

APPENDIX 7.1

Four Season Bat Survey – Winter & Spring Surveys

1. INTRODUCTION

Bat Eco Services was commissioned by *EirEco Environmental Consultants* to carry out the Winter and Spring bat fauna assessment element of the Four Season Bat Survey for the proposed Foynes to Limerick Road (including Adare Bypass). Summer and Autumn Surveys were completed by Aardwolf Wildlife Surveys. The results of these former surveys will be included in this report.

The approach detailed in the National Roads Authority's *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* (National Roads Authority 2006a) and *Guidelines for the Treatment of Bats during the Construction of National Road Schemes* (National Roads Authority 2006b) is being followed. These guidelines recommend that the potential impacts of a proposed road development on bats are assessed in depth and over four seasons once the preferred route is chosen, in order to take into consideration, the affect the road will have on the nightly and seasonal movements of these animals.

This report will address Four Season Bat Survey of the proposed Foynes to Limerick Road. These survey results, along with a desktop study, will be used to identify the principal foraging areas and commuting routes in vicinity of the proposed road development and provide additional information to that already collated from previous bat surveys for the proposed development.

The proposed Foynes to Limerick Road (including Adare Bypass) extends from the port at Foynes on the River Shannon estuary for c. 2km in a south-easterly direction to skirt to the south of the Churchtown estuary. It then swings to the east for a distance of c. 5km to the Ballyclogh Junction (Section A), where a spur will extend north-east to link with the existing N69 on the western side of Askeaton (Section B). From the Ballyclogh Junction the mainline travels in a generally south-easterly direction for just over 9km to the Rathkeale Junction located c. 1km north of the town (Section C).

From the Rathkeale Junction the road development will provide a new motorway replacement for the N21 (Section D) between Rathkeale and Attyflin (east of Adare). To the east of the Rathkeale junction the proposed motorway trends in a north-easterly direction to the north of the existing N21 to pass the village of Croagh where a further junction links south to the N21, and then on to pass north of Adare where the proposed road development will cross the River Maigue, which is within the Lower River Shannon SAC. The junction to Adare is located on the east of the Maigue crossing, while the mainline continues east to join with the existing N21 dual carriageway immediately west of the M20 Motorway junction at Attyflin.

The topography of the area is undulating, with gently rolling hills. Land use throughout the study area is agricultural, mainly consisting of improved grassland pasture and hay meadows. The surrounding land is also mainly agricultural, with areas of mature broadleaved woodland such as those within the Adare Woodlands pNHA. The proposed road development crosses a number of rivers and the railway at numerous locations along its route.

2. METHODOLOGY

2.1 Guidance Documents

This report is informed by the following documents:

- Kelleher & Marnell (2006). *Irish Wildlife Manual No. 25: Bat Mitigation Guidelines for Ireland*. Dublin, Ireland: National Parks and Wildlife Service; Department of Environment, Heritage and Local Government
- McAney (2006). *Irish Wildlife Manual No. 20: A conservation plan for Irish vesper bats*. Dublin, Ireland: National Parks and Wildlife Service; Department of Environment, Heritage and Local Government
- National Roads Authority (2006). *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes*
- Lundy *et al.* (2011). *Landscape conservation for Irish bats and species specific roosting characteristics*
- Hundt (2012). *Bat Surveys: Best Practice Guidelines (2nd edition)*. London: Bat Conservation Trust
- Collins (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition)*. London: Bat Conservation Trust
- Department of Culture, Heritage and the Gaeltacht (2017). *National Biodiversity Action Plan*
- National Park and Wildlife Service (2019). *The Status of EU Protected Habitats and Species in Ireland 2019*

2.2 Relevant Legislation & Bat Species Status

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 and 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat (*Rhinolophus hipposideros*) is further listed under Annex II. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Also, under existing legislation, the destruction, alteration or evacuation of a known bat roost is a notifiable action and a derogation licence for such actions must be obtained from the *National Parks and Wildlife Service* (NPWS) before works can commence. Any works interfering with bats, and especially their roosts, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997 and Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (which transposed the EU Habitats Directive into Irish law), issued by NPWS. The details with regards to appropriate assessments, the strict parameters within which derogation licences may be issued and the procedures by which and the order in relation to the planning and development regulations such licences should be obtained, are set out in Circular Letter NPWS 2/07, *Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 -*

strict protection of certain species/applications for derogation licences, issued on behalf of the Minister of the Environment, Heritage and Local Government on the 16th of May 2007.

There are eleven recorded bat species in Ireland, nine of which are considered resident. Eight resident bat species and one of the vagrant bat species are 'vesper bats', all of which have a tragus (cartilaginous structure inside the pinna of the ear). Vesper bats are distributed throughout the island. Nathusius' pipistrelle (*Pipistrellus nathusii*) is a recent addition, while the Brandt's bat (*Myotis brandti*) has only been recorded in Ireland once to date (only record confirmed by DNA testing, all other records have not been genetically confirmed). The ninth resident species is the lesser horseshoe bat (*Rhinolophus hipposideros*), which belongs to the family Rhinolophidae and has a complex 'leaf nose' on the face, distinguishing it from the vesper bats. This species' current distribution is confined to the western seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork. The eleventh bat species, the greater horseshoe bat (*Rhinolophus ferrumequinum*), was recorded in Ireland for the first time in February 2013 (in Co. Wexford), and is therefore considered to be a vagrant species.

The following species list, therefore, identifies the range of bat species (resident and vagrant) whose presence has been confirmed in Ireland (please refer to Section 4.3 for more information on individual species):

- Common pipistrelle *Pipistrellus pipistrellus*;
- Soprano pipistrelle *Pipistrellus pygmaeus*;
- Nathusius' pipistrelle *Pipistrellus nathusii*;
- Leisler's bat *Nyctalus leisleri*;
- Brown long-eared bat *Plecotus auritus*;
- Natterer's bat *Myotis nattereri*;
- Whiskered bat *Myotis mystacinus*;
- Daubenton's bat *Myotis daubentonii*;
- Lesser horseshoe bat *Rhinolophus hipposideros*;
- Brandt's bat *Myotis brandtii* (Vagrant);
- Greater horseshoe bat *Rhinolophus ferrumequinum* (Vagrant).

According to the Bat Conservation Ireland databases, all nine resident bat species have been recorded in Co. Limerick. The current conservation status of the known bat species occurring in Ireland is given in Table 1, below.

Table 1 Conservation status of the Irish bat fauna
'LC' = Least Concern; 'NT' = Near Threatened; 'DD' = Data Deficient

Common Name	Scientific Name	Irish Status	European Status	Global Status
Resident Bat Species ^				
Daubenton's bat	<i>Myotis daubentonii</i>	LC	LC	LC
Whiskered bat	<i>Myotis mystacinus</i>	LC	LC	LC
Natterer's bat	<i>Myotis nattereri</i>	LC	LC	LC
Leisler's bat	<i>Nyctalus leisleri</i>	NT	LC	LC
Nathusius' pipistrelle	<i>Pipistrellus nathusii</i>	LC	LC	LC
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	LC	LC	LC
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	LC	LC	LC
Brown long-eared bat	<i>Plecotus auritus</i>	LC	LC	LC
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	LC	NT	LC
Possible Vagrants ^				
Brandt's bat	<i>Myotis brandtii</i>	DD	LC	LC
Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>	DD	NT	NT

* Ireland Red List No. 3: Terrestrial Mammals

^ Roche *et al.*, 2014

The lesser horseshoe bat (LHB) is mainly found in Counties on Ireland's western seaboard – Mayo, Galway, Clare, Limerick, Kerry and Cork – although its strongholds are found in Kerry / west Cork and Clare. The LHB is Ireland's only Annex II-listed bat species (as per EU Habitats Directive [92/43/EU]). This means that its populations require special protection measures and designation of Special Areas of Conservation (SACs) within the Natura 2000 network. These designations are usually roost or hibernacula-centred and focus on large roosting sites for the species, usually with >50 individuals in winter or >100 individuals in summer. As a consequence, a roost monitoring scheme is operated by NPWS and managed by Bat Conservation Ireland (BCIreland). BCIreland carried out analysis of the LHB database in 2012, and concerns were expressed about the state of deterioration of many of its roosting sites (McAney, 2014; Roche *et al.*, 2015) as well as the finding that there are genetically distinct clusters within the Irish population (Dool *et al.*, 2013) that are likely to have arisen due to landscape connectivity constraints.

In Roche *et al.* (2015), the status of the roosting resource of the LHB was closely examined and the results highlighted a number of locations in Ireland where clusters of roosts or hibernacula appear to have declined, including in parts of Co. Limerick. Figures 1 and 2, below, are taken from the most recent monitoring report from BCIreland (Aughney *et al.*, 2018) and illustrate the changes in winter and summer roosts in Co. Limerick.

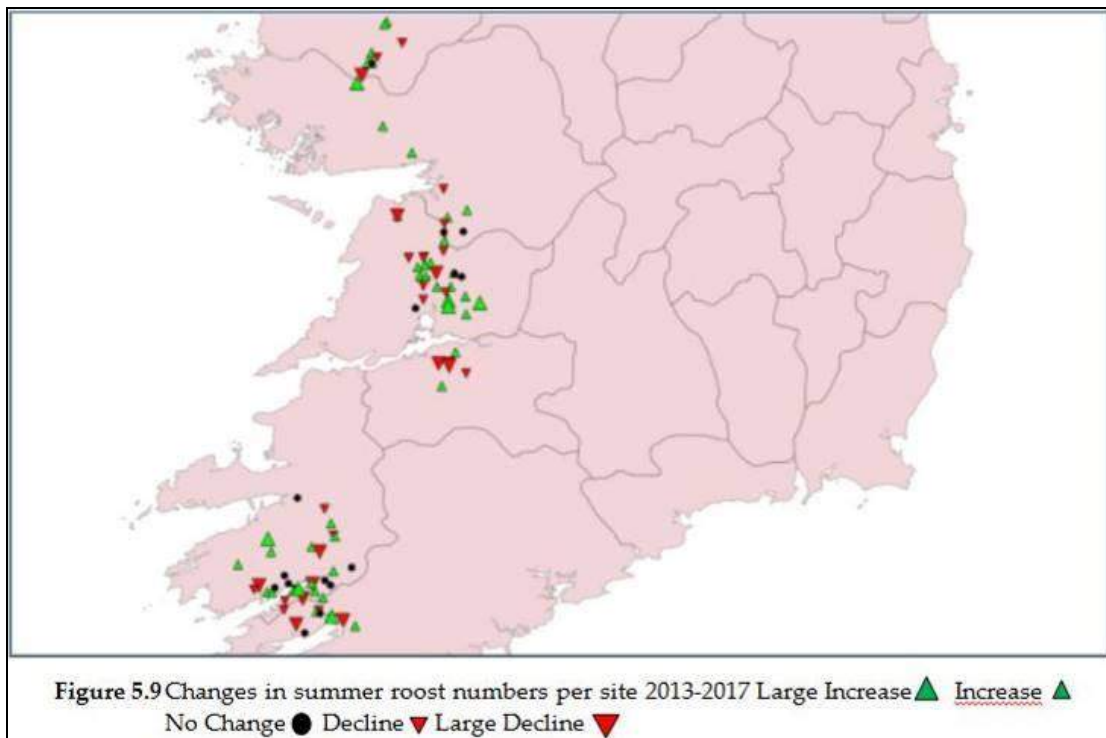


Figure 1 Changes in LHB summer roost numbers (Aughney *et al.*, 2018)

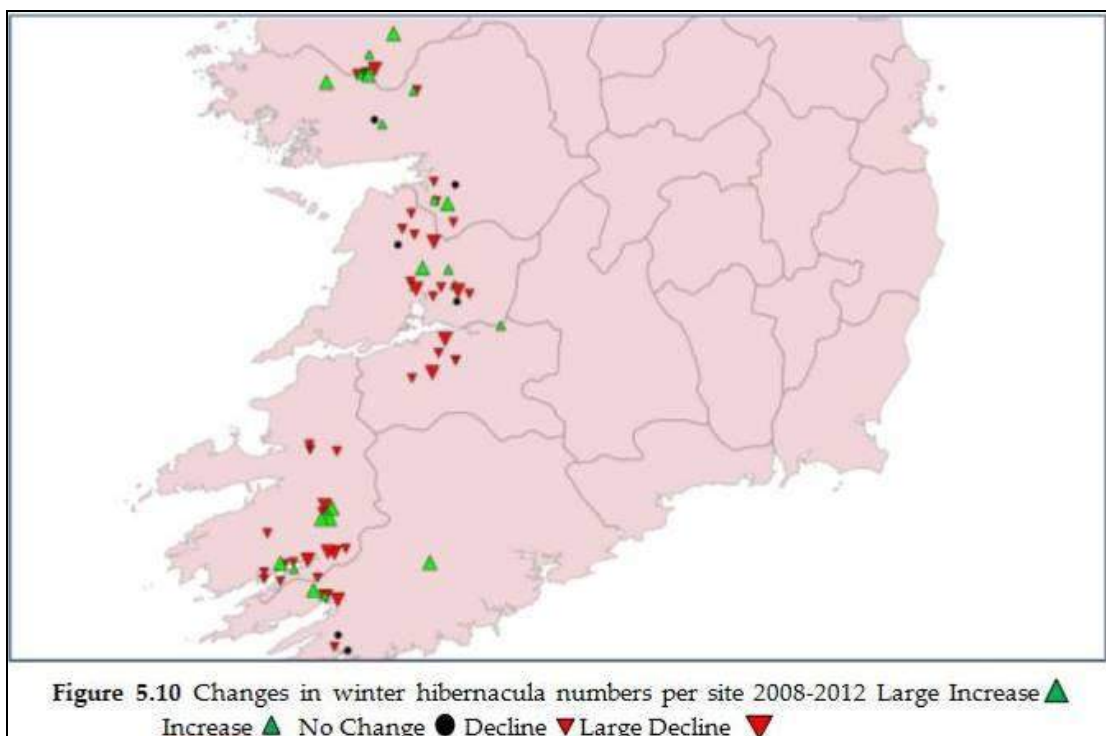


Figure 2 Changes in LHB winter roost numbers (Aughney *et al.*, 2018)

The Vincent Wildlife Trust (VWT) (McAney *et al.*, 2013) reported that a gap of over 45km has opened up between the roosts at Rathkeale in Co. Limerick and those at Castleisland and Tralee in north Co. Kerry. A distance of over 70km was measured between roosts that are used by more than 25 bats. While the LHB population for the county is only several hundred and is confined to a small number of sites, Co. Limerick is key to ensuring connectivity between populations in the north and south. As a consequence, the VWT has concerns about this phenomenon, which they

describe as the 'Limerick Gap', which is likely to have arisen as a result of habitat fragmentation and roost loss. Information on where to focus future conservation actions to enable the species to recolonise this area is essential if future range decline is to be prevented. The VWT have recommend that two areas be targeted for conservation of the LHB, one of which coincides with the proposed road development (see Figure 3).

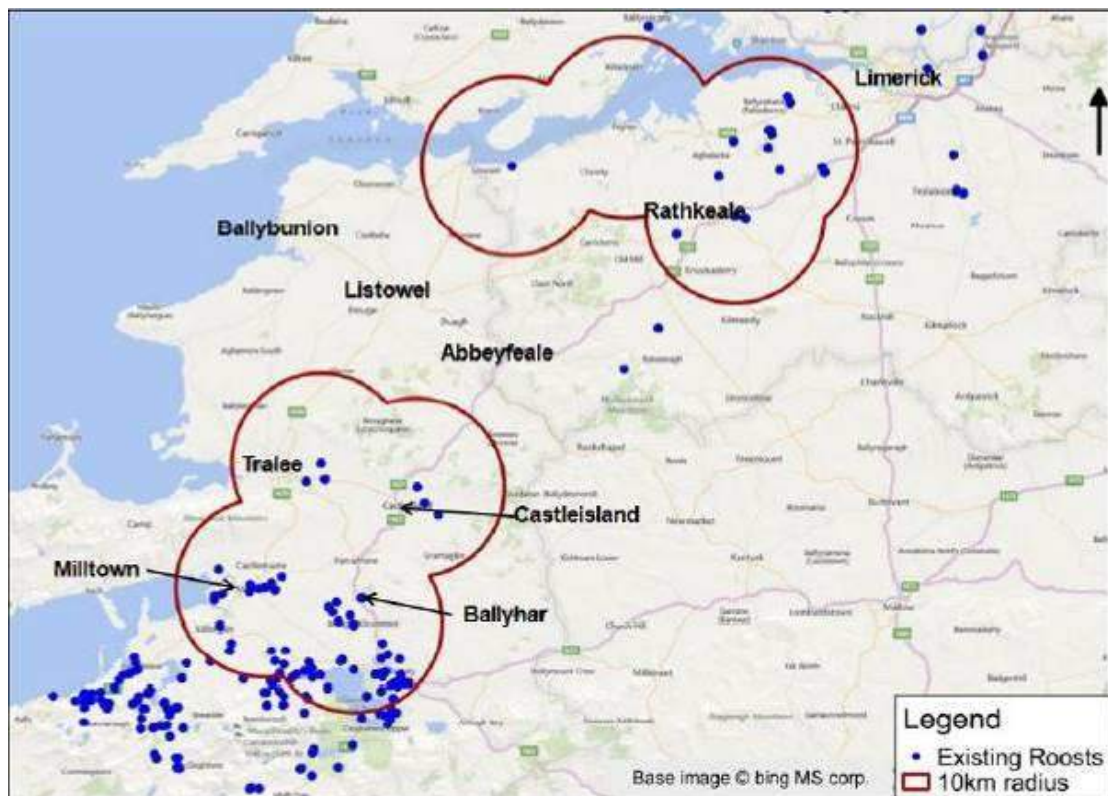


Figure 3 Conservation target areas for LHB (McAney *et al.*, 2013)

2.3 Assessment Methodology

Based on the information collected during the desktop studies and bat surveys regarding the conservation status of species at different geographical scales, and according to the CIEEM guidelines (2016), the bat ecologist assigns an ecological value to each bat species recorded (Table 2). For example, a site may be of national ecological value for a given species if it supports a significant proportion (e.g. 5%) of the total national population of that species.

