Appendix A11.2: Baseline Data and Detailed Survey Methods

1 Purpose of Appendix

1.1 This appendix provides detailed information on the survey baseline for the ecological features outlined in Chapter 11 (Ecology and Nature Conservation). Detailed methods for bats, breeding birds, wintering birds, great crested newt (GCN) and aquatic surveys are also presented in this appendix. It should be noted that baseline information for badger, otter and Schedule 1 bird species can be found in the Appendix A11.3 (Confidential Ecology Features).

2 Online Data

2.1 National Biodiversity Network (NBN) data has been used (NBN 2018a; NBN 2018b; NBN 2019), where appropriate, to assess the occurrence of ecological features within the 10km study area as indicated within Section 11.2 of Chapter 11 (Ecology and Nature Conservation). The data search of NBN omitted records pre-2008 as 10 years was considered a sufficient time period for records to inform the baseline, with the exception for macroinvertebrates which spanned a 20 year search. All post-2008 records of parti-coloured bat from the UK were included as they are a vagrant species and therefore records of them are limited.

2.2 The use of NBN data is governed by the terms and conditions of the network. The data providers, original recorders (where identified), and the NBN Trust bear no responsibility for the further analysis or interpretation of that material, data and/or information. NBN data providers are presented in Table 1.

Table 1: NBN Data Providers, Recorders and Dataset Licence

Ecological Feature	Data Provider	Recorder(s)	Year	Licence	Number of Records
Daubenton's Bat	The Bat Conservation Trust	Unknown	2008-2016	CC-BY*	38 records
Natterer's Bat	HBRG Vertebrates (not Badger) Dataset	Katy Martin	2010	CC-BY	One record
Parti-coloured Bat	Scottish Natural Heritage	Unknown	2009	OGL**	One record
Parti-coloured Bat	Scottish Natural Heritage	Unknown	2011	OGL	One record
Protonemura meyeri	Scottish river macro-invertebrate records from 2007 collected by SEPA	Unknown	2007	OGL	One record
Planaria torva	River macroinvertebrate data for 2005 and 2006	Unknown	2006	OGL	One record

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3 Bats

Ground-based Assessments

3.1 Ground-based roost assessment data collected at Design Manual for Roads and Bridges (DMRB) Stage 2 were carried forward to inform the DMRB Stage 3 survey requirements and assessment. This dataset was updated following design changes at DMRB Stage 3 and is presented in Tables 2 to 4. Where reference is made to the online section of the proposed scheme, this refers to where the A9 Perth – Inverness Trunk Road will be widened with a proposed lane gain/lane drop arrangement between Raigmore Interchange and Inshes Junction (southbound). Where reference is made to the offline section of the proposed scheme, this refers to where the existing U1058 Caulfield Road North meets the A96 Dualling Inverness to Nairn (including Nairn Bypass) proposed Smithton Junction at its southern roundabout.

3.2 To update the baseline data collected at DMRB Stage 2, detailed ground-based assessments were conducted to assess trees, buildings and structures for roosting potential. Surveys extended to a 50m buffer from the online section of the proposed scheme and extended to a 250m buffer from the offline section of the proposed scheme. These were carried out using binoculars with a close focus, a high-powered torch and an endoscope for directly inspecting cavities for signs of bats. Observations were recorded using geo-referenced notes on iPads with ArcGIS software and photographs were taken. Where observed, bat dropping samples were collected during surveys and sent to Nature Metrics where DNA analysis determined the bat species present.

3.3 Access constraints meant that a small number of buildings were surveyed at a preliminary ecological appraisal level (Collins 2016) whereby their roosting potential was assessed from a distance in combination with its proximity to high-, moderate- and low-quality habitat.

3.4 Bat roost potential for trees, buildings and structures were categorised as negligible, low, moderate or high in accordance with Collins (2016). Results of the ground-based roost assessments are presented in Tables 2 to 4 and Figure 11.4 and informed the requirements for further surveys, specifically hibernation surveys and summer emergence/re-entry surveys on features considered to have potential to support roosting bats. No buildings or structures within the survey area were identified as having hibernation potential and therefore hibernation surveys were not undertaken. No further surveys were undertaken on trees beyond the ground-based assessment.

Table 2: Results of the Building Ground-based Assessments for Summer and Winter Bat Roost Potential

Distance from Proposed Scheme	Building Summer Roost Potential					Building Winter Roost Potential				
	Roost	High	Moderate	Low	Total	Roost	High	Moderate	Low	Total
Full Proposed Scheme										
0 to 0.99m	0	0	0	0	**0**	0	0	0	0	**0**
1 to 30.99m	0	1	0	0	**1**	0	0	0	0	**0**
31 to 50.99m	0	1	1	9	**11**	0	0	0	0	**0**
Offline										
51 to 100.99m	0	0	2	5	**7**	0	0	0	0	**0**
101 to 250.99m	0	3	6	4	**13**	0	0	1	0	**1**
Total	**0**	**5**	**9**	**18**	**32**	**0**	**0**	**1**	**0**	**1**

Table 3: Results of the Structure Ground-based Assessments for Summer and Winter Bat Roost Potential

Distance from Proposed Scheme	Structure Summer Roost Potential					Structure Winter Roost Potential				
	Roost	High	Moderate	Low	Total	Roost	High	Moderate	Low	Total
Full Proposed Scheme										
0 to 0.99m	0	0	0	0	**0**	0	0	0	0	**0**
1 to 30.99m	0	0	0	3	**3**	0	0	0	0	**0**
31 to 50.99m	0	0	1	1	**2**	0	0	0	0	**0**
Offline										
51 to 100.99m	0	0	0	0	**0**	0	0	0	0	**0**
101 to 250.99m	0	0	0	0	**0**	0	0	0	0	**0**
Total	**0**	**0**	**1**	**4**	**5**	**0**	**0**	**0**	**0**	**0**

Table 4: Results of the Tree Ground-based Assessments for Summer Bat Roost Potential

Distance from Proposed Scheme	Roost	High	Moderate	Low	Total
Full Proposed Scheme					
0 to 0.99m	0	2	4	5	**11**
1 to 30.99m	0	14	26	33	**73**
31 to 50.99m	0	4	10	7	**21**

Distance from Proposed Scheme	Roost	High	Moderate	Low	Total
Offline					
51 to 100.99m	0	6	10	18	**34**
101 to 250.99m	0	23	30	44	**97**
Total	**0**	**49**	**80**	**107**	**236**
Under A96 Inverness to Nairn (including Nairn Bypass) Proposed Scheme (extracted from totals above)					
0 to 0.99m	0	0	0	2	**2**
1 to 30.99m	0	4	8	10	**22**
31 to 50.99m	0	2	3	2	**7**
51 to 100.99m	0	1	0	1	**2**
101 to 250.99m	0	0	1	1	**2**
Total	**0**	**7**	**12**	**16**	**35**

Roost Surveys: Building and Structure Summer Emergence and Re-entry Surveys

3.5 Buildings or structures with moderate or high potential within 30m of the proposed scheme were taken forward for further survey between May and August 2018. One high potential building fell into this category. The high potential building (BB19a) was surveyed once, which deviates from the guidance but was considered justified as only low impact works would be undertaken within 30m of the location and it is considered that any roosts within this building will be picked up during further surveys at pre-construction.

3.6 One moderate potential building (BB07) within 100m off the offline section of the proposed scheme also had one dusk emergence and one dawn re-entry survey undertaken between July and August 2018. These surveys were undertaken as the building is the closest property to the offline section of the proposed scheme which will see construction of a new road in currently agricultural habitat.

3.7 No structures with moderate or high potential were present within 30m of the proposed scheme. Low potential buildings and structures within 30m of the proposed scheme were not surveyed as the results were not considered pertinent to this assessment. These will be surveyed prior to construction to inform licensing.

3.8 Surveys were carried out using hand-held full spectrum bat detectors (EchoMeter Touch 2, EchoMeter Touch 2 Pro and Anabat Walkabout) complemented by frequency division bat detectors (BatBox Duet) with Tascam DR-05 linear PCM recorders. Acoustic files were analysed using BatSound 4.2 or AnaLook Insight version 21926.

3.9 No summer roosts were identified during the emergence and re-entry surveys. Results of the surveys are presented in Table 5.

Table 5: Results of the Summer Emergence and Re-entry Surveys on Buildings and Structures

Building ID	Distance from Scheme	Survey Date	Bat Roost Potential	Figure Reference
BB19a	1 to 30.99m	22-05-2018	High	11.4c
BB07	51 to 100.99m	09-07-2018	Moderate	11.4g
		16-08-2018		

Activity Surveys: Crossing Point Surveys

3.10 Crossing point surveys were carried out at any significant habitat feature that would be severed by the proposed scheme and that were likely to be bat crossings. These surveys were undertaken to determine the height and frequency at which bats were crossing the proposed scheme at the potential crossing points. Locations for crossing point surveys were chosen using aerial photography and ground-based assessment surveys undertaken at DMRB Stage 3. Survey methods were adapted from Berthinussen

and Altringham (2015); three surveys, rather than six as proposed in guidance, were undertaken to give an overview of seasonal bat use. In addition, survey timing was increased from 60 minutes, as proposed in the guidance, to 120 minutes as detailed below, to collect data for longer periods during each survey.

