgerow boundary on embankments	

Target Note Number	Description	
	Improved grassland in field to the south	
TN2	Outlier single hole sett. Potentially still used by badgers.	
TN3	Single hole sett thought to be dug by badgers but now considered to be used by rabbits.	No image

Target Note Number	Description	
TN4	Two hole outlier sett considered to be in use by badgers.	
TN5	Mammal signs, two collapsed badger holes used by rabbit.	
TN6	Badger signs, likely to be foraging hole.	
TN7	Old bird nest within scrub.	No image

Target Note Number	Description	
TN8	Old bird nest within scrub.	No image
TN9	Small pond, dries annually. Potential habitat for GCN.	
TN10	Small pond, dries annually. Potential habitat for GCN.	

Target Note Number	Description	
TN11	Remnant chimney stack located along the track bed approximately 200m to the north of structure ELW/12. No evidence of bat roosting observed.	 A photograph showing a remnant brick chimney stack in a wooded area. The stack is made of red bricks and has a large opening at the base. It is surrounded by trees and vegetation. A fallen log lies on the ground in the foreground.

Appendix C. Ponds Within 250 m of Structure

Pond Number	Distance from structure (m)	Photograph and description
1	0	 Waterlogged area underneath structure which dries annually. Pasture field to the south and plantation woodland corridor to the north. Immediate habitat is scrub and bare ground with some grasses. Bottom is silty. Plenty of opportunities for hibernating newts in the surrounding habitat.
2	75	 Almost dry, depression in ground. Very shallow with grasses growing throughout. Bordered by scrub. Lies on western boundary of the southern field of Nant Holdings with woodland corridor running along the western edge which north to south down to the structure.

Pond Number	Distance from structure (m)	Photograph and description
3	150	 Located in the middle of an agricultural field grazed by cows. <i>Juncus</i> sp. at the pond margins and willow scrub at the centre. Field is bounded by hedgerows.
4	230	 Located at centre of agricultural field grazed by cows. Willow (<i>Salix</i> sp.), hawthorn (<i>Crataegus monogyna</i>) and blackthorn (<i>Prunus spinosa</i>) scrub and young trees. Bramble (<i>Rubus fruticosus</i> agg.), rose (<i>Rosa</i> sp.) and yellow flag iris (<i>Iris pseudacorus</i>) also present along the pond margin. Hedgerows along field margins. Evidence of poaching by cows.

Pond Number	Distance from structure (m)	Photograph and description
5	125	 Lots of emergent vegetation including grasses and yellow flag iris. Scrub and young trees along margins in some parts
6	245	No access.
7	250	No access.
8	160	Shallow (<10cm), waterlogged area within the woods, no vegetation for egg laying. Lots of leaf litter in the water.

Appendix D. Raw Data

Bat Activity Survey

Dusk emergence survey on 27/06/2016

45Pip = common pipstrelle; 55Pip = soprano pipistrelle

North Side of Structure			South Side of Structure		
Time	Species	Number of passes	Time	Species	Number of passes
22:11	Myotis	1	22:17	Myotis	1
22:12	45Pip	3	22:18	45Pip	1
22:13	45Pip	3	22:20	45Pip	2
22:14	45Pip	1	22:21	45Pip	3
22:16	45Pip	1	22:22	45Pip	3
22:20	45Pip	1	22:23	45Pip	3
22:22	45Pip	1	22:24	45Pip	4
22:23	45Pip	1	22:25	45Pip	4
22:25	45Pip	4	22:26	45Pip	4
22:26	45Pip	3	22:27	45Pip	4
22:27	45Pip	2	22:28	45Pip	4
22:30	45Pip	1	22:31	45Pip	4
22:32	45Pip	1	22:32	45Pip	3
22:44	Myotis	1	22:33	45Pip	4
			22:34	45Pip	1
			22:35	45Pip	1
			22:36	45Pip	3
			22:38	45Pip	1
			22:39	Myotis	1
			22:42	Noctule	1
			22:47	Myotis	1
			22:49	Myotis	1
			22:55	55Pip	1

North Side of Structure			South Side of Structure		
Time	Species	Number of passes	Time	Species	Number of passes
			23:06	45Pip	1
			23:07	45Pip	1
			23:12	Myotis	1

Dusk emergence survey on 12/07/2016

South Side of Structure		
Time	Species	Number of passes
21:53	Noctule	1
22:04	Noctule	1
22:05	Myotis	1
22:05	Noctule	1
22:07	45Pip	2
22:08	45Pip	1
22:11	Noctule	1
22:17	45Pip	1
22:17	Noctule	1
22:18	45Pip	3
22:19	45Pip	4
22:20	45Pip	3
22:20	Noctule	2
22:21	45Pip	4
22:22	45Pip	4
22:23	45Pip	4
22:24	45Pip	2
22:25	45Pip	2
22:26	45Pip	2
22:27	45Pip	3
22:28	45Pip	4