Table 2 The six-level ecological valuation scheme used in the CIEEM Guidelines (2016) Ecological Value

Ecological Value	Geographical Scale of Importance
International	International or European scale
National	Republic of Ireland or island of Ireland scale (depending on species)
Regional	Province scale (i.e. Munster)
County	County scale (i.e. Co. Limerick)
Local	Important at the scale of the proposed road development and immediate surroundings
Negligible	None; the feature is common and widespread

It is recognised that any development will have an impact on the receiving environment, but the significance of the impact will depend on the value of the ecological features affected. Potential direct, indirect or cumulative impacts on ecological features can be described in relation to their magnitude, extent, duration, reversibility and timing/frequency, as outlined in the CIEEM guidelines (2016). Depending on the type of impact and the sensitivities of the important ecological feature, the ecologist may determine that the impact would have a 'significant effect': "[...] *an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project*" (CIEEM, 2016). Where significant effects are identified, measures will be taken to avoid, minimise or compensate accordingly. Based on these measures, the impact assessment will be repeated, and any residual impacts will be discussed.

The guidelines consulted recommend that the potential impacts of a proposed development on bats are assessed as early as possible in the design stage to determine any areas of conflict along each of the proposed route options. This assessment was completed by Aardwolf Wildlife Surveys. A number of studies on the bat fauna in the immediate areas of each of the initial eight route options (subsequently reduced to four options) and a review of the bat favourable habitats along these potential routes were undertaken. The final preferred route was that which it was considered would cause the least negative impact and disturbance to these protected animals.

The initial study was then followed by a more in-depth assessment of the final, preferred route over several seasons in order to determine the effects that the proposed development might have on the nightly and seasonal behaviour of bats, including:

- peak summer activity;
- autumnal mating behaviour;
- winter hibernation; and
- spring re-emergence.

Assessments of potential impacts on summer and autumn activities were completed by Conor Kelleher of *Aardwolf Wildlife Surveys*, while assessments of potential impacts on winter and spring activities were completed by Dr. Tina Aughney of *Bat Eco Services*. Methodologies employed in these surveys are detailed in the following section.

2.4 Survey Methodology

2.4.1 Study Area

The study area was as follows:

- Field network through which the proposed road development is located;
- Local road network adjacent to the proposed road development;
- Derelict railway line adjacent to the proposed road development;
- Structures and buildings identified as potential roosts adjacent to the proposed road development and/or buildings and structures identified as potentially impacted by proposed road development.

2.4.2 Summer and Autumn Surveys (Aardwolf Wildlife Surveys)

In order to inform the assessments of potential impacts on summer and autumn season bat activity, Conor Kelleher of *Aardwolf Wildlife Surveys* carried out surveys along the length of the proposed road development on the 28th and 29th of August, 26th and 27th of September and 14th of October 2016. The methodology employed is outlined below.

Daytime Inspections

Several buildings including dwellings and farm outbuildings, in three separate locations, that are immediately adjacent to the proposed road development were surveyed for the presence of bats. Each of these buildings was inspected externally and internally (where possible) for bats or evidence of their presence. The presence of bats is assessed with reference to their signs – principally staining, droppings, and feeding signs, although direct observations were also made.

Night-time Bat Surveys

Dusk emergence activity and dawn swarming activity around the buildings containing potential bat roosts (as identified during the daytime inspections) was checked for using ultrasonic bat detectors. Areas of habitat likely to be used by bats (as identified during a desk study) were also surveyed for night-time bat activity (i.e. from dusk until dawn) using bat detectors. These included areas based on habitats recorded in the wider area during the Route Selection Phase, while other areas were selected using recent colour aerial photographs. While much of the survey fieldwork was undertaken within 100m of the proposed road development, this distance was increased to 300m or further in some areas where habitats were deemed to be of especial significance to LHB, such as in the vicinity of Adare Manor. Areas of suitable habitat were walked on foot listening for bats with detector, while the wider area of the road was surveyed from a vehicle driven at 20 kph with a detector mounted on the vehicle. Bats were identified by their ultrasonic calls, behavioural and flight observations, and on computer by sound analysis of recorded echolocation and social calls with dedicated software (*Kaleidoscope Viewer - Wildlife Acoustics*).

Bat detectors used were as follows:

1. BatBox Duet - BatBox Electronics;
2. Echometer EM3+ - Wildlife Acoustics.

2.4.3 Winter and Spring Surveys and Tree Surveys (Bat Eco Services)

In order to inform the assessments of potential impacts on winter and spring season bat activity, Dr. Tina Aughney of *Bat Eco Services* carried out surveys along the length of the proposed road development on the 14th and 15th March 2018 (winter surveys delayed due to extreme snow conditions in February 2018) and 23rd April to the 1st May 2018. In addition, tree surveys were carried out on the 20th, 21st and 22nd June 2018. Additional building / structure surveys were also carried out in 20th, 21st, 22nd, 24th August 2018 and 17th and 18th 2019. The methodology employed is outlined below.

Daytime Inspections

Structures, buildings and other likely places that may provide a roosting space for bats were inspected during the daytime in 28th August and 26th and 27th September 2016 for evidence of bat usage by *Aardwolf Wildlife Surveys*. Additional structures and buildings were inspected by *Bat Eco Services* on 14th and 15th March 2018, 20th, 21st, 22nd, 24th August 2018 and 17th and 18th 2019. All accessible areas of these structures were inspected for bats and/or their signs using powerful torches. The

presence of bats is often shown by grease staining, droppings, urine marks, corpses, feeding signs such as invertebrate prey remains and/or the presence of bat fly (*Nycteribiidae*) pupae, although direct observations are also occasionally made. Bat droppings are often identifiable to species-level based on their size, shape and content and those of certain species, for example, brown long-eared (*Plecotus auratus*) and LHBs, are very distinctive and unmistakable. Inspections were undertaken visually with the aid of a strong torch beam and endoscope.

Night-time Bat Surveys

Night-time bat surveying was completed using the following bat detectors:

Surveyor 1:

1. Wildlife Acoustics EchoMeter Touch (with an iPad 2), and
2. Pettersson D200 Heterodyne Bat Detector

Surveyor 2:

1. Wildlife Acoustics EchoMeter Touch 2 Pro (with an android mobile phone), and
2. Pettersson D200 Heterodyne Bat Detector

Dusk surveys started 10 minutes prior to sunset and were completed during mild and dry weather conditions with air temperature of $\geq 8^{\circ}\text{C}$. Dusk surveys involved walking transects along the proposed road development; traversing the field network (where accessible) and following the local road network and railway line. Each bat encounter was noted on maps and determined to species level, where possible. The length of the survey varied according to the length of the walking transect but all surveys were undertaken for at least 120 minutes.

Dawn surveys started 90 minutes prior to sunrise and continued until 10 minutes after sunrise (i.e. 100-minute survey) and were completed during mild and dry weather conditions with air temperature of $\geq 8^{\circ}\text{C}$. Dawn surveys involved walking transects along the proposed road development; traversing the field network (where accessible) and following the local road network and railway line. Each bat encounter was noted on maps and determined to species level, where possible.

Emergence surveys of structures and buildings started 10 minutes prior to sunset and lasted for a total of 100 minutes. These were completed during mild and dry weather conditions with air temperature of $\geq 8^{\circ}\text{C}$. The focus of this survey is to determine whether a structure is a bat roost. Therefore, these surveys were undertaken after the daytime inspections of structures (described previously), which had identified known / potential roosts.

Passive Static Bat Surveys

A passive static bat survey involves leaving a static recording unit (with ultrasonic microphone) to record in a specific location for a specified period of time. There is no observer present during the survey. The bat detector is effectively used as a bat activity data logger. Calls of bats which pass near enough to the monitoring unit are recorded. Analysis of recorded calls is carried out afterwards. This results in a far greater sampling effort over a shorter period of time than the equivalent survey with observer present. Passive static surveillance was completed using the equipment listed in Table 3, below.

Table 3 Recording devices used by Bat Eco Services

Unit Type	Details	No. of units	Software used to analyse recordings
Wildlife Acoustics Song Meter SM2BAT	192 kHz Stereo and SMX-US ultrasonic omni-directional microphone	1	SongScope
Wildlife Acoustics Song Meter SM2BAT+	192 kHz Stereo and SMX-US ultrasonic omni-directional microphone	1	BatClassifyIreland
Wildlife Acoustics Song Meter SM3	192 kHz Stereo and SMM-UI ultrasonic omni-directional microphone	1	BatClassifyIreland
Eleckon BatLogger A+	FG Black microphone	2	BatExplorer

The microphones of the above devices were positioned horizontally to reduce potential damage from rain. All of the listed devices record bat echolocation calls in real time as sonograms. These sonograms are digitally stored on the SD card of the device in question and may be downloaded to a computer for subsequent analysis using the software programmes set out in Table 3. Recorded sonograms are depicted on a graph showing the number of bat passes per species per hour / night. The number of bat passes recorded is representative of bat activity levels rather than the number of individual bats present. This is since some species, such as the pipistrelles, will continuously fly around a habitat and, therefore, it is likely that a single bat will result in multiple bat calls being recorded in a relatively short time frame. Conversely, certain other species (Leisler's bats, for instance) tend to travel through an area quickly and, therefore, an individual sequence or bat pass is more likely to be indicative of multiple individual bats, as opposed to one individual passing quickly back and forth.

Tree Surveys – Potential Bat Roosts

Daytime surveys were undertaken on the 20th – 22nd June 2018 to identify any Potential Bat Roosts (PBRs) in mature trees (from the ground level). Trees that may provide a roosting space for bats using the Bat Tree Habitat Key (BTHK) guide (BTHK, 2018) and the classification system set out in Collins (2016; see Table 4). The Potential Roost Features (PRFs) listed in this guide are used to determine the PBR value of individual trees. Trees identified as PBRs are inspected visually during the daytime using a Phase 1 inspection procedure. Inspections are undertaken from the ground level with the aid of a strong torch beam (LED Lenser P14.2). This provides a list of trees that are deemed suitable as roosting sites for bats.

Table 4 Tree Bat Roost Category Classification System (Collins, 2016).

Tree Category	Description
1	Tree has multiple, highly suitable PRFs, capable of supporting larger roosts
2	Tree has with definite bat potential but supports PRFs suitable for use by individual bats only
3	Tree has no obvious potential, although is of a size and age such that execution of elevated surveys may be expected to identify cracks / crevices or other PRFs, which may have limited potential to support bats
4	Tree has no bat potential

Phase 2 inspections are carried out once a complete list of PBR trees has been developed, and when trees among them are earmarked for felling as part of the proposed development. The Phase 2 inspection will generally involve a closer examination of individual trees using a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope) and, where required and / or possible, height surveys using a ladder. If a tree is deemed to be a roost site, then further surveying involving dusk and dawn surveys of the identified trees may be recommended to determine what species are present.

2.4.4 Survey Constraints

The survey bias associated with this Full Season Bat Survey is as follows:

- a) Walking transects for the spring survey were undertaken along access tracks, railway lines and traversing fields. Occasionally it was difficult to access all fields along the proposed road development in the hours of darkness
- b) Walking transects for the spring survey started each night prior to sunset. Different species emerge from roosts at different times, depending on the ambient light levels (e.g. brown long-eared bats emerge approximately 30 minutes after sunset while Leisler's bat emerges at sunset). Therefore, late emerging bats may have been missed in areas walked at the start of the survey night. However, it is considered that the information collated during the spring surveys provide a good snapshot of bat activity for much of the study area.
- c) Surveying was primarily concentrated within the proposed road development. Therefore, little information was collated on bat roosting sites in the adjacent landscape.

2.4.5 Desktop Study

In order to inform the prescription of appropriate mitigation measures, a desktop study on the ecological requirements and conservation statuses of bats recorded in the study area was carried out using the following sources of information:

- The BC Ireland Database; and
- The BC Ireland Landscape Model (as per Lundy *et al.*, 2011).

BC Ireland produced a landscape conservation guide for Irish bat species using their database of species records collated during the 2000 - 2009 survey seasons. An analysis of the habitat and landscape associations of all bat species deemed resident in Ireland was undertaken and reported in Lundy *et al.*, 2011. The geographical area suitable for individual species was used to identify the core favourable areas of each species. This was produced as a GIS layer for local authorities and planners in order to provide a guide to the consideration of bat conservation. The island is divided into 5km squares and the landscape favourability of each 5km square for each species of bat was modelled. A caveat is attached to the model and it is that the model is based on records held on the BC Ireland database, while core areas have been identified, areas outside the core area should not be discounted as unimportant as bats are a landscape species and can travel many kilometres between roosts and foraging areas nightly and seasonally. This model was used as part of the desktop study for this report.

The findings of this desktop study are presented in Section 4.

3. SURVEY RESULTS

3.1 Summer and Autumn Surveys (Aardwolf Wildlife Surveys)

3.1.1 Building and Tree Surveys

Ballycullen House and Outbuildings

This large farmhouse and its adjoining outbuildings (Figures 4 and 5 below) were surveyed on 28th August 2016. Five species of bat were recorded flying near these structures: common pipistrelle, soprano pipistrelle, brown long-eared bat, Leisler's bat and whiskered bat. Of these, the brown long-eared bats were observed exiting the outbuildings (Figure 5). The common and soprano pipistrelles and whiskered bats may also have emerged from these structures, but this was not confirmed. The Leisler's bats did not originate from the farmhouse or the outbuildings.



Figure 4: (Left) Ballycullen House

Figure 5: (Right) Outbuildings at Ballycullen House which are used by at least one bat species

Stone Cottage and Associated Structures at Ardshanbally

No evidence of bats was noted at the cottage (Figure 6) or sheds at Ardshanbally in September 2016. No bat activity was recorded during the detector survey at this time. Nor was any bat activity was observed at the nearby cottage to the immediate east of the railway line, where pipistrelles were noted roosting during a previous survey of this structure in August 2005.

Bungalow and Farm Buildings at Blossomhill

The disused bungalow at Blossomhill (Figure 7) had been badly damaged by fire prior to survey. The building was effectively roofless and, as such, not fit for habitation by bats. The nearby farm buildings are certainly suitable for bat use, and, although no bat activity was noted at these structures during the survey, it is highly likely that the older buildings in the complex are in occasional use by bats.

Potential Roosts in Trees

Although no bat roost was identified in any tree during the surveys by Aardwolf Wildlife, a number of wooded locations with mature trees containing potential bat roosts were identified:

- the small woodland at Graigeen, along the minor road at Kilknockan and
- mature trees near the River Mague at Ardshanbally.



Figure 6 Single-storey cottage at Ardshanbally



Figure 7 Burned bungalow at Blossomhill

3.1.2 Mating Sites

In September 2016, male Leisler's bats were noted emitting social calls as enticements to attract females for mating along the lane at Ardshanbally where mature tree specimens act as advertisement locations. Male *Pipistrellus* spp. bats were also advertising their presence to females while on the wing at the same location and in the grounds of Ballycullen House.

3.1.3 Hibernation Sites

There are no known major hibernation sites with large numbers of bats along or within several kilometers of the proposed road development and none was identified during the survey by Aardwolf Wildlife Surveys. However, structures such as bridges, medieval tower houses, farm buildings, disused buildings and mature trees in the study area offer unlimited crevices into which bats may nestle themselves individually or in small numbers. Finding single animals in such places is extremely difficult and individual bats may have been overlooked. Hibernation sites can also be transient and used only occasionally by bats and their presence may have been missed due to timing.

3.1.4 Commuting Routes and Foraging Habitat

Favourable bat feeding habitats and commuting features along the proposed road development were surveyed on foot and by vehicle to identify any potential areas of conflict with especial focus given to river crossings and deciduous woodlands.

The key locations of importance for bats along the proposed road development include watercourses (rivers Ahacronane, Deel, Clonshire, Greanagh and Maigue; surveyed in August and September 2016), treelines and hedgerows. Additional habitats adjoining the proposed road development include small areas of woodland and scattered trees in areas such as at Ballycullen House. The following statements present a summary of survey findings with respect to bat foraging / commuting activity in the study area:

- Pipistrelles (common and soprano) were ubiquitous throughout the study area and were found using a variety of habitats, including watercourses, hedgerows, treelines, parkland, and areas of woodland.
- Daubenton's bat was typically found along watercourses and was present over all of the local rivers.
- Leisler's bats were most frequently detected feeding over streetlights in and around the villages of Foynes, Askeaton, Rathkeale, and Adare, and also over open countryside throughout the study area.
- Brown long eared bats were detected at Ballycullen, Askeaton and in the woodlands at Adare. The species is likely to be more frequent within the study area than the current survey indicates as these bats are seldom picked up on bat detectors.
- *Myotis* spp. (whiskered, Natterer's and Daubenton's) are also likely to be more abundant in areas of woodland than detected as these habitats are used by a variety of bat species for foraging and roosting purposes. Whiskered bats were encountered at Ballycullen and in the Adare woodlands, and the Natterer's bat was also present at the latter site.
- The only observation of LHB during the present surveys was of one commuting / hunting specimen at Clonshire Beg, west of Adare, in August 2016. This species produces a very narrow echolocation call which is extremely difficult to detect, and especially so in areas where the population is low. It is likely that this species is more widespread in the local landscape than these surveys would indicate but, as is known from prior local studies, this species' numbers are greater north of the proposed road development at Curraghchase than they are in the Adare area. The species formerly roosted in Adare Manor prior to its development as a hotel and other known major roost sites for this species include several roosts around Curraghchase (Roche, 2001), which is within 4km of the proposed road development, and at Ballywilliam House estate near Rathkeale.