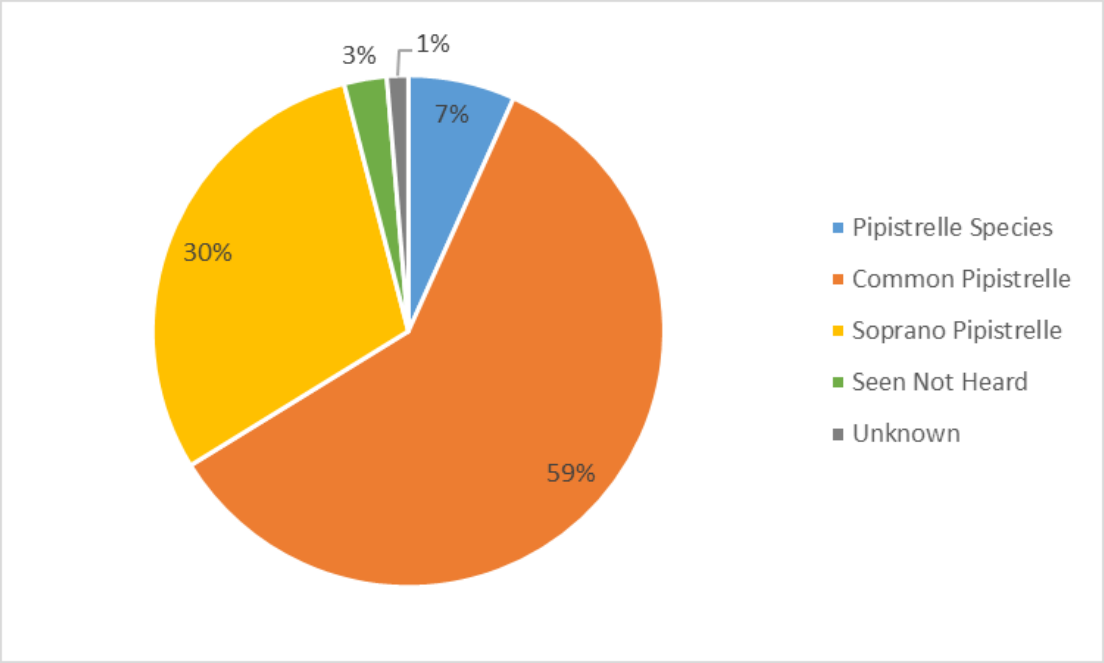
3.11 Ten locations were identified along the offline section of the proposed scheme which are shown in Figure 11.5. The 10 potential crossing points were surveyed on three separate occasions, once in spring (May), once in summer (June/July) and once in late summer (August). The surveys were conducted as a mixture of dusk emergence and dawn re-entry surveys. Surveyors stood at the crossing point from 15 minutes before sunset until 120 minutes after sunset for dusk surveys or 120 minutes before sunrise until 15 minutes after sunrise for dawn surveys. Bat activity and behaviour, including flight height, was recorded using hand-held full spectrum bat detectors (EchoMeter Touch 2, EchoMeter Touch 2 Pro and AnaBat Walkabout) complemented by frequency division bat detectors (BatBox Duet) with Tascam DR-05 linear PCM recorders. Poles 5m in length with markers (glow sticks) every 1m were used so surveyors were able to measure the flight height of bats at each crossing point location.

3.12 Bat activity was recorded in terms of whether the bat crossed the location of the proposed scheme, the height band at which it crossed relative to the ground surface (A: 0 to 2m above ground level; B: 2 to 5m above ground level; and C: more than 5m above ground level), and the direction from which it travelled. It was interpreted that bats flying from 2m to 5m were at risk of collision from Heavy Goods Vehicles (HGVs) and bats flying below 2m were at risk from collision with both cars and HGVs. Surveyors recorded all bats which crossed the proposed scheme. General foraging activity was not recorded, except for noting the first bat of each species and providing a summary of foraging activity levels at the end of the survey. Post-survey sound analysis was undertaken on recorded calls which were not definitively identified in the field; these were analysed using BatSound 4.2 or AnaLook Insight version 21926. A small number (1%) of these calls were unable to be analysed either due to the detector not having recorded the call (if the call was weak) or call quality not being detailed enough to analyse.

3.13 In total 222 bat crossings were recorded; 198 of these were identified to species level (common pipistrelle and soprano pipistrelle); 15 were identified to pipistrelle species level; three were unable to be identified from their calls; and six bats were seen but not heard and therefore could also not be identified. The species composition across all crossing point locations is shown in Chart 1.

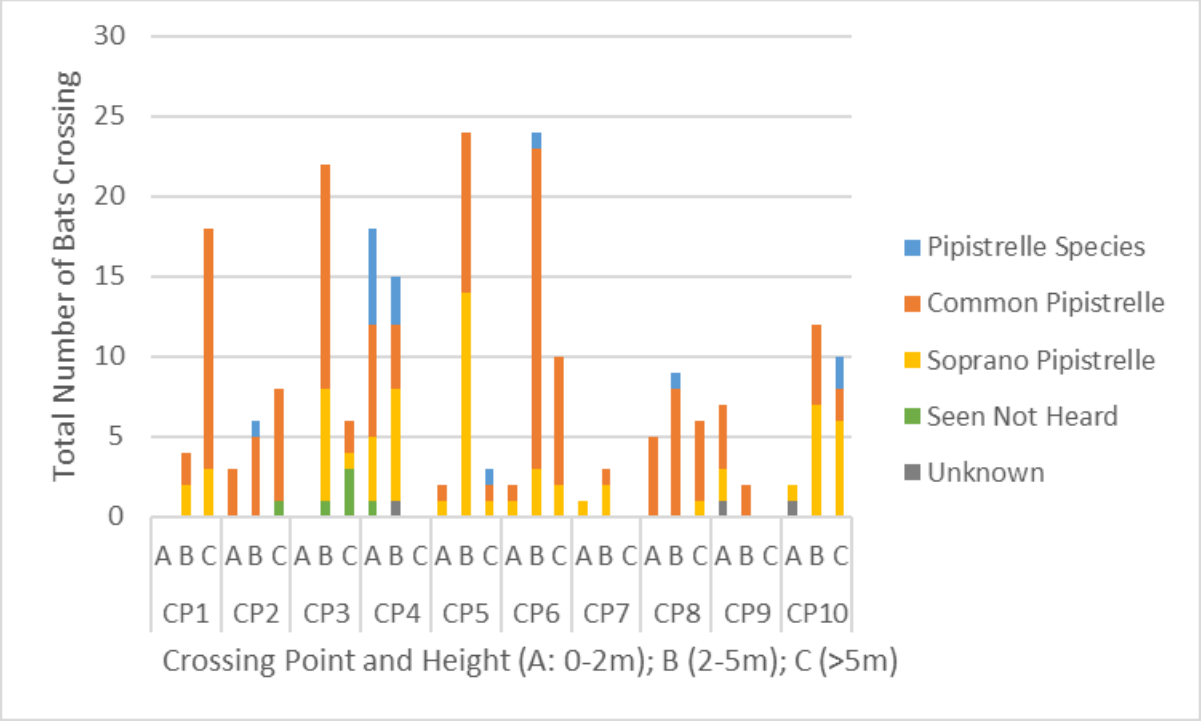
3.14 The highest number of bat crossings recorded was at location CP6, with a total of 36 bats, accounting for 16% of the total bats recorded crossing at all survey locations. Locations CP4, CP5 and CP3 had similar numbers of bat crossings to CP6 (33 crossings, 29 crossing and 28 crossings respectively) and were all located within the northern half of the offline section of the proposed scheme. Here the land was dominated by agricultural use with good connectivity to the surrounding landscape provided by mature treelines, hedgerows and watercourses. The bat crossings at these four crossing points accounted for 57% of the total crossing bats across all crossing point locations.

Chart 1: Species Composition of Bats Crossing the Proposed Scheme



3.15 Of the 222 crossings recorded at all of the crossing points, 18% of bats crossed the location of the proposed scheme at a height of A: 0 to 2m; 55% crossed at a height of B: 2 to 5m; and 27% crossed at a height of more than C: 5m (Graph 1). This equates to 73% of bats crossing at heights which would be at risk of being hit by vehicles on the proposed scheme. Common and soprano pipistrelles crossed the proposed scheme at similar proportions for each height range, with the majority of both species crossing between 2 to 5m (54% of common pipistrelles and 64% of soprano pipistrelles).

Graph 1: Number of Bats Crossing by Species at Different Height at Each Crossing Point Location



3.16 Table 6 presents the percentage of bats crossing at each height range by crossing point location. The majority of bats crossed between 0 to 5m with the exception of crossing point location CP1.

Table 6: Percentage of Bats Crossing by Height at Each Location

Crossing Point	Percentage of Bats Crossing by Height		
	0 to 2m	2 to 5m	>5m
CP1	0	18	82
CP2	18	35	47
CP3	0	79	21
CP4	55	45	0
CP5	7	83	10
CP6	5	67	28
CP7	25	75	0
CP8	25	45	30
CP9	78	22	0
CP10	8	50	42

Activity Surveys: Static Detector Surveys

3.17 To complement crossing point surveys, surveys were undertaken using static detectors (AnaBat Express). Detectors were deployed for a minimum number of seven nights in spring (May), summer (June/July) and late summer (August). Exceptions to this are where there was a possible detector failure at location CP1 during the summer deployment and only three nights of data were recorded and on location CP6 on the late summer deployment where a detector failure meant that no nights were recorded. The potential for this to have increased or decreased the bat passes per night figure was taken into account when interpreting the results and is not considered to represent a constraint.

3.18 The acoustic files were analysed using AnaLook W V4.1 software.

3.19 To assess activity levels at a regional level, the results of the acoustic monitoring were entered into the Ecobat database, an online tool run by the Mammal Society for the standardised, rigorous interpretation of bat activity data. The Ecobat database compiles observations of bat activity (bat passes) at a national level. This is then compared to bat activity recorded at a focal site and contextualised against reference levels such as those recorded in the same region (within 100km) and at the same time of year. The 'reference range' is a stratified dataset by which percentile outputs are generated. The percentiles provide a numerical indicator of the relative importance of a night's worth of bat activity. For example, activity data in the 70th percentile would indicate that the recorded data was in the top 30% of activity for the reference range.

3.20 The percentiles are categorised into five categories:

- Low activity: 0 to 20th percentiles;
- Low to moderate activity: 21st to 40th percentiles;
- Moderate activity: 41st to 60th percentiles;
- Moderate to high activity: 61st to 80th percentiles; and
- High activity: 81st to 100th percentiles.

3.21 Activity recorded from species considered to be vagrant bats rather than resident populations (parti-coloured bats and Leisler's bats) were not included as it is considered that they would not be impacted by the proposed scheme.

3.22 The mean percentiles and categories of the passive monitoring locations are presented in Table 7 and the locations of these features shown on Figure 11.6.

Table 7: Mean Percentiles and Overall Category for Each of the Passive Monitoring Locations

Passive Monitoring Location	Mean percentile (Ecobat)						Category for all Bat Passes
	Myotis	*Pipistrellus sp.*	*Pipistrellus pipistrellus*	*Pipistrellus pygmaeus*	*Plecotus auritus*	Overall for all Bat Passes	
CP1	_	85.4	74.9	51.4	0.0	67.4	Moderate to High
CP2	6.5	62.9	40.9	39.9	6.1	37.5	Low to Moderate
CP3	28.3	95.4	74.3	67.2	0.0	73.0	Moderate to High
CP4	11.8	84.8	68.2	60.5	_	66.3	Moderate to High
CP5	7.0	94.8	80.3	81.3	0.0	78.6	Moderate to High
CP6	8.9	86.1	64.9	47.1	11.7	55.6	Moderate
CP7	_		16.9	4.2	0.0	9.9	Low
CP8	_	89.3	74.9	35.7	0.0	61.4	Moderate to High
CP9	_	68.8	61.8	46.2	_	56.0	Moderate
CP10	0.0	60.9	50.5	25.0	2.6	41.5	Moderate

3.23 To define activity levels on a local level (within the study area), an activity index was created to convert the number of echolocation calls detected into relative activity levels to enable comparison between sites surveyed and allow mitigation to be designed to target the most important impact locations. Activity recorded from species considered to be vagrant bats rather than resident populations (parti-coloured bats and Leisler's bats) were not included in the activity index as it is considered that they would not be impacted by the proposed scheme.

