Appendix 9

Supporting Chapter 9 – Nature Conservation

Appendix 9.1 – Bat Survey Methods and Results

Appendix 9.2 – Great Crested Newt Survey Details

Appendix 9.1 – Bat Survey Methods and Results

1.1 Introduction

1.1.1 This appendix supports Chapter 9: Nature Conservation. It sets out additional information on the survey methods, survey conditions and results of the bat surveys.

1.2 Field Survey Methodology

Bat Roost Survey

1.2.1 The bat roost suitability of all trees and structures within the footprint of the Scheme plus a 50m buffer was assessed following guidance published by the Bat Conservation Trust (BCT) (Collins, 2016). Potential Roost Features (PRF) were identified from the ground and were classified as having 'Negligible', 'Low', 'Moderate' or 'High' bat roost suitability, according to the definitions in Collins (2016). The assessment was conducted on 05 July 2017 (at this time trees were in full leaf, but as it was known there were only a very limited number of trees within the survey area, this was not considered to be a significant constraint).

1.2.2 In late July 2017 a bat was reported within a residential property south-east of Sheriffhall roundabout (hereafter referred to as 'Sheriffhall Farmhouse'). No evidence of bats in this dwelling had yet been collected during field survey, and so to investigate further an internal inspection of Sheriffhall Farmhouse and the adjacent barn was carried out on 18 August 2017.

1.2.3 In accordance with the BCT guidelines, trees assessed as having Moderate or High bat roost suitability, and structures assessed as having Low, Moderate or High bat roost suitability were subject to dusk emergence and/or dawn re-entry surveys. The number of times a survey was repeated was based on the suitability of the feature, as outlined in Collins (2016). These surveys were carried out between 05 July and 29 August 2017. Surveyors stood in a position which allowed them a view of the identified PRF and watched for bats leaving or returning to a roost. Batbox Duet (with Roland R-05 recorders) and Echo Meter EM3 devices recording to an SD card were used to aid in detection and identification of bats. If any bats emerged/entered a roost, the surveyors noted the roost location, identified the species (using bat detection equipment) and counted the number of bats emerging or entering (where light conditions allowed). General bat activity was also noted during the survey to provide further information on use of the Scheme area by bats.

External Inspection

1.2.4 An inspection of the internal spaces available for access at Sheriffhall Farmhouse was carried out during the day on 8th August 2017. Binoculars and torches were utilised during this survey to aid in searching for signs of bat roosting. The external surveys were carried out prior to the first of the dusk activity surveys at each site.

1.2.5 Searches were made for potential entry points which could be used by bats and to locate evidence of roosting. Evidence indicative of bat roosting includes:

- live or dead specimens;
- droppings;
- urine splashes;
- fur-oil staining;
- feeding remains;

- audible squeaking; and,
- odour.

1.2.6 A check of the exterior of the buildings at both sites was also carried out to search for evidence of roosting bats. Again, this aimed to identify possible entry points to the building and field signs indicating the presence of bats (as described above). The external inspection focussed on areas beneath potential entry points, other features which could be used for roosting and on windowsills and door lintels (where droppings can often be located).

1.2.7 Following the completion of the internal and external inspections, an assessment was made of the overall suitability of the buildings to support roosting bats, in accordance with the guidelines and definitions provided in Collins (2016).

Bat Emergence / Re-entry Survey

1.2.8 A series of dawn emergence and dawn re-entry surveys were carried out at both sites, with each site being surveyed on three separate occasions. The surveys were carried out in accordance with industry-standard recommendations published by the Bat Conservation Trust (BCT) (Collins, 2016). Further details of the methods of each survey are provided below.

1.2.9 Dusk emergence surveys were carried out at the Sheriffhall House site on the 5th July and 28th August 2017. A dawn re-entry survey was carried out on the 4th August 2017. Dawn re-entry surveys were carried out at the Summerside site on the 19th July and the 29th August 2017. A dusk emergence survey was carried out on the 3rd August 2017.