South Side of Structure		
Time	Species	Number of passes
22:29	45Pip	4
22:30	45Pip	4
22:31	45Pip	1
22:31	Whisk	1
22:32	45Pip	3
22:33	45Pip	4
22:34	45Pip	4
22:35	45Pip	4
22:36	45Pip	4
22:37	45Pip	3
22:38	45Pip	1
22:38	Whisk	1
22:39	45Pip	3
22:40	45Pip	1
22:43	45Pip	1
22:44	45Pip	1
22:45	45Pip	4
22:45	Whisk	1
22:46	45Pip	1
22:47	45Pip	1
22:47	55Pip	1
22:54	45Pip	1
22:56	45Pip	1
22:56	Myotis	1
22:56	Whisk	1
22:59	45Pip	2
22:59	Myotis	2

South Side of Structure		
Time	Species	Number of passes
23:00	Myotis	1
23:01	Noctule	1
23:03	Myotis	1
23:09	Noctule	2

Dawn re-entry survey on 24/08/2016

North Side of Structure			South Side of Structure		
Time	Species	Number of passes	Time	Species	Number of passes
04:40	Pip	1	04:40	45Pip	1
04:53	Myotis	1	04:41	45Pip	2
04:57	Myotis	1	04:42	45Pip	1
05:43	45Pip	1	04:42	Myotis	2
05:46	45Pip	1	04:42	PipSoc	1
05:47	45Pip	2	04:44	55Pip	2
05:48	45Pip	4	04:45	55Pip	1
05:50	45Pip	1	04:47	55Pip	1
05:51	45Pip	1	04:47	Myotis	1
05:52	45Pip	2	04:48	Myotis	1
05:53	45Pip	3	04:51	Myotis	1
			04:53	Myotis	1
			04:55	Myotis	1
			04:58	Myotis	1
			05:09	45Pip	1
			05:10	45Pip	2
			05:12	45Pip	2
			05:18	45Pip	2
			05:21	45Pip	1
			05:22	45Pip	3

North Side of Structure			South Side of Structure		
Time	Species	Number of passes	Time	Species	Number of passes
			05:30	45Pip	3
			05:31	45Pip	3
			05:32	45Pip	4
			05:33	45Pip	4
			05:34	45Pip	4
			05:34	Noctule	1
			05:35	45Pip	4
			05:36	45Pip	4
			05:37	45Pip	4
			05:38	45Pip	4
			05:39	45Pip	4
			05:40	45Pip	3
			05:41	45Pip	4
			05:42	45Pip	4
			05:43	45Pip	4
			05:44	45Pip	4
			05:45	45Pip	4
			05:46	45Pip	4
			05:47	45Pip	2
			05:48	45Pip	1
			05:49	45Pip	1
			05:51	45Pip	5
			05:51	PipSoc	1
			05:52	45Pip	3
			05:53	45Pip	4
			05:54	45Pip	3

Winter hibernation inspection

Aspect	Potential	Photograph
South- east Wing wall	Missing brickwork and diagonal crack c. 0.5 m deep leading to multiple cavities within brickwork. No evidence of bat activity or hibernating bats identified, but feature is considered to have moderate potential for roosting bats	
South parapet	Vertical crack c. 2 to 3 cm wide leading to multiple cavities within brickwork. Confirmed roost of single common pipistrelle c. 30 cm within cavity.	

Aspect	Potential	Photograph
		
South string course	Diagonal crack passing through string course. Several cavities present up to 30 cm deep, but with much detritus and cobwebs. No evidence of bat activity or hibernating bats identified, but feature is considered to have low potential for roosting bats.	
South spandrel over arch	Crack in arch and where spandrel joins arch. Loose bricks in spandrel over arch. Cracks superficial c. 2 cm deep to. Loose bricks carefully removed (and replaced) to reveal no cavities present. No evidence of bat activity or hibernating bats identified. Feature is considered to have negligible potential for roosting bats.	

Aspect	Potential	Photograph
South spandrel, string course and parapet	Vertical crack passing through spandrel, string course and parapet. Cracks largely superficial or filled with loose mortar and cobwebs. Several wider gaps c. 1 to 2 cm extending into cavities. No evidence of bat activity or hibernating bats identified, but feature is considered to have low potential for roosting bats.	
South-west wing wall	Two diagonal cracks in brickwork/masonry c. 1 cm wide. Relatively superficial with some areas leading into deeper cavities. No evidence of bat activity or hibernating bats identified, but feature is considered to have low potential for roosting bats.	