3.24 This valuation was based on:

- overall activity levels (recorded as bat passes per night for all species), as those areas supporting larger numbers of foraging or commuting bats;
- species richness, as those areas supporting a higher number of species of bats would be deemed most valuable; and
- presence of rare or rarer species (as defined in Wray, Wells, Long and Mitchell-Jones 2010).

3.25 To create the activity index, the bat passes per night (BPpN) for all species across the ten survey locations were combined and the interquartile ranges of the data set calculated. These ranges were used to assign High, Moderate or Low activity to each location according to the following:

- High activity: BPpN above the third quartile;
- Moderate activity: BPpN between the first and third quartiles; and
- Low activity: BPpN below the first quartile.

3.26 Species richness was determined by the number of each species recorded at each location. Where species were unknown, or pipistrelle species could not be discerned (but soprano and common pipistrelle both occurred), these records were excluded from the species richness. Categories of species richness were assigned according to the following:

- High species richness: four species or more;
- Moderate species richness: between two and three species; and
- Low species richness: one species.

3.27 An index value for rarity was determined using the same approach, calculating interquartile ranges for BPpN across the locations but only including *Myotis* species and brown long-eared bats (taken as being rare or rarer (Wray, Wells, Long and Mitchell-Jones 2010)). As above (see paragraph 3.20), a value of High, Moderate and Low were assigned to the quartile ranges for these rare or rarer species.

3.28 An overall value of each passive monitoring location was calculated by combining the three indexes and by assigning three points to each result of High, two points for Moderate and one point for Low. The total points for each feature then equated to an overall value as follows:

- High value for total scores of eight and nine;
- Moderate value for total scores of five, six and seven; and
- Low value for scores of three and four.

3.29 The overall index of the passive monitoring locations is presented in Table 8 and the locations of these features are shown on Figure 11.6.

Table 8: Overall Value of the Passive Monitoring Location

Passive Monitoring Location	Index Score	Overall index Value
CP1	5	Moderate
CP2	7	Moderate
CP3	9	High
CP4	7	Moderate
CP5	8	High
CP6	8	High
CP7	4	Low
CP8	6	Moderate
CP9	3	Low
CP10	7	Moderate

3.30 Common pipistrelle and soprano pipistrelle, both species associated with edge habitat (Russ 2012), made up the majority of the total bat activity recorded. Common pipistrelle were recorded the most, making up 58.3% of the calls, with soprano pipistrelle making up 37.6% of the calls recorded. Common and soprano pipistrelles had the highest BPpN at locations CP3 and CP5 which were situated in the northern half of the offline section of the proposed scheme where the land is dominated by agriculture with good connectivity to the surrounding landscape.

3.31 The level of cluttered habitat associated species (*Myotis* species and brown long-eared bat) (Russ 2012), activity was relatively low with brown long-eared bats making up 0.2% of the calls and *Myotis* species bats also making up 0.2% of the calls recorded. Brown long-eared bats had the highest BPpN at locations CP2 and CP6 and *Myotis* species bats at locations CP3 and CP4.Calls were recorded on the static detector at CP2 on the 13th August 2018 that were not made by a species that's native range would include the Inverness area. Detailed sound analysis was undertaken on these calls that determined the bat to be most likely a parti-coloured bat or a Leisler's bat. It was considered that the bat was a likely vagrant rather than a resident population.

4 Breeding Birds

4.1 Breeding bird surveys were undertaken over four consecutive days each month between April and July 2018 (inclusive) within 250m of the proposed scheme. The surveys followed the methods outlined in Bibby, Burgess, Hill and Mustoe (2000).

4.2 Four visits were undertaken each month to cover the peak months of the general breeding bird season (March to August inclusive). Survey transects were routed to maximise coverage of the study area (Figure 11.7). Transects were walked at a constant slow pace by competent surveyors using 8 x 40 binoculars recording all birds detected by sight or sound. During the survey, an experienced ornithologist recorded bird activity on paper maps using standard British Trust for Ornithology (BTO) conventions (BTO 2018).

4.3 All surveys were conducted between sunrise and midday and surveys were only undertaken during favourable weather conditions for bird activity (surveys not undertaken in heavy rain, poor visibility or strong winds).

4.4 Areas considered to be suitable for breeding waders within 500m of the proposed scheme were identified during winter bird surveys and revisited during breeding bird surveys to check for breeding wader presence.

4.5 Locations with potential for barn owl, identified during wintering bird and other protected species surveys, were checked for breeding presence up to 500m from the proposed scheme (Hardey, Crick, Wernham, Riley, Etheridge and Thompson 2013; Shawyer 2011). See Appendix A11.3 (Confidential Ecology Features) for survey locations.

Data Analysis Methods

4.6 Analysis of the breeding bird data was undertaken to identify the population size and distribution within the 250m survey area. Bird data was derived for each species in the following ways:

- number of records: the number of separate occasions an individual, or group, of birds was recorded;
- number of records of breeding evidence**:** the number of separate occasions an individual, or group, was recorded as:
    - nesting;
    - singing;
    - alarming or acting territorially;
    - carrying food or nest material;
    - paired in suitable habitat;
    - recently fledged juvenile(s), and
    - family groups.

Survey Results

Overview

4.7 A total of 2,310 records of 59 species (including two Schedule 1 species: red kite and quail) were recorded within 250m of the proposed scheme across the four breeding bird walkover surveys (Table 9). A total of 679 records of 44 species indicated breeding presence within 250m of the proposed scheme, which includes quail.

4.8 Twelve of the species recorded are red-listed and 17 are amber-listed (including quail) on the Birds of Conservation Concern (Eaton, Aebischer, Brown, Hearn, Lock, Musgrove, Noble, Stroud and Gregory 2015) (Table 9). Twenty species are listed on the Scottish Biodiversity List (SBL) (Scottish Government 2015) and 20 are listed separately on the Inverness and Nairn Local Biodiversity Action Plan (LBAP) (Inverness and Nairn Biodiversity Group 2004) (Table 9). Further details of the three Schedule 1 species recorded (barn owl, quail and red kite) are present in Appendix 11.3 (Confidential Ecology Features).

Table 9: Bird Species Recorded within 250m of the Proposed Scheme. Species are Colour Coded According to their Listing on Birds of Conservation Concern 4 (Red, Amber, Green).

Species	Scottish Biodiversity List	Inverness & Nairn LBAP	Number of records during breeding bird walkover surveys	Breeding evidence within 250m of the proposed scheme
Corn bunting	Yes	Yes	2	Yes
Curlew	Yes	Yes	9	No
Herring gull	Yes	No	69	Yes
House sparrow	Yes	Yes	105	Yes
Lapwing	Yes	Yes	9	Yes
Linnet	Yes	Yes	7	Yes
Mistle thrush	No	No	12	Yes
Skylark	Yes	Yes	48	Yes
Song thrush	Yes	Yes	47	Yes
Starling	Yes	No	133	Yes
Tree sparrow	Yes	Yes	14	Yes
Yellowhammer	Yes	Yes	82	Yes
Black-headed gull	Yes	Yes	12	No
Bullfinch	Yes	Yes	8	Yes
Common gull	No	No	1	No
Dunnock	Yes	No	44	Yes
Great black-backed gull	No	No	1	No
Greylag goose	No	Yes	2	No
House martin	No	Yes	16	No
Kestrel	Yes	No	1	No
Lesser black-backed gull	No	No	1	No
Mallard	No	No	23	Yes
Meadow pipit	No	No	42	Yes
Oystercatcher	No	No	29	Yes
Pink-footed goose	No	Yes	17	No
Quail	No	No	3	Yes
Reed bunting	Yes	Yes	16	Yes
Swift	Yes	Yes	7	No
Willow warbler	No	No	10	Yes
Barn owl	Yes	Yes	1	Yes
Blackbird	No	No	175	Yes
Blackcap	No	No	3	Yes
Blue tit	No	No	162	Yes
Buzzard	No	No	2	Yes

Species	Scottish Biodiversity List	Inverness & Nairn LBAP	Number of records during breeding bird walkover surveys	Breeding evidence within 250m of the proposed scheme
Carrion Crow	No	No	53	Yes
Chaffinch	No	No	163	Yes
Chiffchaff	No	No	15	Yes
Coal tit	No	No	10	Yes
Collared dove	No	No	10	Yes
Cormorant	No	Yes	2	No
Goldfinch	No	No	79	Yes
Great tit	No	No	92	Yes
Greenfinch	No	No	17	Yes
Grey heron	No	No	5	No
Hooded crow	Yes	No	73	Yes
Jackdaw	No	No	69	Yes
Long-tailed tit	No	No	11	Yes
Pheasant	No	No	12	Yes
Pied wagtail	No	No	21	Yes
Raven	No	No	1	No
Red kite	Yes	Yes	4	No
Robin	No	No	155	Yes
Rook	No	No	16	No
Sedge warbler	No	No	48	Yes
Sparrowhawk	No	No	3	Yes
Swallow	No	Yes	44	Yes
Whitethroat	No	No	9	Yes
Woodpigeon	No	No	103	Yes
Wren	No	No	182	Yes

4.9 A further monthly breakdown of records of breeding evidence are detailed in Table 10. The most abundant species recorded as showing evidence of breeding within 250m of the proposed scheme was the wren (peak of 35 individual records). Further species with over 20 individual breeding records across a monthly survey visit include robin (33 records), blackbird (24 records), starling (22 records) and yellowhammer (20 records).