1.2.10 This involved experienced AECOM ecologists positioning themselves at points around the buildings which enabled the whole structure (or those parts of the structure which were deemed to have some potential to support roosting bats) to be viewed. The surveyors stood facing the buildings and holding Batbox Duet and Wildlife Acoustics SM2+ bat detectors to observe/ record bats emerging from or re-entering the structure. If any bats were recorded exiting the structure, the location from which they emerged/travelled was noted, along with other relevant information including the species (if possible) and numbers, as well as the approximate direction of travel.

1.2.11 Emergence times vary between bat species so the surveys were timed to cover the main activity period associated with all species i.e. 15 mins before to 1.5-2 hours after sunset as indicated in the guidelines.

1.2.12 The details of the emergence/re-entry surveys are provided in Table 9.1-1.

Table A9.1-1: Details of Conditions of Emergence Surveys

Date (2017)	Site	Start Time	End Time	Sunset/ Sunrise	Temp ^{O}C	Cloud Cover %	Precipitation	Wind (Beaufort)
05/07	SH	21:45	23.30	22:00	11	61-80	Nil	2-3
19/07	SS	03:30	05:00	04:54	12	21-40	Nil	1
03/08	SS	21:00	22:45	21:15	16	21-40	Nil	2
04/08	SH	04:00	06:00	05:22	12	41-60	Nil	2-3
28/08	SH	20:00	21:45	20:16	15	61-80	Nil	2-3
29/08	SS	04:45	06:30	06:11	11	0	Nil	1

SH – Sheriffhall House, SS-Summerside

Transect survey

1.2.13 A transect route was designed whereby every habitat type present within the Scheme area was visited, but with a focus on Moderate and High suitability bat habitat (as defined in Collins (2016) (see Figure 9.4). The overall Scheme area was assessed as having Moderate suitability for bat and therefore, as per BCT guidelines (Collins, 2016), the

transect was walked monthly between May and September 2017, inclusive. The transect was walked at dusk, at or during the period shortly after sunset, in suitable weather conditions. Surveys commenced shortly after sunset on most occasions given the open nature of the habitats within the Proposed Scheme Extent and thus the low likelihood that they would be used by several bat species at a time when light levels remained relatively high. The adjusting of start times in this way accords with BCT guidelines. Moreover, all walked activity surveys were completed within three hours of the time of sunset, in accordance with BCT guidelines. Surveyors used Batbox Duet (with Roland R-05 recorders) and Echo Meter EM3 devices recording to an SD card to detect, identify and record bats and their calls.

1.2.14 The transect was walked in differing configurations across the five visits to allow temporal variations in bat activity across the survey area to be recorded.

1.2.15 The surveyors used Batlogger detectors to detect, identify and record bats and their calls.

Table A9.1-2 Transect survey details

Survey Date	Sunrise / sunset	Start Time	End Time	Equipment	Temp. (°C)	Cloud / Sun	Precipitation	Wind	Weather description
31/05/2017	21:47	21:45	00:21	EM3	15	2	0	0	Warm and dry on day of survey and previous day
28/06/2017	22:02	22:13	00:35	EM3	11	n / a	0	1 - 3	
25/07/2017	21:33	22:00	00:45	EM3	18	0-90%	0	0	
08/08/2017	21:09	21:23	23:23	Duet	14	4	0	0	Dry and mild, very calm. Previous days also dry and mild.
11/09/2017	19:41	20:00	22:00	Duet	11	2	0	3	

Static Detector Survey

1.2.16 Wildlife Acoustic SM2+ static bat detectors were placed at three locations within the Scheme area to record general bat activity over an extended period of time during the bat activity season. The three static detector locations were chosen as being representative of the habitats within the Scheme area and which may be important to local bat populations. The locations at which the static detectors were placed are shown on Figure 9.4. Although BCT guidelines recommend monthly monitoring using static detectors in Moderate suitability bat habitat, given the low levels of bat activity encountered within the Proposed Scheme Extent, the detectors were deployed for a minimum of 14 continuous days on three separate occasions between June and August 2017. The level of static monitoring achieved, in combination with the walked activity transects, was sufficient to establish the levels of bat activity occurring within the survey area and the species of bat present.