Aspect	Potential	Photograph
North west and east wing walls	Diagonal cracks c. 1 to 2 cm wide leading into cavities. Several areas within the cracks on both the west and east wing walls extending deeper into restricted cavities, with loose mortar, cobwebs and tree/shrub roots. No evidence of bat activity or hibernating bats identified, but feature is considered to have low potential for roosting bats.	
North arch, spandrel and parapet	Majority of cracks/missing mortar were identified at height as being largely superficial. A horizontal crack c. 1 to 2 cm wide passing through monitoring point twelve extended c. 30 cm into cavity was found to be largely restricted by loose mortar, cobwebs and bramble roots. No evidence of bat activity or hibernating bats identified, but feature is considered to have low potential for roosting bats.	
North west pilaster	Loose/missing brickwork and missing mortar found to be superficial, with no cavities identified. No evidence of bat activity or hibernating bats identified Feature is considered to have negligible potential for roosting bats.	

Great Crested Newt Survey: HSI Assessments

Pond Number	Pond Description	OS Grid Reference	SI ₁ Location	SI ₂ Pond area (m ²)	SI ₃ Pond drying	SI ₄ Water quality	SI ₅ Shade	SI ₆ Fowl	SI ₇ Fish	SI ₈ Pound count	SI ₉ Terrestrial habitat	SI ₁₀ Macrophytes	HSI Score	Suitability	eDNA Result
1	Ponding of water under ELW/12 bridge structure. Agricultural field to the south and woodland strip to the north. Immediate habitat is scrub and bare ground with some grass. Bottom is silty.	SJ395420	A	100	Frequently	Poor	90	Absent	Absent	30	Good	10	0.51	Below average	Positive
2	Almost dry, depression in ground, very shallow. Grasses and ranunculus spp. growing throughout. Bordered by bramble and willow scrub with young hawthorn. Lies on western boundary of the southern field of Nant Holdings with woodland strip running along the western edge which runs down to the structure.	SJ396421	A	33	Sometimes	Moderate	100	Absent	Absent	30	Good	100	0.55	Below average	Positive
3	Located in the middle of an agricultural field grazed by cows. <i>Juncus</i> emerging at the pond margins and willow trees at the centre. Field is bordered by hedgerows.	SJ397421	A	118	Never	Moderate	15	Absent	Absent	30	Good	30	0.78	Good	Positive
4	Centre of agricultural field grazed by cows. Willow, hawthorn and Blackthorn scrub and young trees. Bramble, rose and yellowflag iris also present, all along 60% of the pond margin. Hedgerow around field. Poached by cows at one side where used by cows for drinking.	SJ397422	A	375	Never	Moderate	50	Minor	Absent	27	Good	0	0.79	Good	Inconclusive
5	Lots of emergent vegetation including grasses (bulrush) and yellowflag iris. Scrub and young trees along margins in some parts. Toad	SJ397419	A	82	Never	Good	50	Absent	Absent	28	Good	95	0.81	Excellent	Positive

Pond Number	Pond Description	OS Grid Reference	SI ₁ Location	SI ₂ Pond area (m ²)	SI ₃ Pond drying	SI ₄ Water quality	SI ₅ Shade	SI ₆ Fowl	SI ₇ Fish	SI ₈ Pound count	SI ₉ Terrestrial habitat	SI ₁₀ Macrophytes	HSI Score	Suitability	eDNA Result
	observed in pond. Landowner has bottle-trapped the pond previously and has had GCN.														
8	Waterlogged area within the woods, no vegetation for egg laying. Lots of leaf litter in the water. Shallow (10cm).	SJ396421	A	1.5	Frequently	Moderate	100	Absent	Absent	28	Moderate	0	0.41	Poor	Negative

Presence/Absence Survey Results

Survey	Date	Weather Conditions	Pond Number	Turbidity Score (1-5)	Vegetation Cover	Air Temp. (°c)	GCN Present	Eggs Present	No. of GCN adults									Other Amphibians Present	Comments and limitations		
									Bottle Trap			Torching			Netting					TOTAL	
									Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.				
1	16 th -17 th March 2017	Light rain, light air. Damp ground conditions.	1	0	1	7	No	No	0	0	0	0	0	0	0	0	0	0	0	None.	15 traps
			2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	DRY – NO FURTHER SURVEY
			3	1	1	6	No	No	0	0	0	0	0	0	0	0	0	0	0	0	Smooth newt. Common frog