3.2 Winter and Spring Surveys and Tree Surveys (Bat Eco Services)

3.2.1 Winter Daytime Surveys

There are no known major hibernation sites with large numbers of bats along or within several kilometers of the proposed road and none were identified during the present assessment. However, structures such as bridges, medieval tower houses, farm buildings, disused buildings and mature trees in the study area offer unlimited crevices into which bats may nestle themselves, individually or in small numbers. Finding single animals in such places is extremely difficult and individual bats may

have been overlooked. Hibernation sites can also be transient (i.e. used only occasionally) and occupancy at such sites may have been overlooked due to timing.

The structures listed in Table 5 were inspected.

Table 5 Summary results of winter daytime surveys of structures

Site Name Location	Location	Results of Winter Survey
Clonshire Castle	Off-line Ch 56+450	LHB droppings were recorded within the structure.
Clonshire Bridge	Ch 56+500	Suitable crevices for roosting bats.
Railway Bridge at Ballycullen	Ch 11+300	Suitable crevices for roosting bats.
Railway Bridge at Clonshire	Ch 58+000	Suitable crevices for roosting bats.
Railway Bridge at Feeagh	Off-line Ch 25+550	Suitable crevices for roosting bats.
Derelict cottage & church at Feeagh	Off-line Ch 25+800	Both suitable for roosting bats. (Soprano pipistrelles were recorded 25/04/2018).
Ballycullen House outbuildings	Off-line Ch 20+550	A small number of LHB and brown long-eared bat droppings recorded in open sheds.
Derelict buildings adjacent to Ahacronane River / Bridge	Off-line Ch 4+450	LHB droppings recorded.
Agriculture buildings at Islandea	Ch 50+800	No evidence of bat usage.
Agricultural buildings at Rineroe	Ch 62+400	No evidence of bat usage.

3.2.2 Spring Night-time Surveys

Details of the Spring Surveys completed in relation to survey dates, survey locations and weather conditions are as presented in Table 6, below.

A total of 197 bat encounters were recorded during the walking transects of the spring surveys (Figure 8). These were marked on maps as included in Appendix C and are presented in tabular form in Appendix B. Frequently, more than one bat species was recorded per bat encounter location. Additional occurrences were recorded for areas outside the site of the proposed road development and are presented separately in Table 6, below (e.g. #4, 'Askeaton town environs').

In summary, common pipistrelle was the most frequently encountered bat species and was recorded at 124 locations (Figure 9). Soprano pipistrelles were recorded at 119 locations (Figure 10), followed by Leisler's bats at 42 locations (Figure 11). *Myotis* species were encountered at 24 points (Figure 12), which include 15 positive detections of Daubenton's bat and one identification of the Natterer's bat to species level. Brown long-eared bats were detected at six points during the walking transects (Figure 14).

Table 6 Survey dates and locations of spring night-time surveys

#	Survey Type	Date & Time	Surveyor #	Weather Conditions			
					Chainage	Townland(s)	Description
1	Dusk	23/04/2018 21:00hrs to 01:00 hrs	2	Dry, patchy cloud cover, light breeze, 14°C	Ch 1+000 to Ch 5+100	Ardaneer, Sroolane North, Robertstown, Rincullia	Local road network off N69 north of Robertstown
2	Dusk	23/04/2018 21:00hrs to 01:00 hrs	1	Dry, patchy cloud cover, light breeze, 14°C	Ch 5+300 to Ch 7+350 Ch 10+000 to 11+900	Craggs, Mulderrisksfield, Ballyclough, Ballycullen, Cloonreask	Local road network from Barrigone to Ballyclough Bridge to Askeaton.
3	Dawn	24/04/2018 04:45hrs to 06:00 hrs	2	Dry, patchy cloud cover, light breeze, 8°C			Foynes town environs
4	Dawn	24/04/2018 04:45hrs to 06:00 hrs	1	Dry, patchy cloud cover, light breeze, 8°C			Askeaton town environs
5	Dusk	24/04/2018 21:00hrs to 01:00 hrs	2	Dry, patchy cloud cover, light breeze, 11°C	Ch 20+500 to Ch 24+050	Ballycullen, Baunreagh, Ballynacaheragh, Milltown North	River Deel
6	Dusk	24/04/2018 21:00hrs to 01:00 hrs	1	Dry, patchy cloud cover, light breeze, 11°C	Ch 24+500 to Ch 27+700	Bullaun, Feeagh, Graigeen, Ardgoul South	Local road network in Graigeen
7	Dawn	25/04/2018 04:45hrs to 06:00 hrs	1	Dry, overcast, light breeze, 9°C		Ballingarranne	Local road network in Ballingarranne
8	Dawn	25/04/2018 04:45hrs to 06:00 hrs	2	Dry, overcast cover, light breeze, 9°C	Ch 27+650 to Ch 28+200	Ballingarranne	Railway line in Ballingarranne
9	Dusk	25/04/2018 21:00hrs to 00:00 hrs	1	Dry, patchy cloud cover, light breeze, 11°C	Ch 28+200 to Ch 29+250 Ch 50+000 to Ch 51+400	Kyletaun, Rathkeale, Wolfesburgess East, Blossomhill	Along N21

#	Survey Type	Date & Time	Surveyor #	Weather Conditions			
					Chainage	Townland(s)	Description
10	Dusk	25/04/2018 21:00hrs to 00:00 hrs	2	Dry, patchy cloud cover, light breeze, 11°C	Ch 51+500 to 55+700	Blossomhill, Rathkeale Commons, Clough West, Ballycannon, Croagh	
11	Dusk	29/04/2018 21:00hrs to 00:00 hrs	1	Dry, patchy cloud cover, light breeze, 11°C	Ch 56+400 to Ch 60+700	Islandea, Rower More, Clonshire More, Gortnagrour	Railway line in Curraghbeg
12	Dusk	29/04/2018 21:00hrs to 00:00 hrs	1	Dry, patchy cloud cover, light breeze, 11°C	Ch 60+700 to Ch 66+600	Islandea, Ardshanbally, Gortaganniff	Adare town environs along the River Maigue Local road network in Ardshanbally Railway line in Ardshanbally

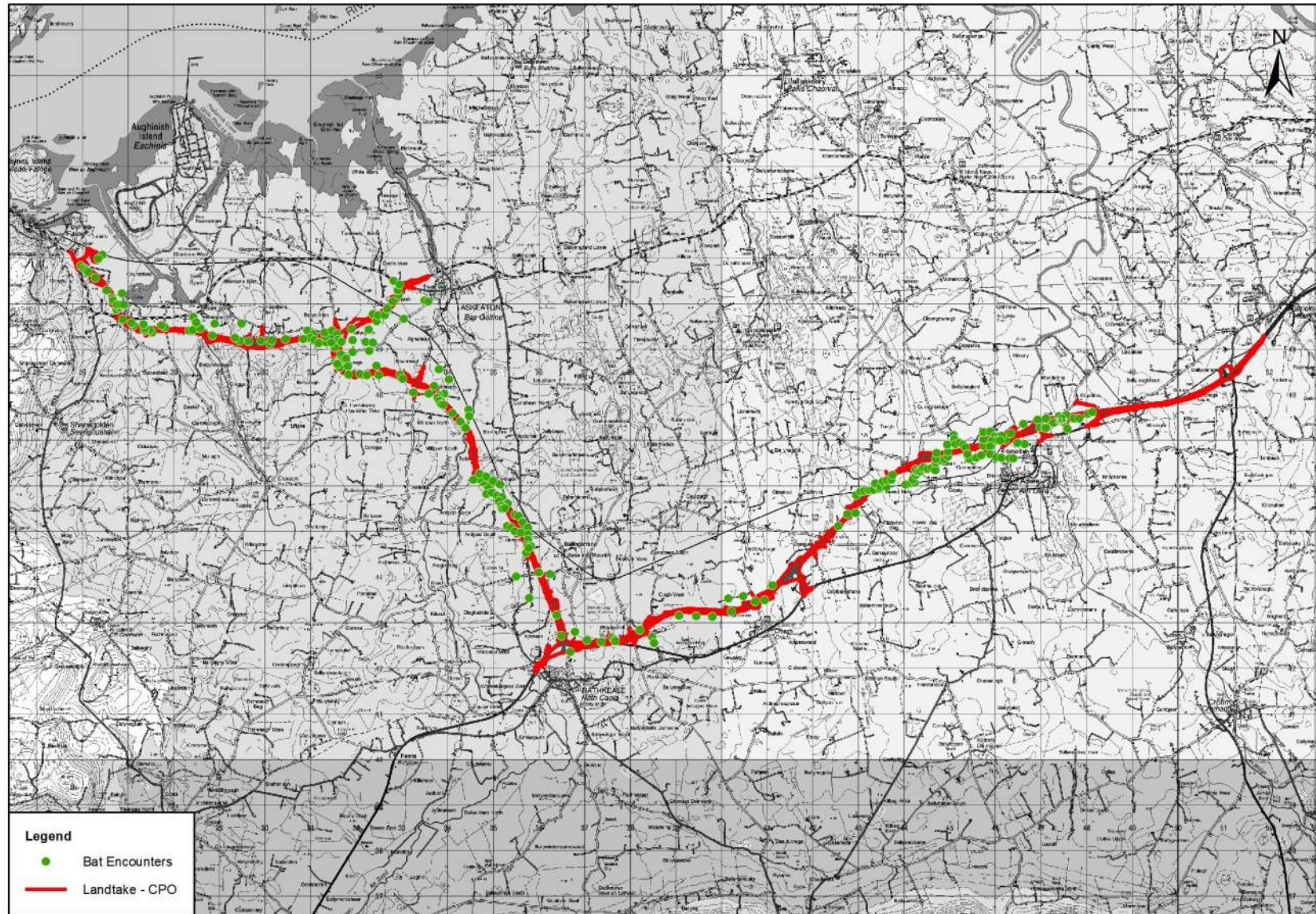


Figure 8 Locations of bat encounters recorded during walking transects, spring bat survey, 2018.

During the dawn survey of Askeaton town environs (#4 in Table 6; 24/04/2018), soprano pipistrelles, common pipistrelles and Daubenton's bats were detected foraging along the River Deel from Askeaton Castle to the Franciscan Friary. Three species of bat were detected foraging within the grounds of the Friary: common pipistrelle, soprano pipistrelle and Natterer's bat. Three species of bat were also recorded foraging along the roadways leading to the N69: common pipistrelle, soprano pipistrelle and Leisler's bat.

During the dawn survey of Foynes town environs (#3 in Table 6; 24/04/2018) only common pipistrelles and soprano pipistrelles were detected along the local roads leading from the entrance to Shannon - Foynes Port to the outskirts of the town.

During the dusk survey of the river walkway towards Adare Manor (#12 in Table 6; 29/04/2018) extensive foraging by five species of bat was recorded: common pipistrelle, soprano pipistrelle, Leisler's bat, Daubenton's bat and brown long-eared bat.

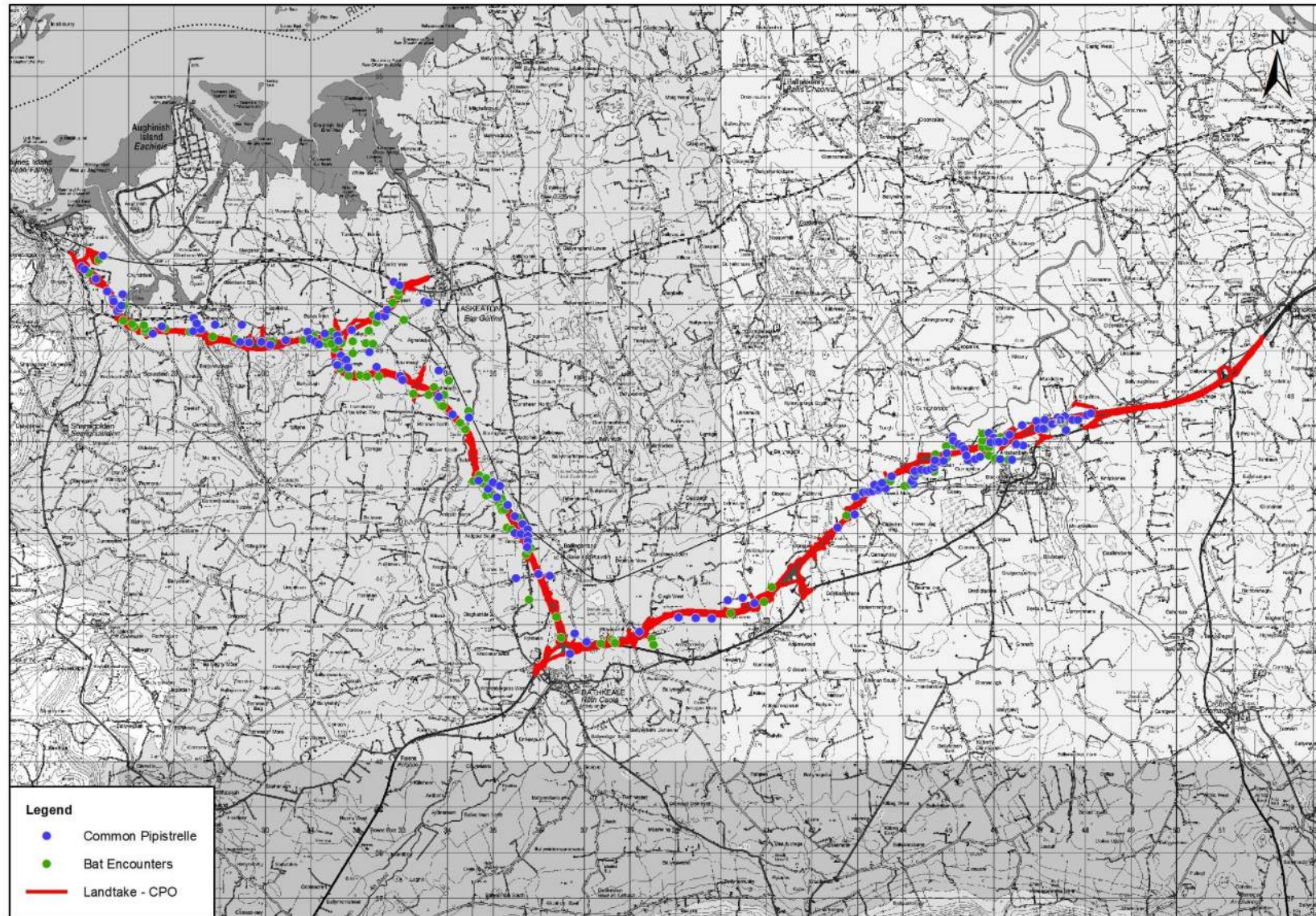


Figure 9 Locations of common pipistrelle bat encounters recorded during walking transects, spring bat survey, 2018.

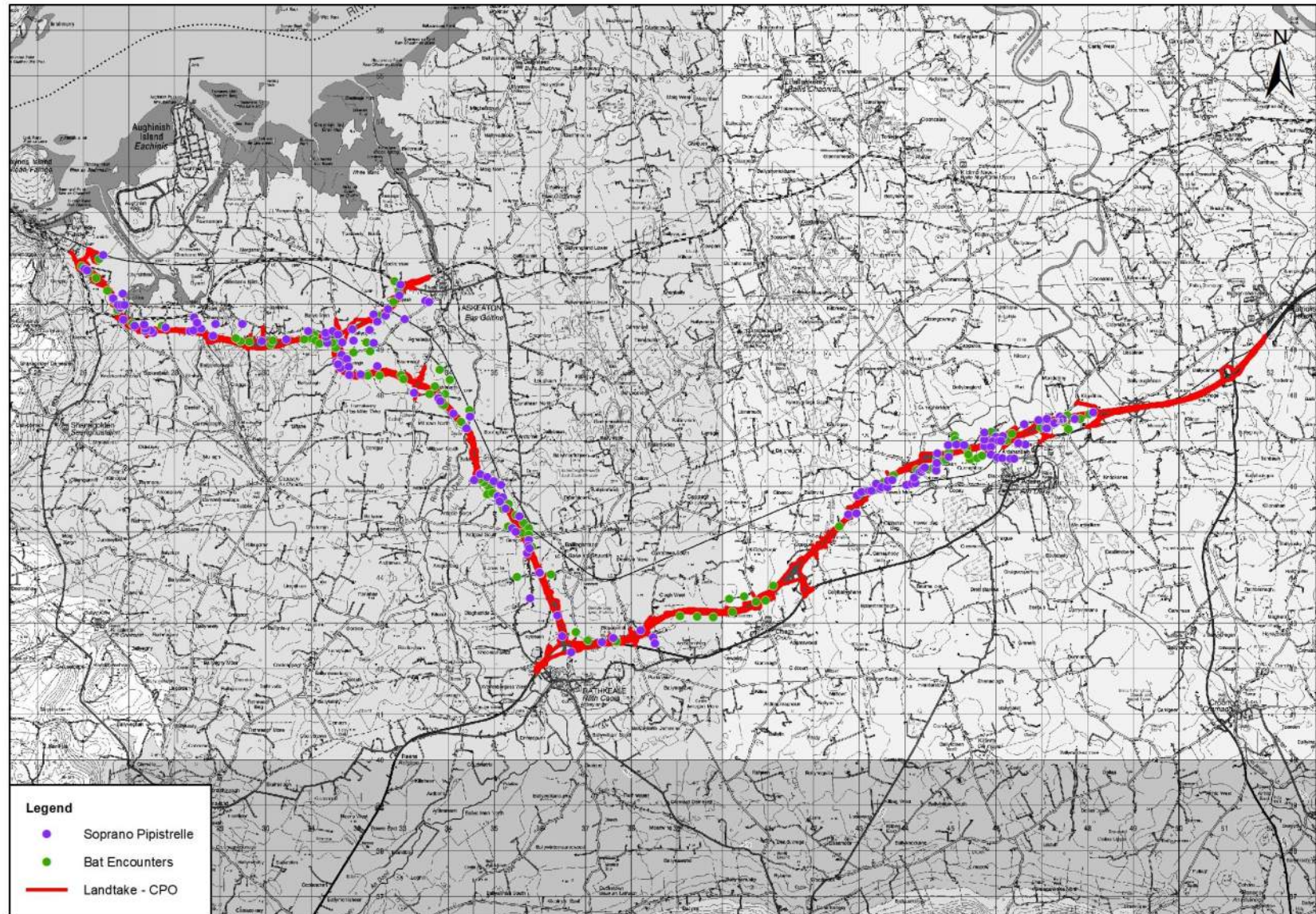


Figure 10 Locations of soprano pipistrelle bat encounters recorded during walking transects, spring bat survey, 2018.