Analysis of Sound Files

1.2.17 Analysis of all bat calls recorded during the bat roost, bat activity and static detector surveys was carried out using Kaleidoscope Pro and BatSound software. This allowed identification of calls to species level (or family in the case of *Myotis* species). Sounds files were inspected manually where required by an ecologist with competency in sonogram identification.

Constraints

1.2.18 There were no constraints to the surveys. All surveys (aside for obvious reasons from the static detector surveys) were all carried out under suitable weather conditions for observation of bats, and all areas to be surveyed were accessible.

1.3 Results

Bat Roost Suitability

1.3.1 The results of the bat roost suitability inspections are shown in Table A9.1-3 below.

Table A9.1-3 Assessment of Bat Roost Suitability

ID Reference	Structure Name /Tree Species	Description	Grid Reference	Bat Roost Suitability
SH1	Sheriffhall House	Large two story stone farm house of approximately 100 years old. Occupied and in good condition. Roof is slate and lead flashing facing north-west and south-east. Older extension on east side has large gaps under some slates. Lifted flashing/slate on north-west side of main roof. Gaps between western extension and main house, gaps in wooden gable end of this extension and missing pantiles.	NT 32014 67988	High
SH2	Sheriffhall Barn	Stone steading/barn with pitched tile roof in poor condition. Many holes and crevices in walls and holes and missing tiles on roof. Windows are mostly broken or boarded up.	NT 32004 67925	Moderate
SH3	Sheriffhall Farmhouse	Two story stone farm farmhouse with additional height in roof. Building is of approximately 100 years of age, occupied and in good condition. The roof faces north-west and south-east and is constructed of slate with lead flashing. Some gaps are present in the roof tiles and under flashing, particularly on the north facing aspect at the base of the chimney.	NT 32035 67908	High
SH4	Sheriffhall Dovecot	Stone dovecot tower of approximately 100 years of age (it is formed of the stairwell of the demolished 17th century 'House of Sheriffhall'). In good state of repair. The roof is made of slate with lead flashing. Openings for pigeons at top and half-way up are present, but the lower opening is blocked. Some gaps under roof slates.	NT 32050 67922	Moderate
SS1	Summerside White Farmhouse	Single story detached farmhouse. Rendered façade and slate roof in good condition. Potential gaps under slates at base of chimney.	NT 31622 68110	Low
SS2	Summerside Stone Farmhouses	Row of single story stone farmhouses. Some gaps in flashing on south side around velux windows and at the side of old dormer windows. Otherwise tiles and slates appear well sealed.	NT 31622 68089	Moderate
SS3	Summerside House	Large two story farmhouse with various extensions. Gaps around velux window on east side. An extension to the west is missing a slate and has small gaps under other slates and under flashing. Occasional larger gaps under roof slates on north side extension.	NT 31614 68064	High
SS4	Summerside Barn	Large barn of wooden construction with composite sheeting roof. Potential gaps under eves and through open door.	NT 31594 68056	Low
T1	Sycamore	Small amount of deadwood.	NT 30868 67855	Low
T2	Beech	Long wound high up in tree where bough has detached. Gaps under strips of wood.	NT 31791 67643	Moderate

Emergence / re-entry surveys

1.3.2 Table A9.1-4 sets out the detailed results of the emergence/re-entry surveys. The single observation of a bat entering a roost feature is highlighted in bold.