Survey	Date	Weather Conditions	Pond Number	Turbidity Score (1-5)	Vegetation Cover	Air Temp. (°c)	GCN Present	Eggs Present	No. of GCN adults									Other Amphibians Present	Comments and limitations			
									Bottle Trap			Torching			Netting					TOTAL		
									Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.					
			4	1	1	6	No	No	0	0	0	0	0	0	0	0	0	0	0	Common frog (incl. spawn)	30 traps	
			5	N/A	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Surveys not undertaken as temperature too low for bottle traps and torching not suitable due to high vegetation cover.
			8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	DRY – NO FURTHER SURVEY
2	3 rd – 4 th April 2017	Dry, light air. Damp ground conditions.	1	2	1	11	No	No	0	0	0	0	0	0	0	0	0	0	0	None.		
			3	3	1	12	Yes	Yes	5	10	0	0	0	0	0	0	0	0	15	Smooth newt		
			4	3	1	12	No	Yes	0	0	0	0	0	0	0	0	0	0	0	Common toad		
			5	2	5	13.5	Yes	No	0	2	0	0	0	0	0	0	0	0	2	Smooth newt	20 traps. Dense scrub along 20% pond margin.	

Survey	Date	Weather Conditions	Pond Number	Turbidity Score (1-5)	Vegetation Cover	Air Temp. (°c)	GCN Present	Eggs Present	No. of GCN adults									Other Amphibians Present	Comments and limitations		
									Bottle Trap			Torching			Netting					TOTAL	
									Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.				
3	11 th – 12 th April 2017	Dry, light air. Damp ground conditions.	1	3	3	8	No	No	0	0	0	0	0	0	0	0	0	0	0	None.	Algae present. Less traps used (10) as pond had dried.
			3	3	1	9	Yes	No	9	15	0	0	0	0	0	0	0	0	24	Smooth newt	
			4	3	1	9	Yes	No	1	1	0	0	0	0	0	0	0	0	2	Smooth newt	25 traps as pond had dried and deep mud in parts restricting access. 2 Canada geese seen.
			5	2	5	9	Yes	No	1	1	0	0	0	0	0	0	0	2	Smooth newt	Difficult to net due to reed vegetation and roots. Pond had dried slightly'	
4	27 th – 28 th April 2017	Light rain/drizzle, light air. Damp ground conditions.	1	1	0	9.5	No	No	0	0	0	0	0	0	0	0	0	0	0	None.	Pond has dried substantially leaving shallow pools of water <10cm. Too shallow for bottle traps. No GCN recorded in

Survey	Date	Weather Conditions	Pond Number	Turbidity Score (1-5)	Vegetation Cover	Air Temp. (° c)	GCN Present	Eggs Present	No. of GCN adults									Other Amphibians Present	Comments and limitations		
									Bottle Trap			Torching			Netting					TOTAL	
									Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.				
																					surveys 1-4 – no further surveys.
			3	3	1	9	Yes	Yes	8	7	0	0	0	0	0	0	0	15	Smooth newt	Cattle in field, evidence of poaching at pond margins. 35 traps used as pond had dried slightly.	
			4	3	1	9	No	No	0	0	0	0	0	0	0	0	0	0	Smooth newt	Cattle in field, evidence of poaching at pond margins. 20 traps as pond had dried and deep mud in parts restricting access.	
			5	2	5	9	Yes	No	1	1	0	0	0	0	0	0	0	2	Smooth newt	15 traps used as pond had dried more.	
5	3 rd – 4 th May 2017	Dry, light air. Ground	3	4	1	6.5	Yes	Yes	4	8	0	0	0	0	0	0	0	12	Smooth newt	Increased turbidity as pond drying and poaching by cattle.	

Survey	Date	Weather Conditions	Pond Number	Turbidity Score (1-5)	Vegetation Cover	Air Temp. (°c)	GCN Present	Eggs Present	No. of GCN adults									Other Amphibians Present	Comments and limitations		
									Bottle Trap			Torching			Netting					TOTAL	
									Male	Female	Imm.	Male	Female	Imm.	Male	Female	Imm.				
6	18 th – 19 th May 2017	conditions dry.	4	4	1	7	No	No	0	0	0	0	0	0	0	0	0	0	0	Smooth newt. Common frog (tadpoles)	Increased turbidity as pond dries.
			5	2	5	6.5	Yes	No	0	2	0	0	0	0	0	0	0	0	2	Smooth newt	
		Dry, light air. Ground conditions dry.	3	4	1	11.5	Yes	No	5	3	0	0	0	0	0	0	0	0	8	Smooth newt	
			4	4	1	11.5	No	No	0	0	0	0	0	0	0	0	0	0	0	Smooth newt. Common frog (tadpoles)	Increased turbidity as pond dries.
			5	2	5	9.5	No	No	0	0	0	0	0	0	0	0	0	0	0	None.	Pond had dried more and emergent vegetation had grown up.
7	23 rd – 24 th May 2017	Dry, calm. Ground conditions dry.	5	3	5	16	No	No	0	0	0	0	0	0	0	0	0	0	Smooth newt (net) Common frog		