Table10: Bird Species Records of Breeding Evidence Within 250m of the Proposed Scheme*

Species	April 2018	May 2018	June 2018	July 2018
Barn owl	-	-	-	1
Blackbird	13	24	19	5
Blackcap	-	1	-	-
Blue tit	11	17	19	17
Bullfinch	-	2	-	-

Species	April 2018	May 2018	June 2018	July 2018
Buzzard	-	-	-	1
Carrion Crow	1	1	2	1
Chaffinch	13	15	16	4
Chiffchaff	1	3	1	2
Coal tit	-	2	1	1
Collared dove	-	-	1	-
Corn bunting	-	2	-	-
Dunnock	3	3	4	2
Goldfinch	2	5	1	1
Great tit	5	7	5	1
Greenfinch	-	3	1	2
Herring gull	-	1	-	1
Hooded crow	-	4	1	-
House sparrow	-	7	5	3
Jackdaw	1	8	5	-
Lapwing	1	3	2	1
Linnet	-	-	1	-
Long-tailed tit	-	1	2	-
Mallard	2	1	1	-
Meadow pipit	-	2	-	1
Mistle thrush	-	1		-
Oystercatcher	-	2	1	-
Pheasant	2	2	-	-
Pied wagtail	-	-	2	-
Quail	-	-	-	3
Reed bunting	-	5	1	2
Robin	26	33	17	8
Sedge warbler	-	11	11	11
Skylark	15	13	11	2
Song thrush	5	3	4	-
Sparrowhawk	-	-	-	1
Starling	2	22	10	-
Swallow	-	-	-	1
Tree sparrow	-	1	-	-
Whitethroat	-	1	3	1
Willow warbler	-	1	1	1
Woodpigeon	2	4	4	-
Wren	9	16	35	22

Species	April 2018	May 2018	June 2018	July 2018
Yellowhammer	10	11	20	14

* - indicates where birds were not recorded during the survey

4.10 Full species accounts are detailed in Table 11. This includes a breakdown and discussion of breeding activity for each species within 250m of the proposed scheme. Locations of three key farmland breeding birds (lapwing, skylark and yellowhammer), which are all red listed on the Birds of Conservation Concern 4, are presented in Figure 11.8.

Table 11: Breeding Bird Species Accounts

Species	Species Accounts
Barn owl	See Appendix 11.3 (Confidential Ecology Features) and Figure 11.9.
Blackbird	Blackbirds were regularly recorded in all survey months and bred within 250m of the proposed scheme. A peak monthly count of 14 singing males in May provides an indication of a minimum number of blackbird territories.
Blackcap	Three separate records of blackcap were noted in May, including one singing male on 16 May.
Black-headed gull	Black-headed gulls were recorded in all months in flight over the survey area on 12 occasions including a peak count of six on 10 April. Black-headed gull did not breed within 250m of the proposed scheme.
Blue tit	A total of 164 records of blue tit were noted with 64 records indicating breeding presence. Breeding presence across all survey months indicates a minimum of 17 blue tit territories within 250m of the proposed scheme.
Bullfinch	Bullfinches were recorded on four occasions in both May and June, including observations of pairs. The records indicate a minimum of three territories to the south-west of the proposed scheme, nearer urban areas.
Buzzard	Buzzards, including recently fledged juvenile buzzards, were recorded near Stratton Farm, confirming breeding presence. These records match those provided by the Highland Raptor Study Group of a buzzard territory within the woodland west of Stratton Farm.
Carrion Crow	A total of 53 records of carrion crow were noted across the survey months, including five records indicating breeding presence within 250m of the proposed scheme.
Chaffinch	Chaffinches were regularly recorded in all survey months and bred within 250m of the proposed scheme. The records indicate a minimum of 15 chaffinch territories within the survey area.
Chiffchaff	Chiffchaffs were recorded in all four survey months. A peak count of three singing males in May indicated a minimum number of territories within 250m of the proposed scheme.
Coal tit	Coal tits were recorded in small number in all survey months and are considered likely to have bred within 250m of the proposed scheme. Coal tit activity was concentrated in the scrub along the southern boundary of Inverness Retail and Business Park and the woodland west of Stratton Farm.
Collared dove	Collared doves were recorded in small numbers in all survey months. The records indicated a minimum of four breeding territories within 250m of the proposed scheme.
Common gull	One record of a common gull in flight over the survey area in April was noted. Common gull did not breed within 250m of the proposed scheme.
Cormorant	One record of individual cormorants in flight over the survey in both May and June. Cormorant did not breed within 250m of the proposed scheme.

Species	Species Accounts
Corn bunting	Corn bunting were recorded on two separate occasions in May; one observation of a pair, another of an individual carrying an unidentified item (nest material or food). Although both observations suggest breeding presence of corn bunting within 250m of the proposed scheme no further records were made and therefore breeding presence is unconfirmed.
Curlew	Nine records were noted of curlew in flight over the survey area, including a peak count of 30 individuals on 11 April. Curlew did not breed within 250m of the proposed scheme.
Dunnock	Dunnock were recorded regularly in all survey months and bred within 250m of the proposed scheme.
Goldfinch	Goldfinches were recorded regularly in all survey months and bred within 250m of the proposed scheme.
Great black-backed gull	One great black-backed gull was recorded flying over the proposed scheme in June. Great black-backed gull did not breed within 250m of the proposed scheme.
Great tit	A total of 92 records of great tit were noted across the survey months. The records indicate a minimum of 20 breeding territories within the survey area.
Greenfinch	Greenfinch were recorded between May and July (inclusive) within the survey area. The records indicate a minimum of three breeding territories within 250m of the proposed scheme.
Grey heron	Individual grey herons were recorded flying over the survey area on five separate occasions between April and June. It is considered unlikely that grey heron bred within 250m of the proposed scheme.
Greylag goose	Greylag geese were recorded in flight over the survey area on two occasions in June, including a group of 16 individuals on 6 June. Greylag goose did not breed within 250m of the proposed scheme.
Herring gull	Herring gulls were regularly recorded within the survey area and are considered likely to have bred within 250m of the proposed scheme on rooftops in urban areas.
Hooded crow	A total of 73 records of hooded crow, including likely hooded crow x carrion crow hybrids, were noted within the survey area. Hooded crow bred within 250m of the proposed scheme.
House martin	A total of 16 records were noted of house martin over the survey area between May and July (inclusive). Although no direct breeding evidence was recorded it is considered likely that house martins bred within 250m of the proposed scheme.
House sparrow	House sparrows were regularly recorded within the survey area and bred within 250m of the proposed scheme.
Jackdaw	Jackdaws were regularly recorded in the survey area. A minimum of eight nests were located during the May survey visit within 250m of the proposed scheme.
Kestrel	A single kestrel was recorded on 12 April adjacent to the Highland Main Line Railway. It is considered that kestrel did not breed within 250m of the proposed scheme although may breed nearby.
Lapwing	Lapwing were observed in all survey months within the survey area. A minimum of three pairs nested within a single field beneath the footprint of the proposed scheme in May near Caulfield Road. Juveniles were recorded in June (one individual) and July (three individuals) which indicates breeding success in the area (Figure 11.8).
Lesser black-backed gull	A single lesser black-backed gull was observed in July in recently mown grassland. Lesser black-backed gull did not breed within 250m of the proposed scheme.

Species	Species Accounts
Linnet	Linnet were observed on seven occasions between May and July (Inclusive) with a peak flock count of 27 in flight over a barley field next to the Inverness College University of the Highlands and Islands (UHI) in July. All observations were recorded around open ground at the Inverness Campus and fields to the south-east. Although no breeding evidence was recorded a pair were observed in June within suitable habitat and it is considered that breeding was possible within 250m of the proposed scheme.
Long-tailed tit	Long-tailed tit was recorded between April and June (inclusive) within the survey area. The records indicate a minimum of two breeding territories within 250m of the proposed scheme.
Mallard	Mallard were recorded in all survey months within the survey area. Several observations were made of birds in flight around fields adjacent the railway crossing. One pair were observed along Scretan Burn (SWF04). Several mallard were present in the artificial waterbodies at the university. It is considered likely that mallard bred within 250m of the proposed scheme.
Meadow pipit	Meadow pipit were recorded in all survey months with a peak count of 22 birds in April. Two observations were made of male birds singing in May and one juvenile bird was recorded in July. The records indicate a minimum of three breeding territories within 250m of the proposed scheme.
Mistle thrush	Mistle thrush were recorded on seven occasions from April to July (inclusive). The records indicate that a minimum of one breeding territory existed in the area of Stratton wood within 250m of the proposed scheme.
Oystercatcher	A total of 29 records of oystercatcher were noted within the survey area predominantly in flight. It is considered likely that a minimum of two breeding territories were present within 250m of the proposed scheme on rooftops in urban areas and around the Inverness Campus.
Pheasant	Pheasant were recorded in all survey months within the survey area. A minimum of five breeding territories were recorded within 250m of the proposed scheme.
Pied wagtail	Pied wagtail was recorded throughout the survey area during each month. The records indicate a minimum of two breeding territories within 250m of the proposed scheme.
Pink-footed goose	Pink-footed geese were recorded in flight over the survey area on 17 occasions in April including two groups of approximately 800 individuals on 11 April. Approximately 800 individuals landed in a grassland field north of Ashton farm within 250m of the proposed scheme. Pink-footed geese did not breed within 250m of the proposed scheme.
Quail	See Appendix 11.3 (Confidential Ecology Features) and Figure 11.9.
Raven	One record of a raven in flight over the survey area in June was noted. Raven did not breed within 250m of the proposed scheme.
Red kite	See Appendix 11.3 (Confidential Ecology Features) and Figure 11.9.
Reed bunting	Reed bunting were recorded on 16 occasions in all survey months within the survey area. Breeding evidence indicates a minimum of five breeding territories predominantly to the south of the Highland Main Line Railway line within 250m of the proposed scheme.
Robin	A total of 155 records of robin were noted with 84 records indicating breeding presence. Breeding presence across all survey months indicates a minimum of 33 robin territories within 250m of the proposed scheme.
Rook	Rook were recorded on 16 occasions during all survey months predominantly in flight. Rook did not breed within 250m of the proposed scheme however a rookery was present immediately south of the 250m buffer.
Sedge warbler	A total of 48 records of sedge warbler were noted from May to July (inclusive) across the survey area. A peak count of eight singing males in June indicated a minimum number of eight territories within 250m of the proposed scheme.