Table A9.1-4 Emergence/ Re-entry Survey Results

Date	Weather	Location		Activity summary	Emergence / re-entry
05/07/17	Dry, light wind. Heavy rain on previous evening.	SH Barn	SH2	Common and soprano pipistrelle. Foraging and commuting north.	N
		SH Farmhouse and Dovecot	SH3 and SH4	Common and soprano pipistrelle foraging around barns and bushes throughout.	N
		SH House	SH1	Soprano pipistrelle commuting along hedge from east to west. Common pipistrelle foraging over house.	N
19/07/17	Dry, warm, still	SS Stone Farmhouses	SS2	Soprano pipistrelle and unknown bat species commuting.	N
		SS House (garden)	SS3	2x common pipistrelles foraging.	N
		SS House	SS3	At least 2 bats of unknown species circling courtyard.	N
		SS White farmhouse	SS1 and SS2	Soprano pipistrelle mainly commuting but some circling car park.	N
03/08/17	Dry and warm	SS House and barn	SS3 and SS4	2x soprano pipistrelle. Commuting west and north west to east and north east and foraging.	N
		SS House (garden)	SS3	No bats	N
04/08/17	Dry and gusty	SH Farmhouse and Dovecot	SH3 and SH4	2x common pipistrelle. Foraging.	N
		SH House	SH1	Common pipistrelle entered south of roof, 6th tile from the right of roof, under ridge flashing at 04:56. 2x soprano pipistrelle foraging around south of house.	Y
28/08/17	Previous day dry but two hours of persistent light rain immediately before survey.	SH Farmhouse and Dovecot	SH3	Unknown pipistrelle species and soprano pipistrelle heard not seen. All faint and brief. Possible barn owl.	N
		SH Barns	SH2	3x common pipistrelle commuting down barn side to north.	N
		SH House	SH1	Several soprano pipistrelle circling trees and roof.	N
29/08/17	Heavy showers previous evening. Dry and mild overnight. Cloud free and very calm during survey.	SS House	SS3	No bats	N
		SS Farmhouses	SS2	Soprano and common pipistrelle mainly commuting up driveway towards bypass.	N
		SS House (garden)	SS3	No bats	N

SH – Sheriffhall, SS – Summerside

Transect survey

1.3.3 Bat activity was low throughout the transect route, with only two species, common and soprano pipistrelle, recorded. Several “hot spots” of concentrated activity were identified. One such “hot spot” was present south of the east arm of the A720, around the Lugton Bog pond and along the woodland edge and hedgerow. Another was present to the north west of the roundabout between the A720 in the west and the A6106 in the north east, where numerous bats were recorded foraging and commuting along field boundaries and along vegetation used for screening the A720.

1.3.4 Activity was less concentrated in the south and east, between the A7 in the south and A6106 in the north east, although multiple bats were recorded using the railway and foraging over farmland.

1.3.5 Activity from both pipistrelle species was spread across the Site, however only 14 recordings were made of common pipistrelle whereas 50 were made of soprano pipistrelle. Three recordings were made of unidentified pipistrelle species and a single record was made of an unidentified bat species.

1.3.6 Transect survey results are shown on Figure 9.4.

Static detector survey

1.3.7 There were technological problems with the SM2 detectors used during this survey. A limited number of nights were successfully recorded, as explained in Chapter 9: Nature Conservation. The limited variety and number of bats agreed with the transects results and is also set out in Chapter 9: Nature Conservation.

Appendix 9.2 – Great Crested Newt Survey Details

1.1 Introduction

1.1.1 This Appendix supports Chapter 4: Nature Conservation. It sets out the methods and results of the great crested newt survey.

1.2 Methodology

Habitat Suitability Indices

1.2.1 Habitat suitability indices (HSI) scores are a measure of pond habitat suitability for great crested newts. In general, ponds with high HSI scores are more likely to support great crested newts than those with low scores. The score is based on the mean of ten suitability indices describing factors known to affect presence of this species, as described in the Amphibian and Reptile Group of the UK (ARG UK) Advice Note 5 (2010). The score is a numerical index between 0 and 1, values close to 0 indicate unsuitable habitat and close to 1 represents optimal habitat. Based on the HSI value ponds can be categorised into poor, below average, average, good and excellent. Please not that as per ARG UK HSI guidance, the HSI score for Lugton Bogs pond was calculated with only 9 indices – the value for pond surface area was not used as it is over 2000 m² (insufficient data for ponds over this size is available).