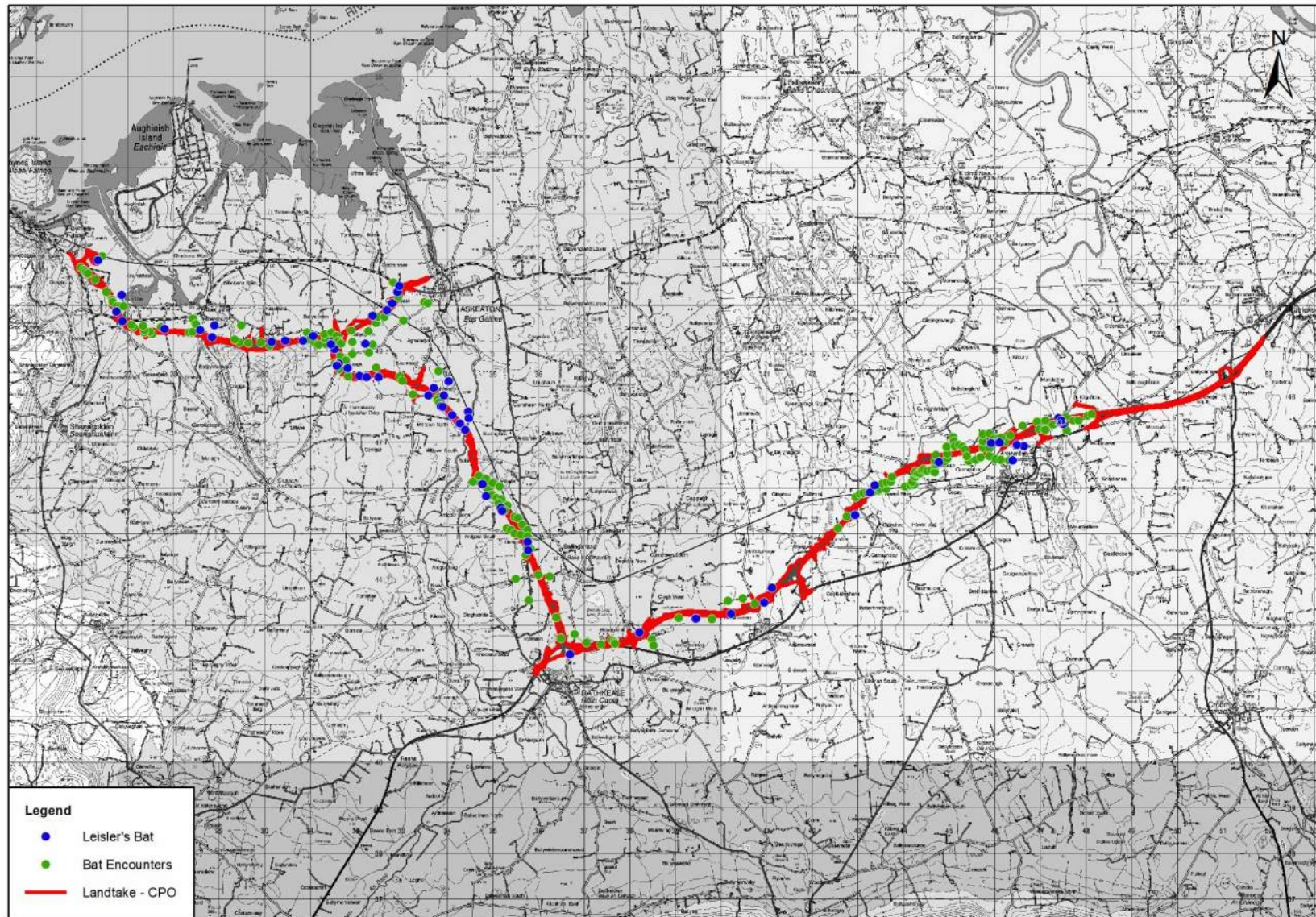


Figure 11 Locations of Leisler's bat encounters recorded during walking transects, spring bat survey, 2018.

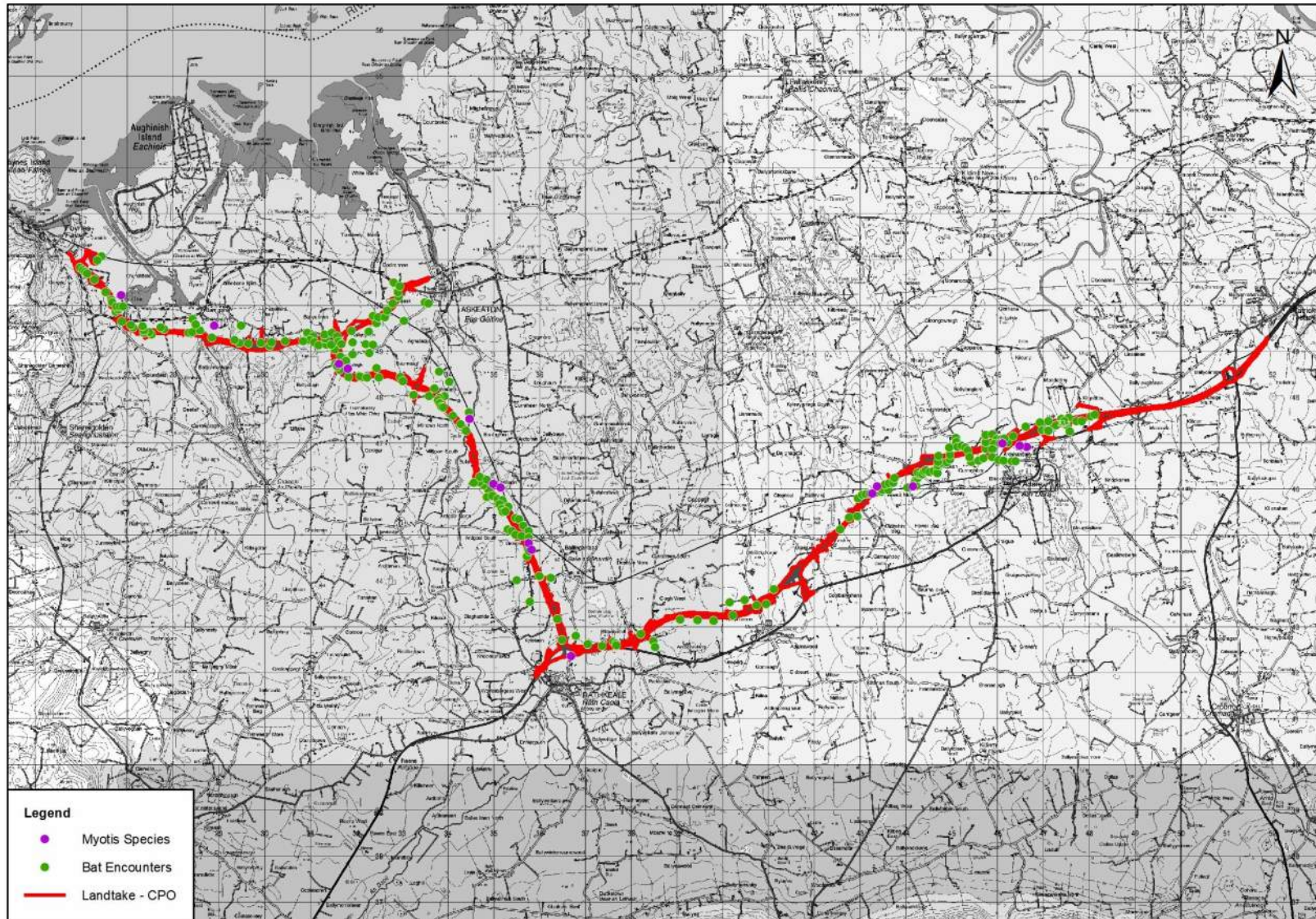


Figure 12 Locations of *Myotis* bat encounters recorded during walking transects, spring bat survey, 2018.

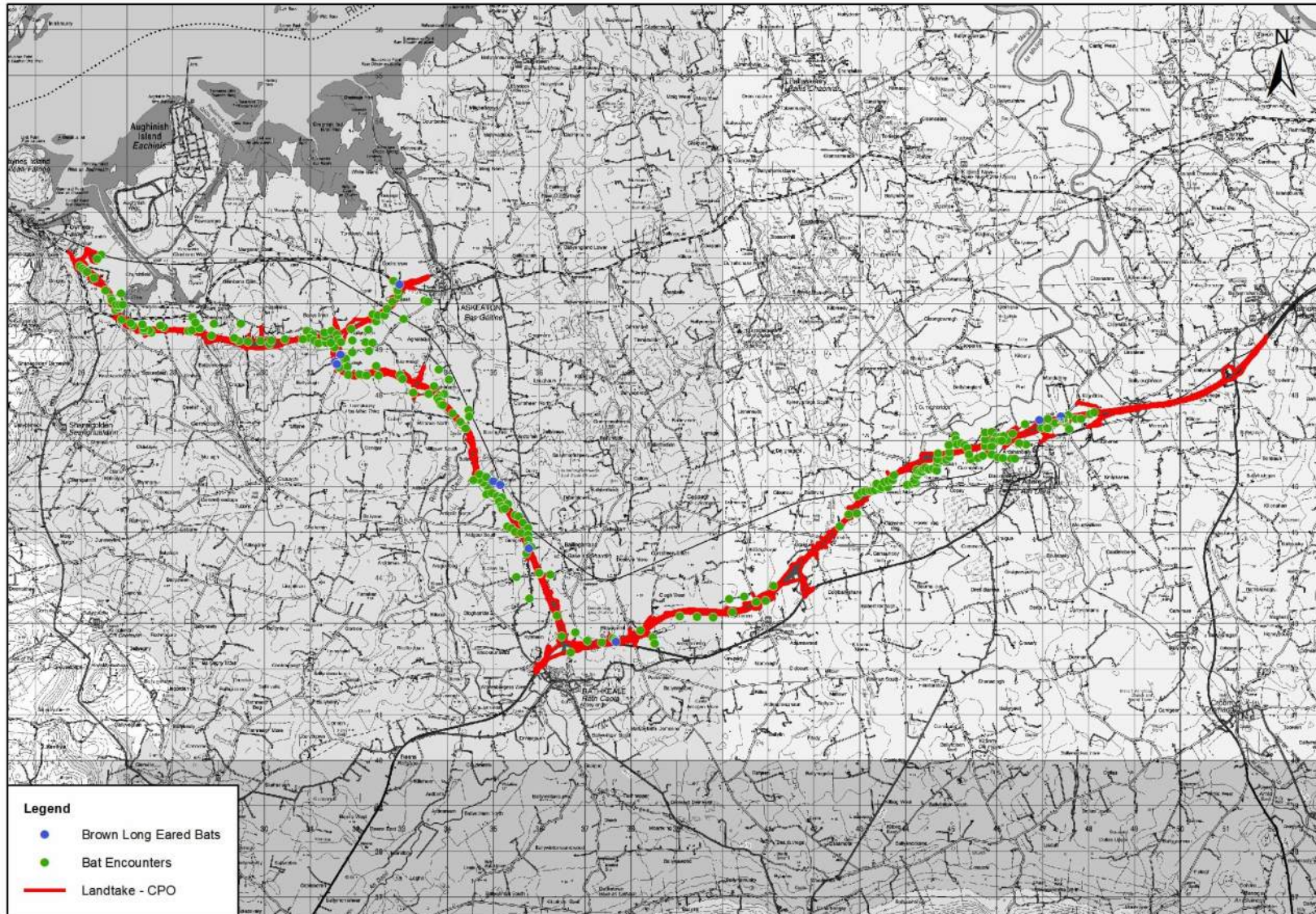


Figure 13 Locations of brown long-eared bat encounters recorded during walking transects, spring bat survey, 2018.

High levels of bat activity were noted at the following chainage numbers:

- Chainage 6+250 to 7+300 Townland of Ballyclogh;
- Chainage 20+000 to 21+100 Townlands of Ballyclogh and Ballycullen / vicinity of Ballyclogh Bridge and Ballycullen House;
- Chainage 11+300 to 11+900 Townland of Cloonreask;
- Chainage 22+800 to 23+600 Townlands of Ballynacaheragh and Milltown North;
- Chainage 25+000 to 26+700 Townlands of Feagh and Graigeen;
- Chainage 60+200 to 61+300 Along the River Maigne, Townland of Islandea;
- Chainage 61+450 Townland of Ardshanbally.

3.2.3 Spring Passive Static Surveys

Static recording units were placed to record nightly in locations listed in Table 7 and presented in Figure 14. Nineteen locations were surveyed accumulating a total of 400 hours of recordings. Recordings were analysed to species level, where possible. *Myotis* species were not identified to species level.

Each bat species has unique bat echolocation calls and the nature of calls influences the ease at which static units record them. For example, LHB have a very directional echolocation call, which means it is very difficult to detect the species when foraging. This can also be true for brown long-eared bats, which produce very quiet echolocation calls. Therefore, any recordings of these two species are noteworthy and are listed as 'present' in Table 7, below. On the other hand, Leisler's bats produce very loud echolocation calls so are easily picked up. However, because they fly fast across the landscape, it is rare to record a large volume of bat passes for this species at any particular static station, unless it is foraging close to the location of the unit. Common pipistrelle and soprano pipistrelle echolocation calls are moderately loud so are easily recorded. In addition, individuals of these two species are likely to forage continuously in the same area, so a large volume of bat passes tends to imply a foraging individual. In terms of *Myotis* species, there are three species which might be recorded: Daubenton's bat, Natterer's bat and whiskered bat. The first is frequently found foraging continuously over water and, therefore, any statics located adjacent to water with a medium to high volume of *Myotis* bat passes is likely to be recording this species. Natterer's bats and whiskered bats are less widespread and, therefore, less frequently recorded.

Table 8 summarises the results at each of the static stations in relation to the number of species detected at each location. This element of the bat survey provides essential information in relation to the presence of LHBs, as this species was not detected during the walking transects. LHBs were detected at 12 of the 19 static stations (63%, Figure 15). The static stations where this species was recorded emphasise the importance of the disused railway line, rivers and woodland in the immediate landscape of the proposed road development for this species.

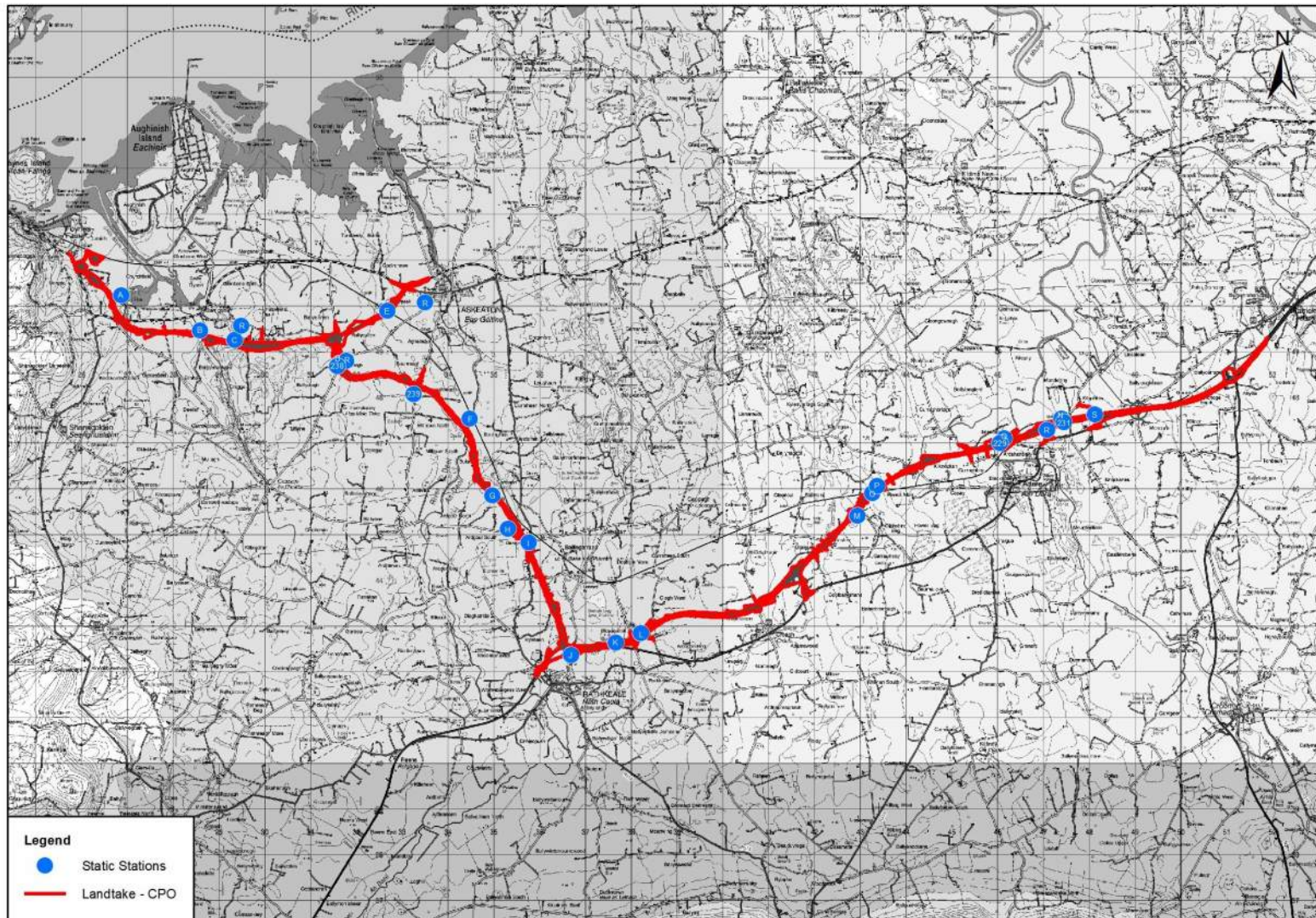


Figure 14 Locations of static stationary recording units during spring survey, 2018. Please note that the static locations are in alphabetical order and that Statics M-P are in close proximity to each other. Therefore Statics N and O are obscured by Statics M and P labels.