Species	Species Accounts
Skylark	Skylark were recorded on 48 occasions across the survey area predominantly across open areas of arable and grassland with a peak count of 15 males in song-flight in April. One juvenile was noted in July. The records indicate a minimum of 15 breeding territories within 250m of the proposed scheme. Skylark were the second most abundant red listed farmland bird recorded within the survey area (Figure 11.8).
Song thrush	A total of 47 records of song thrush were noted across the survey months, including five records indicating breeding presence within 250m of the proposed scheme.
Sparrowhawk	Three observations of individual sparrowhawk in flight were made in April and July around areas of scrub within the university grounds. It is considered that sparrowhawk did not breed within 250m of the proposed scheme although may breed nearby.
Starling	Starling were recorded on 133 occasions across all survey months. A peak count of 320 were recorded in flight over the northern half of the survey area. The records indicate a minimum of 22 breeding territories within 250m of the proposed scheme.
Swallow	A total of 44 records were noted of swallow over the survey area between May and July (inclusive). A peak count of nine birds in flight was recorded in July. Three juveniles were also recorded within the Inverness Campus in July. Although only one observation of breeding evidence was made It is considered likely that a number of breeding territories exist around buildings and structures within 250m of the proposed scheme.
Swift	Swift were recorded in flight on seven occasions during June and July. A peak count of four birds in flight were noted in June. It is possible that swift bred within 250m of the proposed scheme.
Tree sparrow	A total of 14 records of tree sparrow were recorded from April to June (inclusive) along treelines and occasionally amongst house sparrow. One pair were recorded within suitable habitat in May therefore a minimum of one breeding territory existed within 250m of the proposed scheme.
Whitethroat	Whitethroat were recorded on nine occasions from May to July (inclusive) at various field boundaries across the survey area. A peak count of two singing males was recorded in June. Records indicate a minimum of three breeding territories within 250m of the proposed scheme.
Willow warbler	A total of 10 records of willow warbler were noted from May to July (inclusive) around Stratton wood, Ashton Farm and east of the Inverness Campus. The records indicate a minimum of two breeding territories within 250m of the proposed scheme predominantly to the east of the survey area.
Woodpigeon	A total of 103 records of woodpigeon were noted within the survey area. Woodpigeon bred within 250m of the proposed scheme.
Wren	Wren were the most abundant breeding bird recorded during the survey and bred within 250m of the proposed scheme. The records indicate a minimum of 35 wren territories within the survey area.
Yellowhammer	Yellowhammer were recorded on 82 occasions throughout the survey area predominantly within arable land, treelines and hedgerows. A peak count of 19 singing males was recorded in June across the survey area. It is considered likely that up to 20 breeding territories are within 250m of the proposed scheme. Yellowhammer were the most abundant red listed farmland bird recorded within the survey area (Figure 11.8).

5 Wintering Birds

Survey Methods Within 500m of the Proposed Scheme

5.1 Wintering bird surveys were undertaken over three consecutive days each month between October 2017 and March 2018 (inclusive) within 500m of the proposed scheme, discounting urban areas (Figure 11.10). The surveys were designed to target wader and wildfowl species although other notable species

were recorded e.g. Schedule 1 species. Mallards were not noted during the surveys due to their common occurrence and widespread distribution. Monthly visits were timed to coincide with the highest spring tide in the month to identify inland high tide roosts of waders and wildfowl within the study area. Surveys were undertaken as dusk and dawn surveys and daylight surveys.

5.2 Dusk and dawn surveys were undertaken to identify the presence of overnight roosting waders and wildfowl (primarily geese) within the study area. The surveys commenced 30 minutes prior to civil dawn (when the geometric centre of the sun is 6° below the horizon in the morning) for 1.5 hours and similarly began 1.5 hours prior to civil dusk, to 30 minutes after (when the geometric centre of the sun is 6° below the horizon in the evening). Two dawn and two dusk surveys were undertaken in each month from three separate Vantage Points (VPs) (Figure 11.10).

5.3 VPs were selected to provide the least obstructed view of the entire study area. As the purpose of the surveys was simply to identify any roosts, during each monthly visit the combination of VPs surveyed was chosen based upon bird behaviour recorded in the preceding day(s). It was, however, considered likely that all waders and wildfowl roosting within the study area would be recorded from the VPs.

5.4 Surveys during daylight hours were also undertaken which combined walkovers and multiple visits to the VP locations which provided good views across the study area. All waders and wildfowl were recorded within the study area throughout the three day visit each month (October to March) focussing on high tide periods to identify inland high tide roosts. Surveys remained flexible allowing surveyors to react to bird activity within the study area.

5.5 Agricultural land use was recorded monthly within the study area. Meteorological data was also recorded on each day of survey.

5.6 The following data were recorded when waders and wildfowl were encountered:

- time of day;
- species;
- number; and
- behaviour (flying, foraging, loafing or roosting).

Survey Methods Within 5km of the Proposed Scheme

5.7 Additional drive-over surveys were undertaken within 5km of the proposed scheme on one day each month between October 2017 and March 2018. The surveys followed methods outlined in Keller, Gallo-Orsi, Patterson and Naef-Daenzer (1997) and Patterson, Lambie, Smith and Smith (2013). The surveys focused on the corridor of lowland coastal mixed agriculture to the north-east of the proposed scheme with the aim of characterising wader and wildfowl presence in the wider area.

5.8 Two surveyors (one driving and one experienced ornithologist) drove along the available roads within the study area while scanning for flocks of foraging waders and wildfowl, primarily geese. Upon observing waders and/or wildfowl, surveyors stopped in a safe location to record flock sizes and behaviour. Surveyors also stopped at locations that provided good views over wide areas of suitable habitat to observe for any birds which were not observed during the drive-over survey.

Data Analysis Methods

5.9 Analysis of the wintering bird data was undertaken to identify the population size and distribution of waders and wildfowl within 500m and 5km study areas. Bird data was derived for each species in the following ways:

- number of observations: the number of separate occasions an individual, or group, of birds was recorded;

- peak count: the highest individual count of birds in a specified area;
- monthly peak count: the highest peak count within a calendar month;
- winter peak count: the highest peak count between October and March (inclusive); and
- winter mean peak count: the mean (average) of all the monthly peak counts between October and March (inclusive).

5.10 The cumulative total of all records of each species is not presented as observations were recorded on multiple occasions during each survey day to identify peak counts.

Survey Results Within 500m of the Proposed Scheme

Overview

5.11 Six wader and wildfowl species were recorded within 500m of the proposed scheme during the winter of 2017/18, however only four wildfowl and wader species were recorded on the ground. Two of the six species were recorded solely flying across the site (common snipe and whooper swan).

5.12 Four species consisting of two wader species (curlew and lapwing) and two wildfowl species (greylag goose and pink-footed goose) were recorded using nine separate fields surrounding Ashton Farm. In total there were 104 observations of these species on the ground within the 500m study area as shown in Table 12 and Figure 11.10.

Table 12: Monthly Peak Counts of Waders and Wildfowl on the Ground within 500m of the Proposed Scheme* and **

Species	October 2017	November 2017	December 2017	January 2018	February 2018	March 2018	Winter Peak Count	Winter Mean Peak Count	Total No. of Fields Used
Waders									
Curlew	65 (14)	19 (3)	21 (10)	34 (5)	-	16 (1)	**65 (33)**	**26**	**6**
Lapwing	-	12 (1)	136 (4)	214 (6)	120 (4)	-	**214 (15)**	**80**	**5**
Wildfowl									
Greylag goose	-	-	14 (7)	12 (5)	25 (7)	-	**25 (19)**	**9**	**3**
Pink-footed goose	-	-	4 (3)	110 (2)	560 (5)	2740 (27)	**2740 (37)**	**569**	**5**

*(n) indicates the number of observations of each species.

** - indicates where birds were not recorded during the survey

5.13 Greylag goose and lapwing roosted overnight within the 500m study area (Figure 11.10), although the majority of observations were of birds foraging and/or loafing during daylight hours. A detailed breakdown of observations is provided within the full species accounts (Section 5.18).

Agricultural Land Use in Relation to Waders and Wildfowl

5.14 Agricultural land use was recorded each month within the nine fields in which waders and wildfowl were recorded. Five fields remained as semi-improved grassland, grazed on rotation by sheep, throughout the survey period. The other four fields, used for arable farming, contained harvested stubble in October 2017. Two of these fields were ploughed by the time of the November survey and the remaining two were ploughed between the February and March surveys as shown in Table 13.

Table 13: Agricultural Land Use of Fields Used by Waders and Wildfowl*

Land Use	October 2017	November 2017	December 2017	January 2018	February 2018	March 2018
Arable Stubble	4	2	2	2	2	-
Ploughed	-	2	2	2	2	4
Semi-improved grassland	5	5	5	5	5	5

* - indicates where birds were not recorded during the survey

5.15 The distribution of waders and wildfowl in relation to land use across the full survey period is shown in Table 14. The peak count of each species within each land use is also included. Semi-improved grassland was used in the highest frequency by both waders and wildfowl within the 500m study area.

Table 14: Number of Wader and Wildfowl Observations in Relation to Land Use over the Full Survey Period* and **

Species	Arable Stubble	Ploughed	Semi-improved Grassland
Waders			
Curlew	13 (65)	-	20 (34)
Lapwing	1 (186)	5 (136)	9 (214)
Wildfowl			
Greylag goose	-	-	19 (25)
Pink-footed goose	-	-	37 (2740)

*(n) indicates the peak count of each species for each land use.

** - indicates where birds were not recorded during the survey

Wader and Wildfowl Flight Lines

5.16 A total of 177 flight lines of six wader and wildfowl species were recorded over the 500m study area as shown in Table 15. Common snipe and whooper swan were recorded in addition to the four species recorded on the ground. Flight line maps provide an indicative layout of where flight activity was observed in the vicinity of the proposed scheme (Figure 11.10). A further breakdown of observations is provided within the full species accounts (Section 5.18).

Table 15: Wader and Wildfowl Flight Lines Within 500m of the Proposed Scheme*

Species	October 2017	November 2017	December 2017	January 2018	February 2018	March 2018	Total No. of Flight Lines
Waders							
Common snipe	-	1	1	-	-	-	**2**
Curlew	5	9	5	2	-	4	**25**
Lapwing	-	1	3	6	4	-	**14**
Wildfowl							
Greylag goose	-	-	3	3	10	2	**18**
Pink-footed goose	4	6	18	20	28	40	**116**
Whooper swan	1	1	-	-	-	-	**2**

* - indicates where birds were not recorded during the survey

Survey Results Within 5km of the Proposed Scheme

5.17 Within 5km, the six species used 32 separate fields for foraging and loafing, and one species (pink-footed goose) was observed on the shore roosting. Oystercatcher and barnacle goose were recorded in addition to the four species observed on the ground within the 500m study area. In total there were

73 observations of these species on the ground within the 5km study area as shown in Table 16 and Figure 11.10.

Table 16: Monthly Peak Counts of Waders and Wildfowl on the Ground within 5km of the Proposed Scheme* and **

Species	October 2017	November 2017	December 2017	January 2018	February 2018	March 2018	Winter Peak Count	Winter Mean Peak Count	Total No. of Fields Used
Waders									
Curlew	100 (1)	30 (3)	-	101 (3)	119 (5)	15 (1)	**119 (13)**	**61**	**10**
Lapwing	330 (1)	-	-	-	24 (1)	-	**330 (2)**	**59**	**1**
Oystercatcher	-	81 (2)	54 (2)	-	22 (2)	12 (2)	**81 (8)**	**28**	**3**
Wildfowl									
Barnacle goose	-	-	-	-	2 (2)	-	**2 (2)**	**<1**	**2**
Greylag goose	-	-	23 (4)	130 (7)	95 (8)	78 (3)	**130 (22)**	**54**	**18**
Pink-footed goose	2000 (2)	192 (2)	2350 (5)	1200 (4)	1800 (11)	1420 (2)	**2350 (26)**	**1494**	**20**

*(n) indicates the number of observations of each species.