Presence/ Absence Surveys

Bottle Trapping

Bottle trapping was carried out in accordance with the methods described in English Nature (2001). In summary, two litre plastic drinks bottles cut in two, with the top section inverted and inserted into the bottom section, were secured to the substrate of the pond using bamboo canes. The entrance to the bottles was submerged, with a pocket of air left at the top of each trap.

The bottle traps were placed at approximately 2 m intervals around the entire perimeter of the pond, subject to accessibility and the nature of the substrate (i.e. whether it was possible to securely insert the bamboo canes). They were set in the evening, shortly before sunset, and then checked and removed from the pond early the following morning. In line with JNCC guidance (1998), the traps were checked not more than 12 hours after having been set up.

The total number of bottle traps set per survey visit was noted to ensure the correct number were retrieved. The total number of traps varied per survey but was on average 65 bottles, with a minimum of 59.

Torching

Torching surveys were carried out shortly after sunset following the setting of bottle traps. The surveyors walked once around the periphery of the waterbody at a steady slow pace, using a 100,000 candlepower torch beam shining on to the water to look for great crested newts. Particular attention was paid to marginal vegetation, and those clear areas which could be used by displaying males. Please note the steeply sloping north bank of the pond was not subject to this survey due to health and safety constraints .

Survey conditions for bottle trapping and torching are shown in Table A9.2-1.

Table A9.2-3. Survey Conditions

Date	Bottle Traps Set	Bottle Traps Collected	Torching Time	Temperature during surveys	Wind	Cloud	Precipitation
9-10/05/2017	20:00 – 00:00	07:00 – 08:30	23:00 – 00:30	6 – 12	Light	1/8	None
22-23/05/2017	20:30 – 00:15	06:30 – 08:00	00:15 – 01:30	8 – 15	Moderate	8/8	Heavy shower
12-13/06/2017	21:00– 01:00	06:30 – 08:00	00:00 – 01:30	11 – 15	Moderate	1/8	None
18-19/06/2017	21:00 – 01:00	06:30 – 08:00	01:00 – 02:15	14 – 16	Light	1/8	None

Egg searching

Newts lay single eggs which are protected by folding pliable material, usually the leaves of aquatic plants, around them. Surveyors examined submerged marginal vegetation surrounding the pond for these typical folded leaves and for concealed great crested newt eggs within. The eggs of great crested newt are large (approximately 5 mm long in total), a pale yellow in colour with an oval shaped jelly capsule (Langton *et al*, 2001). These can be distinguished from the eggs of other common newt species (palmate *Lissotriton helveticus* and smooth newt *Lissotriton vulgaris*) because the eggs of these common species (which are indistinguishable from each other) are smaller (approximately 3 mm), grey / brown in colour and round in shape.

Constraints

No torching or egg searching was conducted on 22 May 2017 due to heavy rainfall at the time of survey. However, given the poor suitability of the pond for great crested newts and the lack of any evidence of their presence during the remaining three survey visits, this is not considered to have significantly affected the overall results of the great crested newt survey programme.,

The temperature on all evenings and mornings of survey was above the 5 ^{o}C minimum recommended for great crested newt survey (English Nature, 2001) and other than the single evening of heavy rain, weather conditions were favourable on all dates.

The northern bank of Lugton Bogs Pond was not subject to torching surveys as the steeply sloping bank did not allow for safe passage around the periphery of the pond in this area without entering the edge of the water (doing so would cause disturbance which may have affected survey results and presented further health and safety issues).

The pond beside the Sheriffhall Park and Ride (P&R) was dry during the survey season, therefore no surveys could be undertaken, and it is assumed amphibians including great created newt were absent.

1.3 Survey Results

Habitat Suitability Indices (HSI)

The HSI indices calculated for each pond are detailed in Table A9.2-2 below. The pond at Lugton Bogs was calculated to have poor habitat suitability for support great crested newts. HIS calculation for the P&R pond gives below average habitat suitability, although because it was dry all survey season pond suitability was in reality zero, and it is taken that great crested newt and other amphibians were absent.