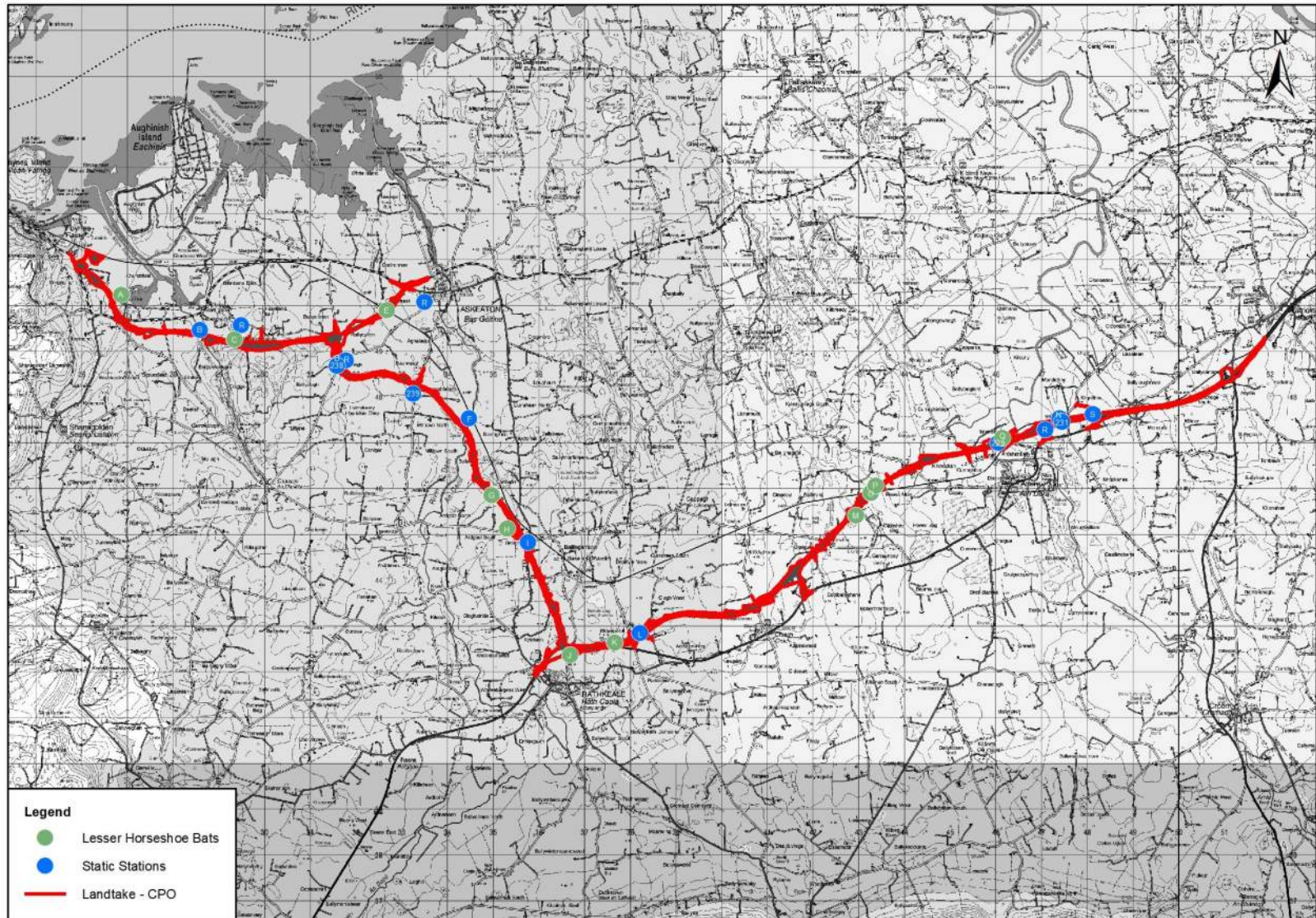


Figure 15 Locations of static stationary units where LHBs were recorded during spring survey, 2018.

Table 7 Survey dates and locations of static recording units.

Species: 'LHB' = lesser horseshoe bat; 'CP' = common pipistrelle; 'SP' = soprano pipistrelle; 'Leis' = Leisler's bat; 'BLE' = brown long-eared bat; 'Nathpip' = Nathusius'pipistrelle; 'Daub' = Daubenton's bat; 'My' = *Myotis* species

Activity level: 'Low' = <10 bat passes / hr; 'Medium' = >10 - <50 bat passes / hr; 'High' = >50 bat passes/hr

Ref.	Date & Time	Unit	Chainage	Townland	Habitat Type	Bat Species (activity level)
A	23/04/2018 20:00hrs to 06:00 hrs	Eleckon Bat Logger A+ Unit B	2+100	Sroolane North	On a tree adjacent to bridge/river. Treelines and grassland	LHB (present) CP (medium) SP (medium) Leis (low) My (low)
B	23/04/2018 20:00hrs to 06:00 hrs	Wildlife Acoustics Song Meter SM3	4+350	Rincullia	On a tree adjacent to a stream, scrub and agricultural fields	CP (medium) SP (high) Leis (low)
C	23/04/2018 20:00hrs to 06:00 hrs	Wildlife Acoustics Song Meter SM2BAT	5+150	Rincullia	On a tree adjacent to treelines, scrub, agricultural fields	LHB (present) CP (high) SP (high) Leis (medium) My (low) BLE (present)
D	23/04/2018 20:00hrs to 06:00 hrs	Wildlife Acoustics Song Meter SM2BAT+	20+550	Ballyclough Bridge	On the river bank adjacent to the Ahacrohane River	LHB (present) CP (medium) SP (high) Leis (low) My (medium) Daub (medium)

Ref.	Date & Time	Unit	Chainage	Townland	Habitat Type	Bat Species (activity level)
E	23/04/2018 20:00hrs to 06:00 hrs	Eleckon Bat Logger A+ Unit A	11+350	Railway Line - Ballycullen	On the railway lines -treelines / Scrub adjacent to agricultural fields	LHB (present) CP (high) SP (high) Leis (medium)
F	24/04/2018 20:00hrs to 06:00 hrs	Wildlife Acoustics Song Meter SM3	23+800		On tree next to river and railway	LHB (present) CP (medium) SP (high) Leis (low) My (medium)
G	24/04/2018 20:00hrs to 06:00 hrs	Wildlife Acoustics Song Meter SM2BAT	25+550		On tree next to grassland and scrub	CP (medium) SP (medium) Leis (low) BLE (present)
H	24/04/2018 20:00hrs to 06:00 hrs	Eleckon Bat Logger A+ Unit B	26+400		On tree adjacent to woodland	LHB (present) CP (medium) SP (medium) Leis (low)
I	24/04/2018 20:00hrs to 06:00 hrs	Eleckon Bat Logger A+ Unit A	26+900		On tree adjacent to treelines / scrub	CP (high) SP (high) Leis (low) My (low)
J	25/04/2018 to 29/4/2018 20:00hrs to 06:00 hrs, each day (4 nights recording)	Wildlife Acoustics Song Meter SM2BAT+	50+150		On tree within an immature woodland	LHB (present) CP (medium) SP (medium) Leis (low) My (low)

Ref.	Date & Time	Unit	Chainage	Townland	Habitat Type	Bat Species (activity level)
K	25/04/2018 to 29/4/2018 20:00hrs to 06:00 hrs, each day (4 nights recording)	Wildlife Acoustics Song Meter SM2BAT	51+200		On tree along linear habitat	LHB (present) CP (medium) SP (medium) Leis (low) My (low)
L	25/04/2018 to 29/4/2018 20:00hrs to 06:00 hrs, each day (4 nights recording)	Wildlife Acoustics Song Meter SM3	51+750		On tree along linear habitat	CP (high) SP (medium) Leis (low) BLE (present)
M	25/04/2018 to 29/4/2018 20:00hrs to 06:00 hrs, each day (4 nights recording)	Eleckon Bat Logger A+ Unit A	57+350		On tree within an immature woodland	LHB (present) CP (low) SP (medium) Leis (medium)
N	25/04/2018 to 29/4/2018 20:00hrs to 06:00 hrs, each day (4 nights recording)	Eleckon Bat Logger A+ Unit B	62+450		On the railway lines -treelines / Scrub adjacent to agricultural fields	SP (medium) CP (low) Leis (medium) BLE (present) My (low) Nath pip (low)
O	29/04/2018 to 01/05/2018 20:00hrs to 06:00 hrs, each day (2 nights recording)	Eleckon Bat Logger A+ Unit A	58+000		On the railway lines -treelines / Scrub adjacent to agricultural fields	LHB (present) CP (medium) SP (low) Leis (low) My (low)

Ref.	Date & Time	Unit	Chainage	Townland	Habitat Type	Bat Species (activity level)
P	29/04/2018 to 01/05/2018 20:00hrs to 06:00 hrs, each day (2 nights recording)	Wildlife Acoustics Song Meter SM3	58+150		On fence post beside river	LHB (present) CP (high) SP (medium) Leis (low) My (low)
Q	29/04/2018 to 01/05/2018 20:00hrs to 06:00 hrs, each day (2 nights recording)	Wildlife Acoustics Song Meter SM2BAT	61+125		On tree beside river	LHB (present) CP (high) SP (high) Leis (medium) My (medium)
R	29/04/2018 to 01/05/2018 20:00hrs to 06:00 hrs, each day (2 nights recording)	Eleckon Bat Logger A+ Unit B	62+070		On tree along treeline	CP (low) SP (low)
S	29/04/2018 to 01/05/2018 20:00hrs to 06:00 hrs, each day (2 nights recording)	Wildlife Acoustics Song Meter SM2BAT	63+200		On the railway lines -treelines / Scrub adjacent to agricultural fields	CP (low) SP (low)

Common and soprano pipistrelle were detected at all 19 stations, confirming that these are the two most common bat species in the survey area. Common pipistrelle was detected at a high level of bat activity at six static stations while soprano pipistrelle was detected with high levels of activity at seven static stations. Leisler's bats were detected at 17 (90%) of the stations, generally with low to medium levels of bat activity, indicating commuting individuals. *Myotis* species were recorded at eleven of the stations and generally the bat activity level of these species was deemed to be low. Brown long-eared bats were present in vicinity of four static stations, while Nathusius' pipistrelle was only recorded at one static station (Ref. N in Tables 7 and 8; chainage 62+450).

Table 8 Summary of results from static stationary units

Blue Shading = High level of activity

Species: 'LHB' = lesser horseshoe bat; 'CP' = common pipistrelle; 'SP' = soprano pipistrelle; 'Leis' = Leisler's bat; 'BLE' = brown long-eared bat; 'Nathpip' = Nathusius' pipistrelle; 'My' = *Myotis* species

Station	LHB	CP	SP	Leis	BLE	Nath Pip	My
A	Yes	Yes	Yes	Yes			Yes
B		Yes	Yes	Yes			
C	Yes	Yes	Yes	Yes			Yes
D	Yes	Yes	Yes	Yes			Yes
E	Yes	Yes	Yes	Yes			
F	Yes	Yes	Yes	Yes			Yes
G		Yes	Yes	Yes	Yes		
H	Yes	Yes	Yes	Yes			
I		Yes	Yes	Yes			Yes
J	Yes	Yes	Yes	Yes			Yes
K	Yes	Yes	Yes	Yes			
L		Yes	Yes	Yes	Yes		
M	Yes	Yes	Yes	Yes			
N		Yes	Yes	Yes	Yes	Yes	Yes
O	Yes	Yes	Yes	Yes			Yes
P	Yes	Yes	Yes	Yes			Yes
Q	Yes	Yes	Yes	Yes			Yes
R		Yes	Yes				
S		Yes	Yes				
Total	12	19	19	17	3	1	10

3.2.4 Additional Building Surveys – 2018 and 2019

Eight buildings/structures were investigated in 20th, 21st, 22nd, 24th August 2018 and 17th and 18th 2019 by Bat Eco Services. These included the following buildings/structures at the stated chainages. Results of these surveys are presented in Table 9, below.

- 11+900 Un-occupied cottage;

- 20+700 Pill box;
- 27+000 Occupied house;
- 27+050 Occupied house;
- 27+650 Occupied house;
- 61+150 Un-occupied house (renovation works on-going);
- 61+100 Quay Keeper's cottage;
- 62+500 Farm yard;
- 20+600 Derelict Schoolhouse (Figure 16); and
- 22+550 Derelict Building (Figure 17).



Figure 16 Derelict school house at chainage 20+600.



Figure 17 Ruins located at chainage 22+550 in dense vegetation.

The results of these surveys are presented in Table 9, below.

Table 9 Survey results of buildings / structures investigated in 2018 and 2019

Species: 'LHB' =lesser horseshoe bat; 'CP' = common pipistrelle; 'SP' = soprano pipistrelle; 'Leis' = Leisler's bat; 'BLE' = brown long-eared bat; 'Nathpip' = Nathusius' pipistrelle; 'My' = *Myotis* species; 'Natt' = Natterer's bat

#	Survey Type(s)	Date & Time	Surveyor #	Weather Conditions	Location		Results
					Chainage	Description	
1	Dawn	22/06/2018 03:30hrs to 05:00 hrs	1	Dry, clear sky, calm, 12°C	11+900	Unoccupied cottage	Two SP recorded returning to roof of building at dawn. Satellite roost
2	Dusk to Dawn – Static x 1 (in structure)	21/06/2018 21:00hrs to 01:00 hrs	1	Dry, clear sky, calm, 17°C	20+700	Pill box	No evidence of bat usage during daytime inspection. No bats detected. However, suitable as a night roost .
3	Dusk; Static x 1 (in adjacent field)	21/06/2018 22:20hrs to 23:50 hrs	1	Dry, clear sky, calm, 17oC	27+000	Occupied house	No bats roosting in building Dusk: Commuting SP and BLE to rear of buildings along woodland edge. Leis also recorded foraging in adjacent field. Statics: Leis – 2 passes BLE – 1 pass CP – 54 passes <i>Myotis</i> spp. – 12 passes
4	Dusk	24/08/2018 20:40hrs to 22:15 hrs	2	Occasional rain showers, patchy cloud cover, breezy, 12oC	27+050	Occupied house	No bats roosting in building. Dusk: Commuting SP and BLE to rear of buildings along woodland edge. Leis also recorded foraging in adjacent field.
5	Dusk	21/06/2018 22:20hrs to 23:50 hrs	2	Dry, clear sky, calm, 17oC	27+650	Occupied house	No bats roosting in building. Commuting / foraging bats along treelines: CP and Leis

#	Survey Type(s)	Date & Time	Surveyor #	Weather Conditions	Location		Results
					Chainage	Description	
6	Dusk	20/06/2018 22:00hrs to 23:40 hrs	1	Dry, patchy cloud cover, calm, 14oC	61+150	Cottage undergoing renovation works	No bats roosting in building. Commuting / foraging bats along treelines: SP, CP, My and Leis
7	Static x 2 (one in building; other adjacent to stone wall)	21/06/2018 22:00hrs to 05:00 hrs	1		61+100	Quay Keeper's Cottage – derelict	Static in building: SP and CP. Likely night roost
8	Dusk; Static x 4	20/06/2018 22:00hrs to 00:00 hrs	2	Dry, patchy cloud cover, calm, 14oC	62+500 to 62+600	Farmyard	Leis, CP and SP commuting and foraging throughout the farmyard. Statics in stable courtyard: CP: 7 passes SP: 4 passes Leis: 3 passes Static in open barn: CP: 66 passes SP: 25 passes Leis: 2 passes Static in closed barn: CP: 36 passes SP: 3 passes Bat droppings were recorded on the floor of this building below insulation. Satellite roost

#	Survey Type(s)	Date & Time	Surveyor #	Weather Conditions	Location		Results
					Chainage	Description	
9	Dusk (road); Static x 1 (near rear of building)	17/8/2019 20:50 hrs to 22:30 hrs	1	Dry, patchy cloud cover, 15°C, dry	20+600	Derelict schoolhouse, partial roof, extensive dense vegetation growth (access not possible)	Leis (1 st bat recorded at 21:15 hrs), SP (1 st bat recorded at 21:31 hrs), CP (1 st bat recorded at 21:46 hrs) and Natt (1 st bat recorded at 21:43 hrs) foraging around structure. Single SP likely to have emerged from structure but due to extensive vegetation, not 100% possible to confirm this. Static (passes / night): Natt: 13 passes Leis: 15 passes BLE: 7 passes CP: 47 passes SP: 39 passes Potential satellite roost
10	Dawn (road and laneway); Static x 1 (under tree canopy at rear of ruin, adjacent to stream)	18/8/2019 05:00hrs to 06:10 hrs	1	Rain showers, patchy cloud cover, 11.5°C, light wind.	22+550	Derelict structure covered in dense ivy and dense vegetation. Inspection was not possible due to vegetation.	Due to rain showers, bats only detected when rain stopped at 05:50 hrs. Two SP foraged above /along adjacent treelines. These bats not detected entering ruin but visibility greatly reduced due to density of vegetation. Static: Single SP at 21:19 hrs. Length of FM portion of call indicated that bat was within wooded area and not commuting above treeline.