** - indicates where birds were not recorded during the survey

Species Accounts

5.18 Overall, eight wader and wildfowl species were recorded within 5km of the proposed scheme. Three (curlew, greylag goose, oystercatcher) were qualifying species of the Inner Moray Firth SPA/Ramsar site, either in their own right or as part of the assemblage qualification. Full species accounts are provided in Table 17.

Table 17: Wader and Wildfowl Species Accounts

Species	Species Accounts
Waders	
Common snipe	Common snipe was recorded in flight on two occasions within the 500m study area. Three snipe in flight, south of the Highlands and Islands Enterprise premises, was noted as an incidental record on 20 November and therefore does not have a flight line associated to it. Another individual was recorded at dusk on 19 December (Figure 11.10), which is considered likely to have flushed from a field boundary north of Ashton Farm.
Curlew[1*]	Curlew were recorded within both the 500m and 5km study areas (Figures 11.10). A total of 33 curlew observations were recorded of individuals using six separate fields within the 500m study area (Figure 11.10). A peak count of 65 individuals was noted on 24 October to the east of Ashton Farm. This represents 5.2% of the Inner Moray Firth SPA qualifying population of curlew (Scottish Natural Heritage (SNH) 2018). Curlew favoured arable stubble fields during the autumn for foraging although after two fields were ploughed in November, curlew were only observed on semi improved grassland. Numbers decreased throughout the survey period and between February and March there was a single observation (16 individuals) on 19 March. As each monthly visit was timed to coincide with spring high tides it is considered likely that the presence of curlew in the area is related to tidal cycles, in addition to availability of foraging habitat. A total of 25 curlew flight lines were recorded (Figure 11.10). The flight activity was primarily birds commuting between the coast at Longman Bay and the fields surrounding Ashton Farm. There were six records of curlew flying further south over Cradlehall beyond the 500m study area. A total of 13 curlew observations were recorded of individuals using 10 separate fields within the 5km study area. A peak count of 119 individuals was recorded on 15 February west of Lower Cullernie, 2.5km north-east of the proposed Scheme (Figure 11.10). An additional 40 curlews were recorded in other fields during the same drive-over survey, indicating a higher peak count of 159 individuals. This represents 12.6% of the Inner Moray Firth SPA qualifying population of curlew (SNH 2018). Curlew were not recorded within the 5km study area during the December visit.
Lapwing	Lapwing were recorded within both the 500m and 5km study areas (Figures 11.10). A total of 15 observations were recorded of individuals using five separate fields within the 500m study area. Lapwing were not recorded in October or March within the 500m study area although numbers were consistent during the winter months in between. A peak count of 214 individuals was noted on 16 January to the north of Ashton Farm. Lapwing favoured ploughed fields in November and December, switching preference to semi-improved grassland from January onwards. As each monthly visit was timed to coincide with spring high tides it is considered likely that the presence of lapwing in the area is related to tidal cycles, in addition to availability of foraging habitat. Lapwing (120 individuals) were confirmed to have roosted overnight in a ploughed field north of Ashton Farm on 19 December within 150m of the proposed scheme (Figure 11.10). It is considered likely that lapwing roosted overnight on numerous occasions near Ashton Farm during their peak presence in December and January. A total of 14 lapwing flight lines were recorded (Figure 11.10). All flight lines encompass activity over Ashton Farm, consistent with lapwing circling fields prior landing in or leaving the area. There were two records of lapwing within the 5km study area. A peak count of 330 individuals was noted on 24 October, with one other observation of 24 individuals in the same field east of Lower Cullernie, on 14 February, 2.8km north-east of the proposed scheme (Figure 11.10).
Oystercatcher[1*]	Oystercatcher was not recorded within the 500m study area. Eight observations were recorded of individuals using three fields within the 5km study area (Figure 11.10). All oystercatcher activity was recorded along the coastal road north of Allanfearn, 1.7km north-east of the proposed scheme. A peak count of 81 individuals was noted immediately east of Allanfearn Waste Water Treatment Works on 21 November. A further 31 individuals were recorded in an adjacent field during the same survey indicating an overall peak count of 112 individuals.
Wildfowl	
Barnacle goose	Barnacle geese were not recorded within the 500m study area. Two barnacle geese were observed together on two occasions in February 2018 in adjacent fields within 5km of the proposed scheme (Figure 11.10). The birds were observed associating with larger flocks of pink-footed and greylag geese east of Lower Cullernie.

Species	Species Accounts
Greylag goose[1]	Greylag geese were recorded within both the 500m and 5km study areas (Figure 11.10). A total of 19 observations were recorded of individuals using three fields within the 500m study area (Figure 11.10). A peak count of 25 individuals was noted on 15 February. This represents 0.9% of the Inner Moray Firth SPA qualifying population of greylag goose (SNH 2018). Greylag geese were only recorded during winter months (December to February (inclusive)) and in fields of semi-improved grassland. A small number of greylag geese roosted overnight within a flooded field corner northwest of Ashton Farmhouse on 19 December (11 individuals) and 15 February (four individuals) within 300m of the proposed Scheme (Figure 11.10). A total of 18 greylag geese flight lines were recorded between December and March (inclusive) (Figure 11.10). The flight activity was primarily of birds commuting between the coast at Longman Bay and the fields surrounding Ashton Farm, or continuing further south past Cradlehall towards Lower Muckovie. Greylag goose was the only species where the peak count, within the 500m study area, was higher for a flight line record than observations of birds on the ground; 50 individuals were recorded flying south over Ashton Farm on 17 January. A total of 22 observations were recorded of individuals using 18 separate fields within the 5km study (Figure 11.10). Most activity was spread out along the Moray Firth coast to the north-east between Allanfearn and Newton of Petty, between 1.5km and 5km from the proposed scheme. A peak count of 130 greylag geese was recorded at Allanfearn on 16 January. This represents 4.9% of the Inner Moray Firth SPA qualifying population of greylag goose (SNH 2018). Two small groups were recorded away from this area in December, south-west of the proposed scheme, at Lower Muckovie (23 individuals) and Woodside of Culloden (10 individuals) (Figure 11.10). Greylag geese regularly associated with pink-footed geese throughout the 5km study area.
Pink-footed goose	Pink-footed goose was the most abundant species recorded within both the 500m and 5km study areas (Figure 11.10). A total of 37 observations were recorded of individuals using five fields within the 500m study area. A peak count of 2,740 individuals was recorded on 20 March. The flock was observed briefly coming in to land at Ashton Farm, prior to the birds moving to a field immediately north of the Highland Main Line Railway at Cradlehall and settling within 200m of the proposed scheme (Figure 11.10). Pink-footed geese were not recorded on the ground within the 500m study area in October or November although numbers rose from December through to a peak in March. Pink-footed geese were only recorded in fields of semi-improved grassland. Pink-footed geese were not observed roosting within the 500m study area. During a dusk VP survey on 19 March a flock of 1,420 individuals was observed at distance landing in Longman Bay and were considered likely to have roosted there overnight. A total of 116 pink-footed geese flight lines were recorded across the full survey period (Figure 11.10). The frequency of flights increased throughout the survey period from four in October to forty in March. Pink-footed geese crossed over the study area in all directions although regular flight paths were birds commuting south, past Cradlehall, towards Lower Muckovie, and returning north to known main roosts within the Moray Firth, such as Munlochy Bay (Patterson, Lambie, Smith and Smith 2013). It was also noted that geese were 'moved on' from fields surrounding Ashton Farm on more than one occasion by activities associated to Ashton Farm. A total of 26 observations were recorded of individuals using 20 separate fields within the 5km study area (Figure 11.10). The distribution of pink-footed geese was very similar to that of greylag geese with most recorded between Allanfearn and Newton of Petty throughout the winter. Pink-footed geese were also regularly recorded at Lower Muckovie, 1km south-east of the proposed scheme. A peak count of 2,350 individuals was recorded at Lower Cullernie on 19 December. This area remained a preferred area for foraging geese throughout the winter. With the exception of November pink-footed goose numbers remained consistent between one and two thousand individuals. It is considered likely that the main flock was not located within the 5km study area during the drive-over survey in November, as opposed to a decrease in the number of geese in the wider area.
Whooper swan	Two whooper swan flight lines were recorded within the 500m study area (Figure 11.10). A peak count of six individuals, three adults and three juveniles, passed over Ashton Farm from west to east on 24 October. Two further individuals flew south-west over Inverness Retail Park on 23 November.

[1] Inner Moray Firth SPA/Ramsar site qualifying interest, *assemblage qualifier only.

6 Water Vole

6.1 Surveys were undertaken in accordance with best practice guidance (Strachan, Moorhouse and Gelling 2011). In October and November 2017 and May 2018, 10 watercourses were surveyed across the study area. No evidence of water vole was recorded within the study area.

6.2 Seven watercourses of the 10 surveyed had some suitable habitat for water vole and are detailed below in Table 18.

Table 18: Watercourses Recorded with Suitable Habitat for Water Vole

Watercourse	Description
Inshes Burn (SWF02)	Inshes Burn (SWF02) runs through a business park, behind a hospital and through recreational ground with the surveyed reach. It is heavily modified, with bank reinforcements and culverted several times. Water was shallow and slow flowing or absent at time of survey. There were localised sections of watercourse with sloping earth banks covered with vegetation.
Beechwood Burn (SWF03)	Watercourse runs between a retail park and field and is fenced on both sides. At the time of survey, it was shallow and slow flowing. Banks were muddy and vegetated – in some areas, vegetation shades the watercourse and there are patches of macrophytes.
Scretan Burn (SWF04)	Watercourse runs through arable land and under railway line. North of the railway line, the watercourse is faster flowing with generally wider and steeper vegetated banks.
Tributary of Scretan Burn (SWF05)	Watercourse runs through arable land and has vegetated banks. Water was shallow and slow flowing or absent at time of survey.
Un-named Drain (SWF07)	Drainage ditch with vegetated banks which is situated between arable land and an access track.
Cairnlaw Burn (SWF08)	Mesh bank protection for first 100m on both banks north of road. Burn meanders between arable and pasture fields. Most sections are fenced on both sides, although fence condition is variable. Banks are generally earth and vegetation covered, with mix of open grassy and shaded overgrown bramble and gorse sections.
Indirect Tributary of Cairnlaw Burn (SWF09)	Section of watercourse surveyed runs though arable land. East bank of ditch is fenced off and heavily vegetated. There is no obvious connection with the drainage ditch which runs along the southern field boundary.