Table A9.2-2 Great Crested Newt HSI Scores

Factor	Lugton Bogs pond	SuDS pond (Park and Ride)
UK location	B	B
Surface area (m^2)	3300	2000

Factor	Lugton Bogs pond	SuDS pond (Park and Ride)
Desiccation rate	Never	Frequently
Water quality (estimated)	Moderate	Poor
Shade (% margin)	40	40
Waterfowl presence	Major	Minor
Fish population	Major	Possible
Pond density (no. ponds within 1 km)	0	2
Terrestrial habitat	Good	Good
Macrophyte cover (%)	70	20
HSI score	**0.27 (poor)**	**0.54 (below average)**

The high desiccation rate of the P&R pond is very likely to have influenced its score of 0.58. This is because a high frequency of desiccation would reduce the fish population and thus reduce or remove fish predation effects on amphibians. The frequency at which this pond dries out is not known.

The pond at Lugton Bogs is suspected to be used for the recreational shooting of waterfowl because wooden hides and a decoy duck were present, therefore waterfowl presence has been assessed as high. Waterfowl incidentally recorded at this pond include mute swan and moorhen, but waterfowl were often absent and were therefore assessed as having a minor presence.

Bottle trapping at Lugton Bogs pond confirmed a substantial population of three-spined stickle back, which exert a heavy predatory effect on the younger stages of newts and other amphibians.

There are no ponds within 1 km of Lugton Bogs included in the HSI calculation, since although the dry SuDS pond is located 420 m north-west, it is on the opposite side of the Edinburgh City Bypass, which constitutes a major barrier to amphibian land movement and effectively disconnects the two ponds. One pond is within 1 km of the dry P&R pond – this is an artificial pond which is densely vegetated with ornamental macrophyte species in the grounds of a private hospital.

Terrestrial habitats around both ponds include reasonable terrestrial habitat for amphibians including semi-improved neutral grassland. Beyond this, and between the ponds surveyed and nearby waterbodies, the land use is largely arable farmland and pasture, which are suboptimal terrestrial commuting habitats for amphibian.

Macrophyte plant species in the pond at Lugton Bog Pond comprised abundant broad-leaved pondweed *Potamogeton natans* which covered a large proportion of the surface (up to 70%). Also present submerged in the water, and at least occasional, was Canadian pondweed *Elodea canadensis*. At the P&R pond a small stand of reed canary-grass *Phalaris arundinacea* was recorded but there was no indication of macrophytes, which is to be expected given its dry condition during the survey season.

Presence/ Absence Surveys

No great crested newts, or eggs belonging to great crested newts, were encountered on any of the four survey visits carried out in 2017.

One adult male palmate newt was found in a bottle trap on the east side of Lugton Bogs Pond on the morning of 10 May 2017. Subsequently, two adult male and one adult female palmate newts were found in bottle traps on the east side of the pond (in the same general area as the previous capture) on the morning of 23 May 2017. No other sightings of palmate or smooth newts were made and no eggs belonging to these species were identified during egg searches.

No amphibians were recorded when torching, and no frog or toad spawn was recorded in Lugton Bogs Pond at any time during the field surveys. One common frog was encountered during non-amphibian surveys in peripheral neutral grassland on one occasion.

Three-spined stickleback *Gasterosteus aculeatus* was found in numerous bottle traps on two of the survey visits. Large numbers were present on the morning of 23rd May and, the species was again present but in considerably lower numbers on 13th June. The presence of substantial numbers of stickleback would have exerted a considerable predatory effect on the younger stages of any amphibians attempting to breed in the pond.

1.4 References

Amphibian and Reptile Groups of the United Kingdom (ARG) (2010). ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index. ARGUK

English Nature (2001). Great Crested Newt Mitigation Guidelines. English Nature, Peterborough.

Langton T, Beckett C and Foster J (2001). Great Crested Newt Conservation Handbook. Froglife, Suffolk.