3.2.5 Tree Surveys

Mature trees along the proposed development were examined and noted if they have bat roosting potential. The results of these surveys (completed on the 20th, 21st and 22nd June 2018) are presented in Table 10, below. Trees deemed to be PBRs (of which there were 103) were identified at 51 locations in the study area. This majority of these trees have been classified as Category 2 trees.

Table 10 Results of tree surveys, 2018

Site #	Location			No. Trees	Category (Collins, 2016)
	Grid Reference	Chainage	Description		
1	R2661650131	2+100	Along WL2	1	2
2	R2698149551	2+800	Along GA1	1	2
3	R3043049216	6+300	Along WL2	1	2
4	R3064449204	6+500	Along WL2	1	2
5	R3067049316	6+550	Along WL2	1	2
6	R3164249459	10+150	Boundary of GS4	1	2
7	R3190149548	10+450	Along WL1	1	2
8	R3163148659	20+650 to 20+700	Along WL2	3	2
9	R3168948417	20+850 to 20+950	Along WL2	4	2
10	R3220548520	21+350 to 21+400	Boundary of WD1	3	2
11	R3447946980	24+350	Boundary of WD1	5	2
12	R3453046713	24+550 to 24+650	Along W4	4	2
13	R3456946547	24+800	Along W4	1	2
14	R3457846207	25+150	Along WL2	1	2
15	R3509945776	25+750	Within GS1	1	2
16	R3521045066	26+750	Along local road	1	2
17	R3570844905	26+800 to 27+050	Within WDI	8	Mixed
18	R3572944584	27+100	Along WL2	1	2
19	R3587044459	27+250	Along WL1	1	2
20	R3590444384	27+350	Along WL1	1	2
21	R3601444150	27+550	Along railway line	1	2

Site #	Location			No. Trees	Category (Collins, 2016)
	Grid Reference	Chainage	Description		
22	R3621243561	28+250	Along WL	1	2
23	R3630343379	28+450	Along WL1	1	2
24	R2627843134	28+650	Along WL1	1	2
25	R3603142270	51+400	Along WL2	3	2
26	R3724342559	52+600	Along WL2	2	2
27	R3759642623	53+000	Along WL1	3	2
28	R3778842624	53+150	Along WL2	1	2
29	R3785642640	53+250	Along WL2	1	2
30	R3808542744	53+500	Along WL1	3	2
31	R3827342907	53+750	Along WL1	3	2
32	R3851243089	54+000	Along WL1	3	2
33	R3862343177	54+150	Along WL1	3	2
34	R4123443867	57+000	Along WL2	2	2
35	R4130843962	57+050 to 57+150	Along WL1	4	2
36	R4164344196	57+450	Along WL2	2	2
37	R4225944865	58+400	Along WL1	1	2
38	R4248145083	58+750	Along WL1	1	2
39	R4385146395	60+600	Along WL2	2	2
40	R4392646413	60+700	Along WL2	2	2
41	R4397546501	60+800	Along WL2	1	2
42	R4394146500	60+900	Along L1422	3	2
43	R4429246551	61+100	Within GA1	1	1

Site #	Location			No. Trees	Category (Collins, 2016)
	Grid Reference	Chainage	Description		
44	R4512846991	62+000	Along WL1	1	2
45	R4616547039	63+050	Along WL2	3	2
46	R4622747079	63+150	Along railway line	1	2
47	R4682747347	63+800	Along WL2 - 2	2	2
48	R4699347065	63+750	Along boundary WD1	4	Mixed
49	R4713147148	63+950	Within WD1	4	Mixed
50	R4784747556	64+800	Within GA1	1	2
51	R4898247713	66+000	Along boundary GA2	1	1

4. DESKTOP STUDY

4.1 Introduction

Figure 18 depicts the bat records within a 5km radius of the proposed road development on the BC Ireland database. This dataset consists of 806 bat records. The number of records for each species is as follows:

LHB:	27 records;
Common pipistrelle	231 records;
Soprano pipistrelle	199 records;
<i>Pipistrellus</i> species	89 records;
Leisler's bat	137 records;
<i>Myotis</i> species	5 records;
Daubenton's bat	39 records;
Natterer's bat	1 record;
Brown long-eared bat	10 records; and,
Nathusius' pipistrelle	1 record.

Figure 19 depicts the BC Ireland Landscape Favourability Model (Lundy *et al.*, 2011). The county is divided into 5km squares and the darker the shading of the square, the higher favourability of the 5km square for bats. There are a number of high favourability 5km squares located to the east and north of the proposed development and these squares coincide with important areas for local populations of bats (e.g. Curraghchase Forest Park).

The Four Season Bat Survey carried out for the purposes of the proposed development recorded all nine resident Irish bat species in vicinity of or within the site of the proposed road development. This section presents a description of the species in question in terms of their ecological requirements and, accordingly, their sensitivity to environmental change in the study area. Each bat species has their own specific ecological requirements, which vary according to their roosting and foraging preferences. These requirements determine the potential impacts of the proposed road development due to potentially varying effects of the road on habitats (e.g. fragmentation). This section also presents a list of bat roosts previously identified in the west Co. Limerick area.

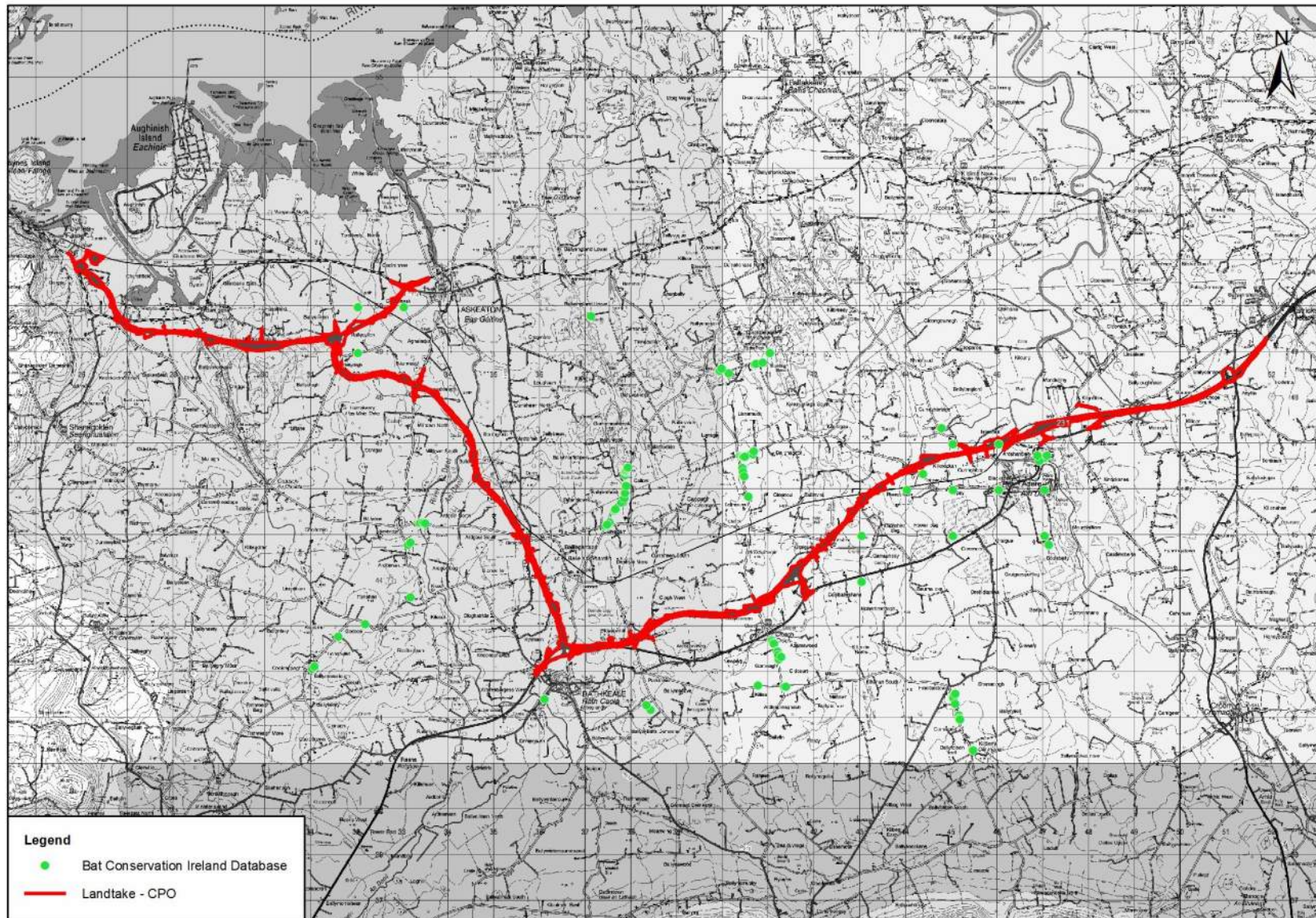


Figure 18 BC Ireland database records within 5km radius of proposed road development.

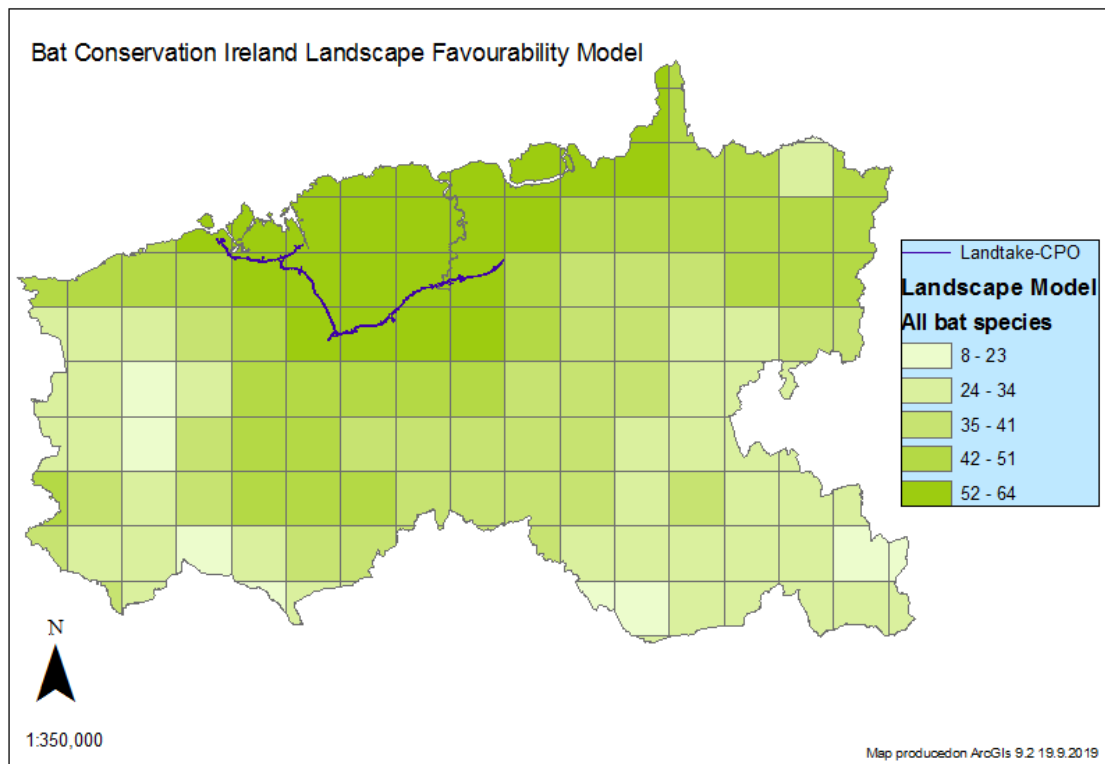


Figure 19 Proposed road development overlaid on the BCireland Landscape Model for Co. Limerick

4.2 Previously Identified Bat Roosts in West Co. Limerick

A baseline survey of buildings near deciduous woodland that may be suitable as LHB summer roosts in the west Limerick area was carried out by Dr. Niamh Roche in 1997 for the *Vincent Wildlife Trust* (Roche, 2001). This survey identified several new roosts of this and other bat species in the area although none was or is located immediately adjacent to the proposed road development. The locations of these roosts and others which were since discovered have been reviewed for this assessment. Note that the focus of the 1997 survey was the LHB, and that there are likely to be many roosts of other bat species in the area and other, still unknown, roosts of LHBs may also be present. Two roosts of brown long-eared bats were discovered in April 2002 in the grounds of Adare Manor (Kelleher, pers. obs.). One was located in the old gamekeepers' lodge and one in a tree near the River Maigue. Neither will be directly impacted by the proposed road development.

4.3 Ecological Requirements of Species Recorded

4.3.1 Lesser Horseshoe Bat (*Rhinolophus hipposideros*)

Figure 20 depicts the LHB records within a 5km radius of the proposed road development from the BCireland database. During the surveys, this species was recorded along much of the length of the proposed road development on static recording units.

The knowledge of roosting sites for this species is extensive as a result of an intensive survey completed in six Counties by the VWT between 1994 and 2004 (McAney *et al.*, 2013). In general, this species has a preference for buildings constructed prior to the 1900s, built of stone with slate rooves (Schofield, 2008). Such sites are also relatively undisturbed and uninhabited by people. Kelleher, (2006), documented a demise in the quality of buildings used by LHBs in Ireland;

many summer roosting sites are now in one-storey buildings often roofed with corrugated iron and this may be a indication that optimal sites are less available to the species (McAney *et al.*, 2013). Hibernation sites in Ireland are typically found underground, although at a number of buildings, bats are recorded in ground storey rooms during the winter months and there is a general trend in such hibernacula towards greater numbers of bats in buildings with two storeys or more (Roche *et al.*, 2012). As stated previously, the BCIreland Landscape Model indicates that the species' habitat preference is for areas with broadleaf and mixed woodland and that a mosaic of habitats is important (Roche *et al.*, 2014). One of the principal issues for LHBs commuting in the landscape is the need for continuous linear habitats to fly along (i.e. flight corridors). The VWT prepared a map of potentially important flight paths for LHBs in the Limerick landscape, linking the Curraghchase SAC to the south of the county. This map has been overlaid with the proposed road development (Figure 21) and the combined map highlights a number of locations where commuting bats are likely to occur (e.g. Rathkeale area).

Compared to other regions on the west coast of Ireland, where this species is found, the number of individuals and roosts is considered to be low in Co. Limerick. As such, the County population is considered to be vulnerable. As discussed previously, the modelled Core Area for LHBs is a relatively small area is restricted to the Counties on the western seaboard (5,993km²). Given this small range, significant impacts on this species may occur even with small levels of habitat modification or changes to roost availability.

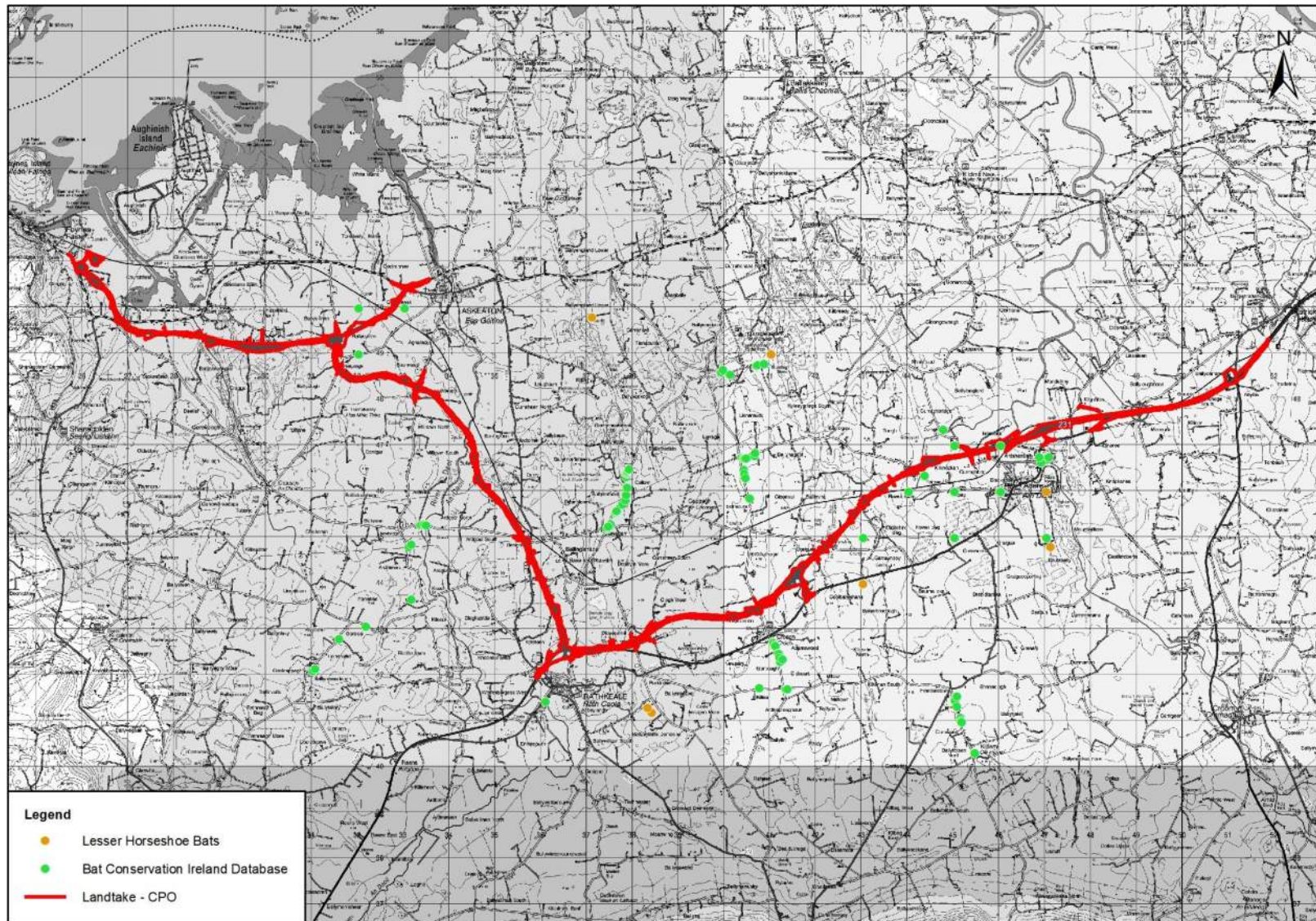


Figure 20 BCIreland Bat Database LHB records within 5km radius of proposed road development.