7 Great Crested Newt

7.1 A Habitat Suitability Index (HSI) assessment of ponds was undertaken following the standard approach (Oldham, Keeble, Swan and Jeffcote 2000; Amphibian and Reptile Group (ARG) 2010). Standard HSI methods place the Inverness area in 'Zone C - unsuitable' for Factor 1: Geographic location; however, O'Brien, Miro and Wilkinson (2017) redefined the distinct zones for Factor 1 to accommodate the disjunct, native Inverness population which has likely been isolated in the region for approximately 3000 years. O'Brien, Miro and Wilkinson (2017) proposes that the Inverness area is therefore covered under 'Zone B - marginal.' HSI scores were calculated utilising this updated Factor 1 for the Inverness area. As HSI assessments were conducted outwith the GCN breeding season, Factor 10: Macrophytes was also removed from the calculations.

7.2 A desk-based assessment identified six ponds for investigation (including HSI). Following a site visit, five ponds were subject to HSI and environmental DNA (eDNA) assessment. Pond 4 was dry and was not assessed. Results of the pond assessments are shown in Table 19.

7.3 Four of the five ponds achieved average (0.60 to 0.69) to excellent (>0.80) HSI scores (ARG 2010). One pond (pond 6) was assessed as having poor (<0.50) suitability; however, it was proposed to still subject pond 6 to eDNA assessment as it is located under the footprint of the proposed scheme. However, when eDNA surveys were undertaken, pond 6 was found to be dry and so was not sampled.

7.4 The eDNA analysis results were negative for all ponds, confirming likely absence of great crested newts.

Table 19: Results of Pond Assessments for Great Crested Newt Suitability

Pond ID	Grid Reference	HSI	Notes	eDNA Analysis Results
1	NH 69075 45592	0.68	Average pond suitability	Negative
2	NH 69214 45045	0.64	Average pond suitability	Negative
3	NH 69268 44990	0.63	Average pond suitability	Negative
4	NH 69911 44653	Dry	Dry at time of survey – not suitable	Not sampled
5	NH 70138 44498	0.83	Excellent pond suitability	Negative
6	NH 70405 46110	0.39	Poor pond suitability; to be lost under footprint of proposed scheme	Not sampled

8 Phase 1 Habitat Survey

8.1 A Phase 1 habitat survey was undertaken within the footprint of the proposed scheme and up to 500m from the proposed scheme at A9/A96 Inshes to Smithton DMRB Stage 2 (Jacobs 2017). Targeted surveys were undertaken in 2017 and 2018, to supplement and update the data with any changes in land use and habitat classification since the DMRB Stage 2 Assessment of the proposed scheme.

8.2 Phase 1 habitat surveys followed the Joint Nature Conservation Committee (JNCC) Handbook for Phase 1 habitat survey - A technique for environmental audit (JNCC 2010).

8.3 Target notes collected at DMRB Stage 2 (Jacobs 2017) that fall within the study area for DMRB Stage 3 are provided in Table 20 and on Figure 11.2.

Table 20: Phase 1 Habitat Survey Target Notes

Target Note Reference	Grid Reference	Description
TN4	NH 69686 44031	Broad-leaved woodland of mainly mature beech and sycamore, up to 50cm diameter at chest height, and 30m in height. Ground and scrub flora generally poor. Scots pine also present
TN5	NH 69613 44031	Invasive non-native species. Few-flowered leek present along Beechwood Burn (SWF03) by Simpson's Garden Centre.
TN6	NH 69012 44020	Sustainable Drainage Systems (SuDS) pond with soft-rush and yellow iris, sedge species and water mint. Himalayan balsam (invasive non-native species) was also present.
TN7	NH 68917 44370	Invasive non-native species. Himalayan balsam present along Inshes Burn (SWF02).
TN8	NH 70227 44474	Semi-natural mainly mature beech broad-leaved woodland. Trees are 25 to 30m, with wych elm, rowan, oak, elder and horse chestnut also present. Diameter at chest height generally approximately 60cm but was up to 1m. The ground flora was generally poor or grassy, with a number of unidentified garden escapes, or ground-elder frequent. Two small ponds (c. 8m x 8m) were present towards the south-western corner.
TN9	NH 69735 44846	Invasive non-native species. Few-flowered leek present along Scretan Burn (SWF04).
TN10	NH 69200 45490	Waste ground/scrub/poor semi-improved grassland. An area of rough grassland, scrub, tall ruderal and ephemeral vegetation bounded on three sides by plantation woodland. Fly-tipping was common. Species include sheep's sorrel, soft-rush, broad-leaved dock, cock's-foot, selfheal, creeping thistle, Yorkshire-fog, white clover, flowering currant, lady's-mantle, field wood-rush, wavy hair-grass. Scattered scrub (including gorse) was present in central area.
TN11	NH 69801 45890	Invasive non-native species. Himalayan balsam present along the Scretan Burn (SWF04) adjacent to Inverness Business and Retail Park and spreading along the Inshes Burn (SWF02) through the retail park.
TN12	NH 70329 45987	Semi-natural woodland of mainly oak, birch and willow.

Target Note Reference	Grid Reference	Description
TN13	NH 70447 46090	Riparian habitat along the Cairnlaw Burn (SWF08). Species include alder, ash, beech, hawthorn and oak.
TN14	NH 70490 46134	Invasive non-native species. Himalayan balsam present along Cairnlaw Burn (SWF08) and in woodland and scrub adjacent to the main road. Alder and gorse are abundant, with tall ruderal species, rosebay willowherb and common nettle. Bracken is also present.
TN15	NH 70065 46335	Invasive non-native species. Himalayan balsam present adjacent to the Scretan Burn (SWF04) at Scretan Bridge. Himalayan balsam extends down the water course through the coastal grassland area almost to the edge of the sea.
TN16	NH 70067 46364	Small patch of woodland of wych elm, larch, ash, elder and sycamore. Coastal grassland (saltmarsh) dominated by couch with orache, beech and oak.

9 Invasive Non-native Species

9.1 Invasive non-native species (INNS) were recorded as incidental data during other species/habitat surveys at DMRB Stage 2 and DMRB Stage 3. Records of INNS in the study area are presented in Table 21.

Table 21: INNS Recorded within the Study Area

Species	Grid Reference	Description
Plants		
Few-flowered leek	NH 69686 44031	Present along Beechwood Burn (SWF03).
Few flowered-leek	NH 69735 44846	Present along Scretan Burn (SWF04).
Himalayan balsam	NH 69012 44020	Present around SuDS pond.
Himalayan balsam	NH 68917 44370	Present along Inshes Burn (SWF02).
Himalayan balsam	NH 69801 45890	Present along Scretan Burn (SWF04) and spreading along Inshes Burn (SWF02) through Inverness Business and Retail Park.
Himalayan balsam	NH 70490 46134	Present along Cairnlaw Burn (SWF08) and in woodland adjacent to the main road.
Himalayan balsam	NH 70065 46335	Present adjacent to Scretan Burn (SWF04) at Scretan Bridge.
Himalayan balsam	NH 70394 46075	Present along Cairnlaw Burn (SWF08)
Animals		
American mink	NH 69899 46046	Recorded on Scretan Burn (SWF04).

10 Aquatic Species

Aquatic Habitat

10.1 Watercourses were classified as being of high, medium or low ecological value, using the criteria in Table 22 which were derived based on professional judgement.

Table 22: Example of High, Medium or Low Ecological Habitat Value Criteria

Ecological Value	Criteria
High	Permanent watercourse with variable flow types and heterogeneous habitat. In-stream and bankside cover for fish. No signs of pollution (e.g. sewage sludge, excess algae growth, ochre coloured water/sediment). High potential to support species of conservation interest. No obvious habitat modifications. No barriers to migration.
Medium	Two or more flow types. Heterogeneous habitat. Some in-stream and/or bankside fish cover noted. Potential to support species of conservation interest. Some habitat modifications. Barriers to migration may be present. Low Reach dominated by a single flow type. Homogenous habitat. No in-stream or bankside cover. Pollution may be present.

Ecological Value	Criteria
Low	Reach dominated by a single flow type. Homogenous habitat. No in-stream or bankside cover. Pollution may be present. Low potential to support species of conservation interest. Heavily modified. Barriers to migration are likely to be present.

10.2 At DMRB Stage 2 (Jacobs 2017), Cairnlaw Burn (SWF08) and Scretan Burn (SWF04) were assessed as being of 'medium' ecological value, with supporting habitat for aquatic species (Table 23). The remaining watercourses were assessed as having little supporting habitat for aquatic species and were classified as having low ecological value. Site survey data obtained during DMRB Stage 2 assessment (Jacobs 2017) identified that Cairnlaw Burn (SWF08) is the only watercourse within the study area thought to both allow the upstream passage of migratory fish and contain suitable habitat to support fish species of conservation interest. Fish surveys undertaken to inform the DMRB Stage 3 Environmental Statement for the A96 Dualling Inverness to Nairn (including Nairn Bypass) (Jacobs 2016) recorded brown trout, European eel and three-spined stickleback in Cairnlaw Burn (SWF08).

Table 23: Description of Aquatic Habitat Based on DMRB Stage 2 Assessment

Location	Habitat description
Scretan Burn (SWF04)	Watercourse has been straightened and deepened in sections. Some tree cover, undercutting and natural features observed. Supporting habitat for trout, adult lamprey, European eel and macroinvertebrates and macrophytes present. A barrier to migration was noted at NH 69731 45024, preventing the upstream migration of fish species of conservation interest.
Cairnlaw Burn (SWF08)	The lower part of the reach is more natural, with wooded banks and some undercutting. The upper reach is a drainage ditch that has been straightened and over-deepend. Multiple habitat types and heterogeneous flows (a mix of run, glide and pool sections) were observed. Supporting habitat for macroinvertebrates and juvenile lamprey was noted.

Macroinvertebrates

Methods and Analysis

10.3 A three-minute kick-sample (using a standard Freshwater Biological Association sampling net) and one-minute hand search were undertaken at each survey location, following the Water Framework Directive (WFD) UK Technical Advisory Group (WFD-UKTAG) protocol for sampling macroinvertebrates (Environment Agency 2012). Recovered invertebrate samples were preserved in 70% Industrial Methylated Spirit (IMS) for transportation. Water chemistry parameters, such as temperature, dissolved oxygen, pH, salinity and specific conductivity were recorded in the field using a YSI handheld multi-parameter instrument, which was calibrated at the start and completion of each survey.

10.4 The aquatic macroinvertebrate surveys were conducted between 10 and 12 October 2017 and on 26 April 2018. This approach ensured that seasonal variations in abundance and invertebrate life stages are accounted for, to provide a representative sample of the local macroinvertebrate community.

10.5 All sites were sampled in both seasons except Cairnlaw Burn (SWF08), which could not be accessed in April due to safety concerns over large equipment operating in the vicinity of the sampling point.