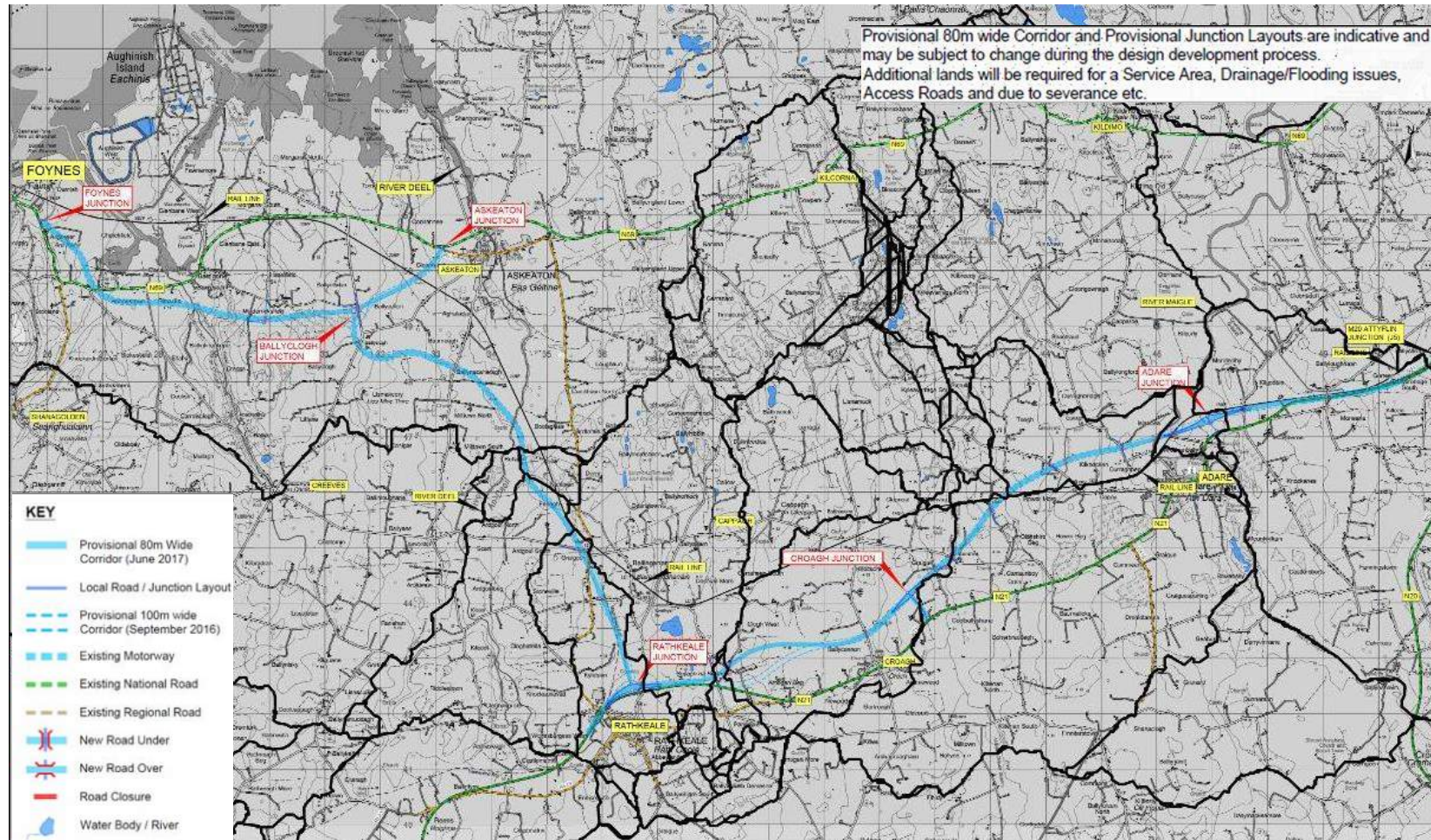


Figure 21 LHB flight paths (reported by the VWT in black) and the route of the proposed road development.

Examining the BC Ireland Landscape Model for LHBs is important as there are concerns about the vulnerability of this species' population in Co. Limerick, as discussed earlier in the report (Section 2.2). The majority of LHB records collated by the static recording units coincide with 5km squares of medium or greater landscape favourability for the species.

Table 11 Lesser horseshoe bat conservation status

Irish Status	Least Concern
European Status	Least Concern
Global Status	Near threatened
Estimated Irish Population Size	14,000 (2010-2011)
Irish Population Trend	1993-2013 Increasing trend in 2003 to 2005, stable after this.
Estimate Core Area (km²)	5,993 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

The principal conservation concerns for the LHB in Ireland are as follows:

- Roost loss as a result of demolition / deterioration / renovation of old buildings;
- Loss of commuting routes linking roosts to foraging sites; and
- Loss of foraging habitat as a result of land use change (Marnell *et al.*, 2009).

4.3.2 Leisler's Bat (*Nyctalus leisleri*)

This species was recorded along much of the length of the proposed road development on static recording units and during the walking transects.

The majority of records held by BC Ireland for this species are bat detector records, as opposed to roost records. Of the known roost records, the majority of roosts are located in buildings, with the remainder in bat boxes and trees. Studies have shown that this species is very transient. Autumnal roosting sites and, therefore, potentially also winter hibernation sites, may be situated exclusively in trees. The BC Ireland Landscape Model indicates that the species habitat preference has been difficult to define in Ireland. Habitat modelling for Ireland shows an association with riparian habitats and woodlands (Roche *et al.*, 2014). The landscape model emphasises that, unlike other resident Irish bat species, the Leisler's habitat preference cannot be defined at a local scale; rather, this is a 'landscape species' which exhibits habitat preference at a scale of 20.5km. In addition, of all Irish bat species, Leisler's bats have the most specific roosting requirements. The species tends to select roosting habitat with areas of woodland and freshwater.

Ireland's population of the species is considered to be of international importance. That coupled with the paucity of knowledge of its roosting sites makes the species vulnerable. However, the species is believed to have a widespread distribution across the country and the modelled Core Area for Leisler's bat is relatively large, covering much of the island (52,820km²).

Table 12 **Leisler's bat conservation status**

Irish Status	Near Threatened
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	73,000 to 130,000 (2007-2013) Ireland is considered the world stronghold for this species
Irish Population Trend	2003-2013 ↑
Estimate Core Area (km²)	52,820 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche et al., 2014

The principal conservation concerns for Leisler's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Specificity of selection of maternity sites;
- Poor knowledge of roost sites;
- Tree felling, especially during autumn and winter months; and
- Increasing urbanisation.

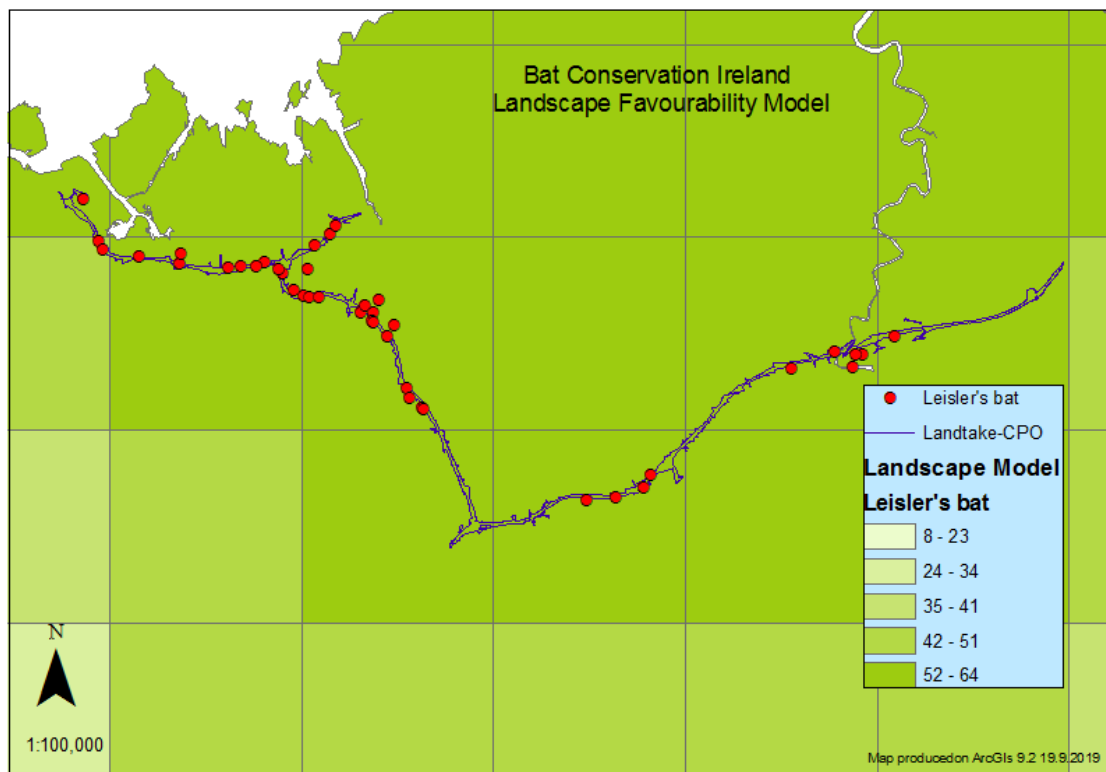


Figure 22 **Locations where Leisler's bat was recorded during spring walking surveys and static surveys, 2018, overlaid on BC Ireland Landscape Model for the species.**

4.3.3 Brown Long-eared Bat (*Plecotus auritus*)

This species was only occasionally encountered during surveys. However, it may have been under-recorded due to its quiet echolocation calls, which make detection difficult.

The species is generally considered to be widespread across the island, but only a few records exist for Co. Limerick. The modelled Core Area for the species is relatively large, covering much of the island of Ireland (52,820km²), with preference suitable areas in the southern half of the island. The BCIreland Landscape Model indicates that the species' habitat preference is for areas with broadleaf woodland and riparian habitats on a small scale of 0.5km, emphasising the importance of local landscape features for this species (Roche *et al.*, 2014). Roche *et al.* (2014) report that the vast majority of known roosts are in buildings close to woodland habitat, but there is a paucity of information in relation to winter roosting sites of the species.

Table 13 Brown long-eared bat conservation status

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	64,000 to 115,000 (2007-2012)
Irish Population Trend	2008-2013 Stable
Estimate Core Area (km²)	49,929 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

Principal conservation concerns for the brown long-eared bat are poorly known in Ireland, but those that are relevant for this survey area are as follows:

- Specificity of selection of maternity sites;
- Lack of knowledge of winter roosts;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

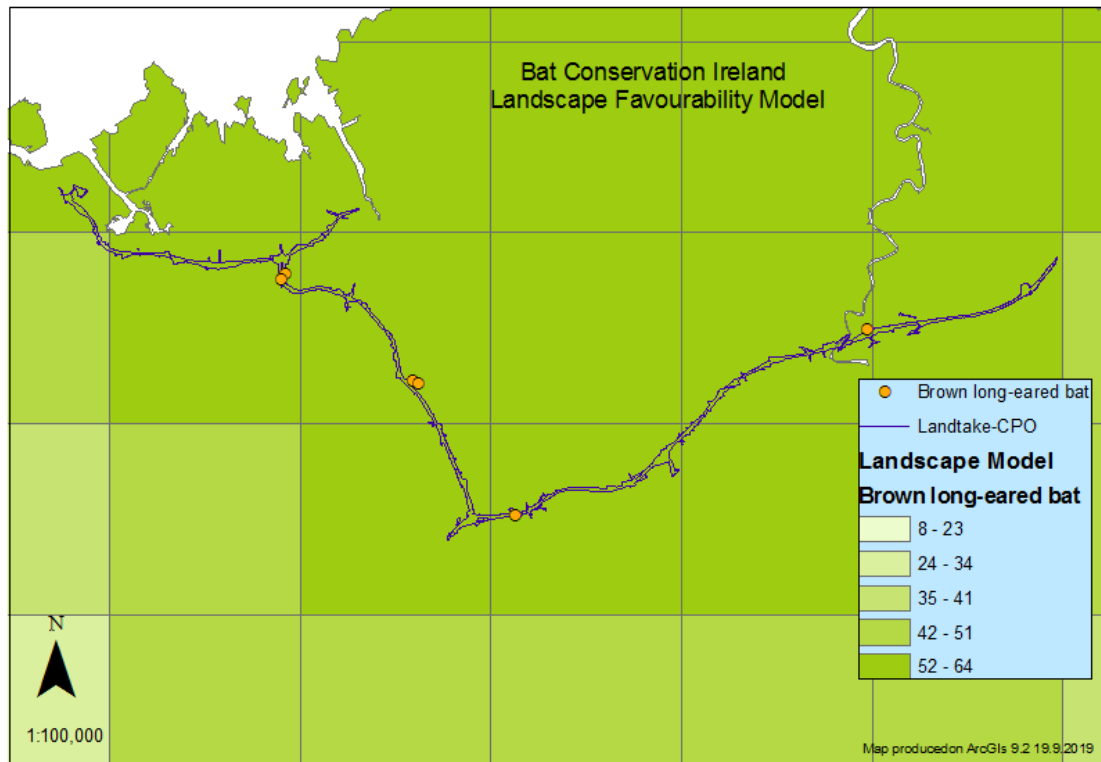


Figure 23 Locations where brown long-eared bat was recorded during spring walking surveys and static surveys, 2018, overlaid on BCireland Landscape Model for the species.

4.3.4 Natterer's Bat (*Myotis nattereri*)

This species was rarely encountered during surveys. However, unidentified *Myotis* species echolocation calls were regularly recorded on the static units, many of which are likely to belong to this species, especially in relation to the static units located away from waterbodies. As such, it is likely that the species is more widespread in the study area than the results of the survey would seem to indicate.

The modelled Core Area for the species is relatively large, covering much of the island of Ireland (52,864km²). The BCireland Landscape Model indicates that the species has a preference for areas with broadleaf woodland, riparian habitats and areas with larger scale provision of mixed woodland (Roche *et al.*, 2014). Therefore, it is likely that this species is more widespread within the survey area than the surveys would indicate. Roche *et al.* (2014) report that this species is likely to use an array of structures as roosting sites including buildings and bridges.

Table 14 Natterer's bat conservation status

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	Unknown
Irish Population Trend	Unknown
Estimate Core Area (km²)	52,864 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

Principal conservation concerns for Natterer's bats in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements;
- Complex habitat requirements in the immediate vicinity of roosts – careful site specific planning is required in order to ensure all elements are present;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

4.3.5 Whiskered Bat (*Myotis mystacinus*)

This species was rarely encountered during surveys. However, unidentified *Myotis* species echolocation calls were regularly recorded on the static units, some of which may likely to belong to this species, especially in relation to the static units located away from waterbodies and in woodlands. As such, it is likely that the species is more widespread in the study area than the results of the survey would seem to indicate. However, this species is likely to Ireland's rarest bat.

Roche *et al.* (2014) report that the majority of known roosts for this species are in buildings, and usually of stone construction. The BCIreland Landscape Model for the species is the smallest of all the *Myotis* bats. It is restricted to the southern and eastern half of the country (Roche *et al.*, 2014). It is positively associated with woodland and wooded riparian valleys.

Table 15 Whiskered bat conservation status

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	Unknown
Irish Population Trend	Unknown
Estimate Core Area (km²)	29,222 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

Principal conservation concerns for Natterer's bats in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements and roosting sites;
- Riparian habitat loss
- Lack of knowledge of swarming behaviour, requirements or sites;
- Agricultural intensification, loss of woodland and similar habitats;
- Renovation or demolition of derelict buildings;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

4.3.6 Nathusius' Pipistrelle (*Pipistrellus nathusii*)

This species was only encountered once during the surveys. There is also only one record of the species on the BCIreland database in the study area.

The modelled Core Area for the species is relatively restricted (13,543km²) and these areas are primarily associated with large water bodies such as Lough Neagh and the

Lough Erne complex. The BC Ireland Landscape Model indicates that the species exhibits a habitat preference for large waterbodies (Roche *et al.*, 2014). Roche *et al.* (2014) report only five known roost records in the Republic of Ireland, none of which are maternity roosts. Maternity roosts have only been documented in Northern Ireland. Roosts in the Republic of Ireland tends to occur in older buildings of natural stone. Due to the paucity of information on this species, any records of this species are important.

Table 16 Nathusius' pipistrelle conservation status

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	10,000 to 18,000 (2007-2013)
Irish Population Trend	2003-2013 (limited data, probably stable)
Estimate Core Area (km²)	13,543 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

The principal conservation concerns for Nathusius' pipistrelle are as follows:

- Lack of knowledge of roosting sites in Republic of Ireland;
- Lack of knowledge of winter sites and whether migration occurs;
- Risk of roost loss as a result of renovation or demolition of buildings / structures; and
- Water pollution in lakes.