10.6 Sampled macroinvertebrate specimens were identified in the laboratory using WFD compliant procedures (Environment Agency 2008). The following macroinvertebrate metrics were calculated for each site: WFD classification; Whalley, Hawkes, Paisley and Trigg (WHPT) score, Number of Scoring Taxa (NTAXA) and Average Score Per Taxon (ASPT); Lotic Invertebrate Index for Flow Evaluation (LIFE); Proportion of Sediment-Sensitive Invertebrates (PSI); and Community Conservation Index (CCI). Descriptions of these metrics are given below.

WFD Classification

10.7 An ecological status class of High, Good, Moderate, Poor or Bad is calculated for the macroinvertebrate biological quality element in surface waters using the WFD-compliant River Invertebrate Classification

Tool (RICT) (WFD-UKTAG 2014). Environmental characteristics recorded during the field survey, macroinvertebrate metric data and other site data including water chemistry, distance to source and altitude are used to assign each site to a class (WFD-UKTAG 2014). The observed macroinvertebrate community is compared to that expected from a similar watercourse in reference condition and the variance between the observed and expected determines the ecological status.

WHPT Metrics

10.8 RICT was used to calculate macroinvertebrate metrics using the WHPT method (WFD-UKTAG 2014). The WHPT metric assesses macroinvertebrates in relation to general degradation, including organic pollution, under the WFD. It is abundance-weighted and scores are considered representative of the general pollution tolerance of a macroinvertebrate family. The metrics WHPT score, WHPT ASPT (measure of macro-invertebrate tolerance to organic pollution) and WHPT NTAXA (measure of macro-invertebrate diversity) were used to classify the site.

LIFE

10.9 Freshwater macroinvertebrates have specific requirements for flow conditions and can be used to determine not only predominant flow types (Extence, Balbi and Chadd 1999) but also changes in flow character. The LIFE metric uses abundance data to assign a flow preference score to macroinvertebrate species present in a sample and an overall score for the site can be interpreted as an abundance-weighted ASPT metric. The species-level LIFE score is also calculated in RICT as is a family-level Observed/Expected (O/E) ratio (observed/expected at reference sites) for the sample. A LIFE O/E score of 0.93 or greater suggests that a site is not subject to flow-related stress (Clarke, Armitage, Hornby, Scarlett and Davy-Bowker 2003).

PSI

10.10 The PSI metric aims to act as a proxy for the quantity of fine sediment at a site (Extence, Chadd, England, Dunbar, Wood and Taylor 2011). Macroinvertebrate species are assigned a fine sediment sensitivity rating that ranges from highly insensitive to highly sensitive to fine sediment. The PSI score is calculated as the percentage of sensitive taxa in the sample (as shown in Table 24).

Table 24: Interpretation of PSI Scores

PSI Score	Description
81 to 100	Minimally sedimented/unsedimented
61 to 80	Slightly sedimented
41 to 60	Moderately sedimented
21 to 40	Sedimented
0 to 20	Heavily sedimented

CCI

10.11 The CCI metric represents the national rarity and diversity of species identified within a site and designates a conservation value to the sampled community (Chadd and Extence 2004). A conservation score (CS) based upon each species' national rarity is applied to each species. The CCI is calculated from the sum of the CS divided by the number of contributing species to obtain the mean value. This is then multiplied by the community score (CoS), derived either from the rarest taxon present or the Biological Monitoring Working Party (BMWP) score. The BMWP score is obtained by assigning a value to a macroinvertebrate family based on its relative tolerance to organic pollution and summing the total scores of all macroinvertebrate families found in that location. CCI scores are assigned into conservation classes, which are described in detail in Table 25. CCI scores and classes can be adjusted to take into account local conditions. For example, a species may be nationally scarce but relatively common in a particular location, and vice versa.

Table 25: CCI Score Classifications (Chadd and Extence 2004)

Conservation Class	Score	Description
Low	≤ 5.0	Sites supporting only common species and/or low taxon richness.
Moderate	>5.0 to 10.0	Sites supporting at least one species with limited distribution and/or moderate taxon richness.
Fairly High	>10.0 to 15.0	Site supporting at least one uncommon species or several of limited distribution and/or high taxon richness.
High	>15.0 to 20.0	Site supporting several uncommon species, one of which may be nationally rare and/or high taxon richness.
Very High	>20.0	Site supporting several rare species and/or very high taxon richness.

Metrics Limitations

10.12 The metrics calculated by RICT are not appropriate for artificial water bodies, non-flowing or ephemeral water bodies (such as ditches) and are limited in their use for sites located within 2.5km of their source. The use of WFD assessment tools is restricted in headwater sites as RICT is not suitable for watercourses that are dry for some part of the year (EU STAR 2008) and predictions are less accurate in headwaters (defined as within 2.5km from the source) due to the lack of reference sites for comparison (Furse 2000). The Scretan Burn South (SWF04) site is within 2.5km of the headwaters. In earlier versions of RICT, headwater sites were under representative, however, RICT currently incorporates River InVertebrate Prediction and Classification System (RIVPACS) IV predictive models and the predecessor developments from RIVPACS III (EU Star 2008). These developments include the incorporation of more small stream sites (Cox, Wright, Furse and Moss 1997). As such, RICT has been used on those flowing, perennial watercourses within 2.5km of the headwaters, taking into account RICT suitability codes as described below.

10.13 RICT sets minimum and maximum validation values and warning values for environmental and physical variables entered. The minimum validation values that result in rejection is 0.0km for distance to source with warnings for distance to source values set at 0.1km (WFD-UKTAG 2008). Headwater sites can be classified provided that they are stream habitats (rather than online ponds) which are not considered to be ephemeral. In addition to this, suitability codes provided by RICT will be considered which denote the likelihood of being within the parameters of the end group set. All sites within this study meet these criteria and have been classified using RICT.

Survey Results

10.14 No consultee data for DMRB Stage 3 have been received to date.

10.15 The results of the RICT analysis indicated that three of the sites (Cairnlaw Burn (SWF08), Inshes Burn (SWF02) and Scretan Burn North (SWF04)) supported macroinvertebrate communities yielding a WFD classification of Good, with Scretan Burn South (SWF04) classified as Moderate for macroinvertebrates (Table 26). Cairnlaw Burn (SWF08) is the only watercourse to receive a SEPA WFD classification and was determined to be of Good status for macroinvertebrates during the 2017 round of sampling. This classification is directly comparable to the results obtained in the Stage 3 DMRB aquatic macroinvertebrate surveys. Cairnlaw Burn (SWF08) was given an overall WFD classification of Moderate.

10.16 The WHPT scores, WHPT ASPT and WHPT NTAXA values obtained for all locations were close to mid-range, suggesting moderate to very good diversity in all locations. The Cairnlaw Burn (SWF08) had the lowest overall values, suggesting that the burn is subject to higher levels of pollution and is supporting a lower overall biodiversity of the macroinvertebrate community than the other locations surveyed. The very good WHPT ASPT values obtained for Inshes Burn (SWF02) and Scretan Burn North (SWF04) in the spring, and both Scretan Burn South (SWF04) samples suggests that these watercourses are not impacted by a significant level of organic pollution.

10.17 Species-level LIFE scores calculated from the macroinvertebrate communities recovered from all four locations were indicative of moderately flowing watercourses. The high LIFE O/E scores observed at Scretan Burn North and South (SWF04) in spring suggest that these watercourses are not subject to flow-related stress. The Cairnlaw Burn (SWF08) and Inshes Burn (SWF02) are likely exposed to periods of low flow.

10.18 All watercourses surveyed were exposed to some degree of sedimentation. Values varied between watercourses, with sites ranging from slightly sedimented (Scretan Burn North and South (SWF04)) to moderately sedimented (Cairnlaw Burn (SWF08) and Inshes Burn (SWF02)), based on calculated PSI Scores. The lowest PSI scores were observed in Cairnlaw Burn (SWF08) and Inshes Burn (SWF02), which were also the sites exposed to low flow conditions. Increased sedimentation is likely to occur in slow-flowing watercourses, particularly if there are localised areas of erosion. Field notes taken during the October 2017 site visit to Cairnlaw Burn (SWF08) indicated eroding banks in close proximity to the survey site.

10.19 There was a high degree of variance in the conservation value of the macroinvertebrate communities at each survey location. The samples obtained from Scretan Burn South (SWF04) were of high conservation value in spring and moderate conservation value in Autumn. Scretan Burn North (SWF04) was classified as fairly high in April and moderate in October. The macroinvertebrate community of Inshes Burn (SWF02) was found to be of moderate conservation value in both survey seasons, and the Cairnlaw Burn (SWF08) was of low conservation value when surveyed in October 2017. The stonefly species *Nemoura erratica*, recovered from Inshes Burn (SWF02) (autumn) and Scretan Burn South (SWF04) (spring) is considered a locally important species within the macroinvertebrate community. The flatworm species *Planaria torva* (recorded in Inshes Burn (SWF02)), stonefly species *Protonemura meyeri* (recorded in Scretan Burn North and South (SWF04)) and the cased caddisfly *Potamophylax rotundipennis* (sampled from Scretan Burn South (SWF04)) are all regionally notable species. Conservation categories applied to specific macroinvertebrate species reflect their relative regional importance but are not measured on the same scale as the overall evaluation classifications applied in this EIAR. *Planaria torva* and *P. meyeri* are well distributed and relatively common in Scotland, whereas published records of *N. erratica* and *P. rotundipennis* are scarcer (NBN 2018a). See Figure 11.13 for further detail.

Table 26: Metrics Calculated for Macroinvertebrate Surveys

Site	Month	Overall WFD Classification	WHPT Score	WHPT ASPT	WHPT NTAXA	LIFE (O/E)	LIFE Score	PSI Score	CCI Score	CCI Species of Conservation Interest
Cairnlaw Burn (SWF08)	Oct	Good	78.4	4.90	16	0.86	8.00	60	4.2	n/a
Inshes Burn (SWF02)	Apr	Good	158.8	6.11	26	0.92	7.67	59.5	9.21	*Planaria torva*
	Oct		132.4	5.76	23	0.88	7.69	53.33	10	*Planaria torva* *Nemoura erratica*
Scretan Burn North (SWF04)	Apr	Good	198.4	6.84	29	0.96	8.35	75.41	12.09	n/a
	Oct		169.7	5.85	29	0.96	8.08	65.52	9.76	*Protonemura meyeri*
Scretan Burn South (SWF04)	Apr	Moderate	197.2	6.57	30	0.94	8.34	70.83	16.33	*Nemoura erratica* *Potamophylax rotundipennis* *Protonemura meyeri*
	Oct		204	6.38	32	0.89	8.55	69.50	9.58	n/a

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