4.3.7 Daubenton's Bat (*Myotis daubentonii*)

This species was recorded along waterbodies within the survey area, which is the typical habitat for foraging Daubenton's bats.

The modelled Core Area for Daubenton's bats is relatively large, covering much of the island of Ireland (41,285km²), reflecting the distribution of sizeable river catchments. The BC Ireland Landscape Model for the species indicates a habitat preference for areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.*, 2014). Roche *et al.* (2014) report that the majority of roost records for this species are in bridges. Confirmed hibernacula are rare but have tended to be underground sites such as caves.

Table 17 Daubenton's bat conservation status

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	81,000 to 103,000 (2007-2012)
Irish Population Trend	2008-2013 Stable
Estimate Core Area (km²)	41,285 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

Principal conservation concerns for Daubenton's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Potential roost loss due to bridge maintenance;
- Loss of woodland and forest clearance;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

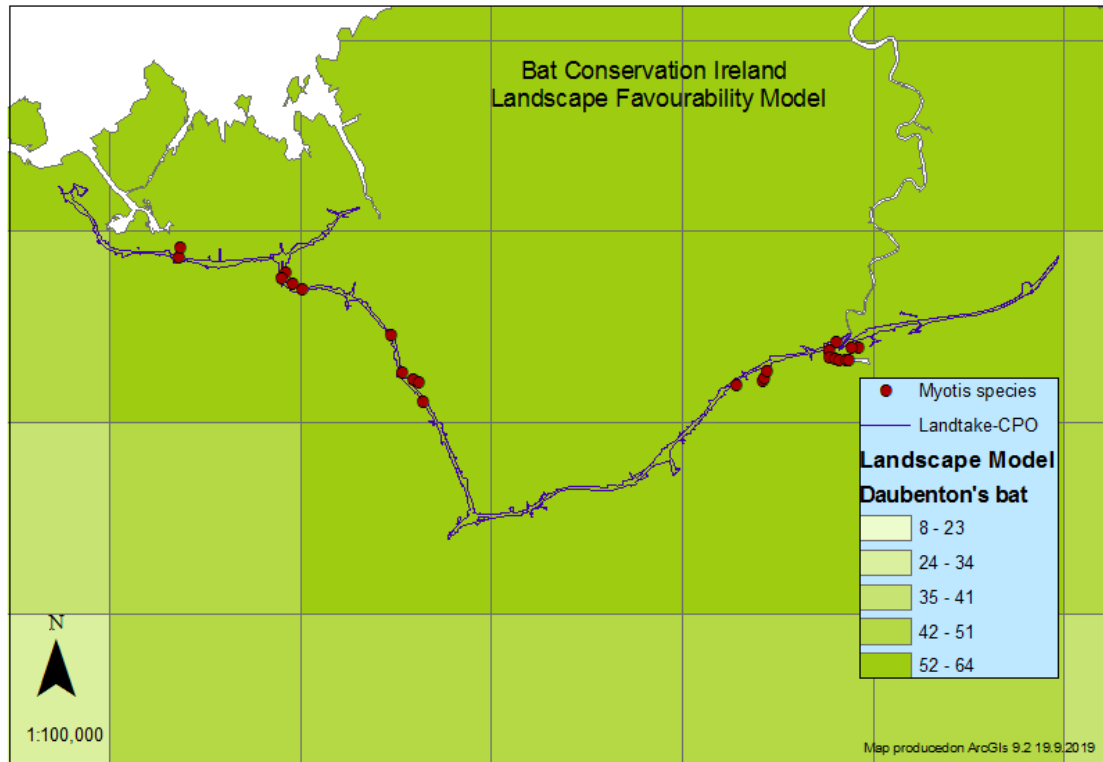


Figure 24 Locations where Daubenton's bat was recorded during spring walking surveys and static surveys, 2018, overlaid on BCireland Landscape Model for the species.

4.3.8 Common Pipistrelle (*Pipistrellus pipistrellus*)

This species was the most commonly recorded of all bats during the surveys.

Indeed, the species is generally considered to be the most common in Ireland. Its distribution is widespread (found in all provinces). The modelled Core Area for the species is large, covering much of the island of Ireland (56,485km²) which covers primarily the eastern and south-eastern parts of the study area (Roche *et al.*, 2014). The BCireland Landscape Model indicates that the species favours areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.*, 2014). Roche *et al.* (2014) reported that this species roosts in an array of building types in the summer but that there is little knowledge of winter roosting requirements.

Table 18 Common pipistrelle conservation status

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	1.2 to 2.8 million (2007-2012)
Irish Population Trend	2003-2013 ↑
Estimate Core Area (km²)	56,485 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

Principal conservation concerns for common pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements;
- Complex habitat requirements in the immediate vicinity of roosts - careful site specific planning is required in order to ensure all elements are present;
- Roost loss as a result of renovation or demolition of derelict buildings;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

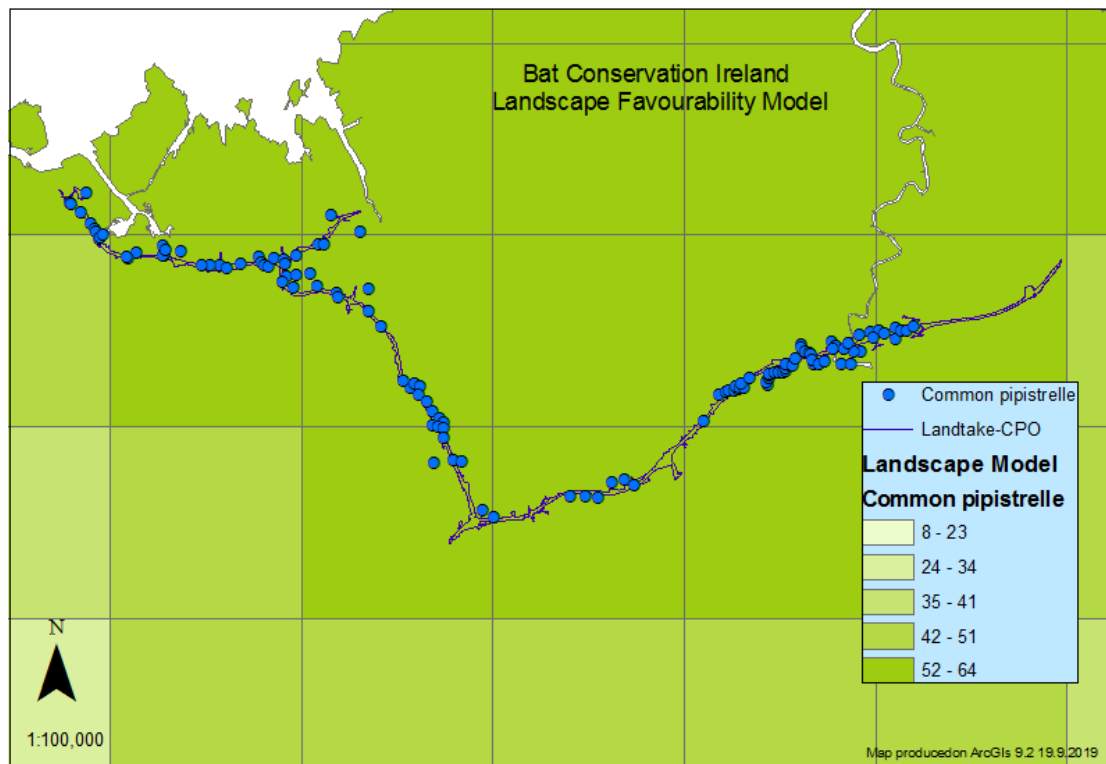


Figure 25 Locations where common pipistrelle were recorded during spring walking surveys and static surveys, 2018, overlaid on BC Ireland Landscape Model for the species.

4.3.9 Soprano Pipistrelle (*Pipistrellus pygmaeus*)

This species was the second most recorded species during the surveys. Indeed, it is generally considered to be the second most common bat species in Ireland. Its distribution is widespread (found in all provinces), with particular concentration along the western seaboard. The modelled Core Area for the species is large, covering

much of the island of Ireland (62,020km²). The BC Ireland Landscape Model for the species indicates a preference for areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.*, 2014). Roche *et al.* (2014) reported that species roosts in an array of building types in the summer but that there is little knowledge of winter roosting requirements. Analysis has shown that this species has a preference for brick-constructed buildings during the maternity season.

Table 19 Soprano pipistrelle conservation status.

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Estimated Irish Population Size	0.54 to 1.2 million (2007-2012)
Irish Population Trend	2003-2013 ↑
Estimate Core Area (km²)	62,020 (Lundy <i>et al.</i> , 2011)

Source: Unless otherwise stated, Roche *et al.*, 2014

Principal conservation concerns for soprano pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosts;
- Risk of roost loss as a result of renovation or demolition of structures;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

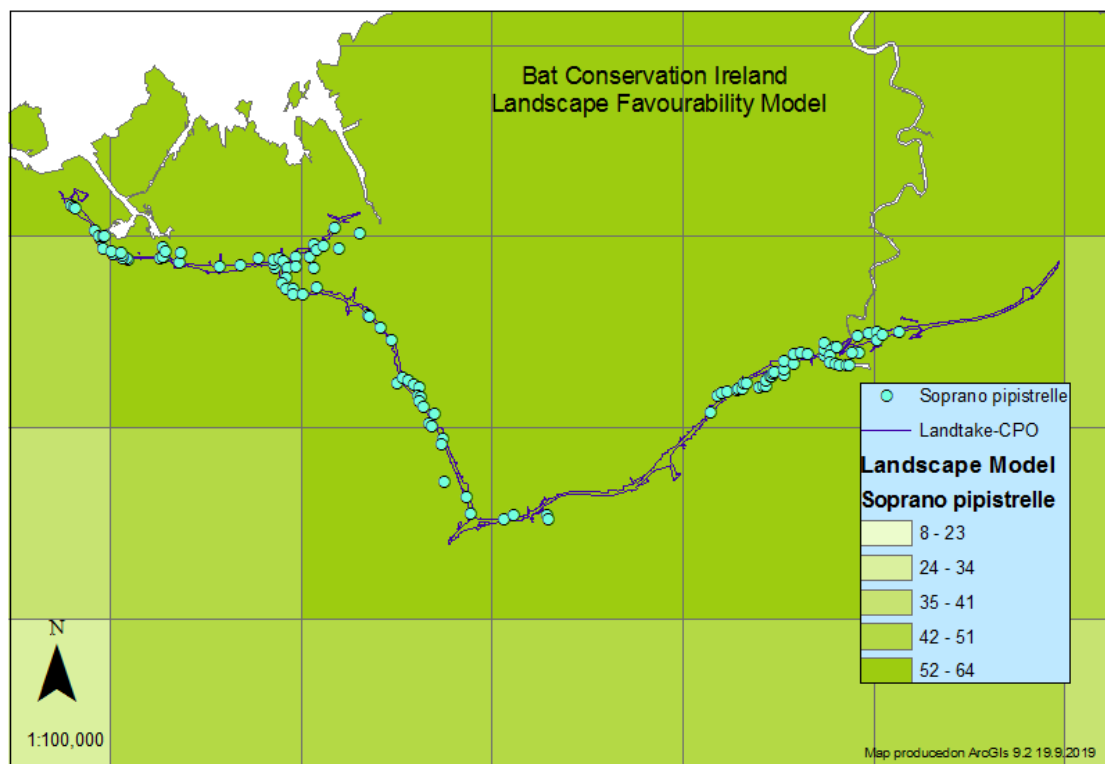


Figure 26 Locations where soprano pipistrelle were recorded during spring walking surveys and static surveys, 2018, overlaid on BC Ireland Landscape Model for the species.

5. SIGNIFICANCE OF STUDY AREA

In consideration of the results (Section 2.5), and findings of the desktop study (Section 2.6), this section describes the significance of the study area in respect of the bat species recorded. It assigns ecological values to the species recorded in the context of the study area, and identifies flight corridors and areas of foraging habitat in the study area that will require protection.

5.1 Ecological Valuation of Species Recorded in the Study Area

In light of the findings of the four season bat surveys and the desktop study, the following ecological values have been assigned to the individual bat species, as they occur in the study area (Table 20).

Table 20 Ecological valuation of bat species recorded in the study area during the surveys (as per CIEEM, 2016)

Ecological Value	Species
International	LHB Leisler's bat
National	Whiskered bat Nathusius' pipistrelle
Regional	Brown long-eared bat Natterer's bat
County	Daubenton's bat
Local	Soprano pipistrelle Common pipistrelle
Negligible	-

5.2 Ecological Valuation of Habitats in the Study Area

For the purposes of this ecological assessment, the habitats adjacent to the proposed development may be considered in terms of extent, diversity, naturalness, rarity, fragility, typicalness, recorded history, position, potential value and intrinsic appeal (Regini, 2000). The potential of these habitats for bat fauna is considered in this framework also. In the following statements, the ecological value of the habitat types found in the study area are defined.

Agricultural Grasslands

This habitat is present within the survey area as agricultural blocks surrounded by linear habitats. These agricultural blocks and associated hedgerows / treeline boundaries provide foraging habitat for common bat species especially common pipistrelle and Leisler's bat. Habitat type may be considered to have Low to Medium ecological value.

Hedgerows, Treeline Boundaries and Access Tracks

These habitat types are present around agricultural blocks, boundaries of the survey area, roadways and along the disused railway. They act as ecological corridors for wildlife and foraging areas for many bat species. They may also provide roosting sites. Bats may use trees with heavy ivy growth as occasional roosts, and they may use mature trees with tree holes etc., as roosting sites all year around. A tree assessment in relation to Potential Bat Roosts was undertaken and 103 trees,

located on the line of the proposed road development, were deemed to be PBRs, the majority of which are classed as C-value PBRs. The total lengths of treeline and hedgerow removal by the proposed road development is 36.67km. These habitat types may be considered to have High ecological value.

Areas of Scrub and Woodland

The survey area includes some large areas of scrub and woodland, much of which are associated with waterbodies. This provides a mosaic of habitat which is essential for foraging and commuting bat species such as LHBs. Variable in species composition, any areas of scrub can provide foraging areas for bats with some commuting potential. Scrub and woodland may also contain trees which provide roost sites, as discussed above. Approximately 7.9 hectares of woodland and/or scrub will be removed also. The importance of this habitat type is greater when associated with riparian ditches and treelines / hedgerows. This habitat type may be considered to have High Local ecological value for bats.

Turloughs / Riparian Linear Habitats

There is a large array of riparian ditches and rivers (of various sizes) throughout the survey area with a small number of open water (e.g. turloughs). Where these are located adjacent to scrub, hedgerows / treelines, their value to bats is higher and creates an area of high ecological value for commuting and foraging bats. These habitat types may be considered to have High ecological value for bats, especially rivers, which provide an essential commuting route through the landscape.

Disused Railway Line

A disused railway line traverses the survey area and provides an essential commuting route for the majority of bat species recorded. Also, because the railway is associated with scrub, hedgerows and treelines (as a result of it being abandoned) its value to bats, in terms of commuting and foraging, is higher than it would otherwise be. This habitat may be considered to have High ecological value for bats, especially where it crosses rivers, which also provide an essential commuting route through the landscape. Collectively, the rivers and the railway line are extremely important for local bat populations of west Co. Limerick.

Buildings

An extensive array of buildings are located adjacent to the survey area while a small number of buildings are located within the survey area. Such buildings may provide roosting sites for bats. A number of buildings have been surveyed as part of the proposed road development, some of which have been recorded as bats roosts (satellite and night roosts). In addition, a small number of buildings (primarily residential buildings and agricultural buildings) and structures (bridges) were recorded as bat roosts or potential bat roosts, but these were located outside the survey area. In general, surveying was concentrated along the proposed road development and, therefore, little information has been gathered on potential roosting sites adjacent to the proposed road development. Of the small number of buildings located within the study area, some provide occasional roosting potential for bats. Most of these buildings are associated with hedgerows and treelines, which increases their ecological value to bats. This habitat type may be considered to have medium ecological value for bats.

Bats are extremely transient animals, moving between summer, autumn, winter and spring roosting sites and the typical farmed landscape of the survey area and adjacent diverse habitats provides an array of building with supporting commuting

network (treelines, hedgerows and stone walls) and foraging habitat (scrub, woodland, treelines, hedgerows and local road network) that is essential for a healthy local bat population. This diversity is typical example of Irish landscapes.

5.3 Commuting Corridors in the Study Area

In light of the results of the surveys, the following areas are considered to be important commuting corridors for bat species:

1. Chainage 2+150 – River (Static Station A in Tables 7 and 8)

LHBs (plus four other bat species, including *Myotis* species likely to be Daubenton's bat) were recorded on a static unit to the north of this chainage. The unit was located adjacent to the river which flows under the proposed road further south.

2. Chainage 5+150 – Woodland (Static Station C in Tables 7 and 8)

LHBs (plus four other bat species, including *Myotis* species likely to be Natterer's bat) were recorded on a static unit to the north of this chainage. The unit was located along a treeline / woodland. There was a high level of bat activity at this station.

3. Chainage 20+550 – Ballyclogh Bridge (Static Station D in Tables 7 and 8)

LHBs (plus five other bat species, including unconfirmed *Myotis* species and confirmed Daubenton's bat) were recorded on a static unit adjacent to this chainage. The unit was located on the banks of the river. There was a high level of bat activity at this station. Also, there are roosts located in the buildings adjacent to the bridge and this area is also an important foraging habitat for local bat populations. Additional surveying of the derelict schoolhouse adjacent to the bridge recorded five bat species foraging: common pipistrelle, soprano pipistrelle, Leisler's bat, Natterer's bat and brown long-eared bat. This brings the total to eight bat species in this area, which is a bat species rich habitat.

4. Chainage 11+300 – Railway (Static Station E in Tables 7 and 8)

LHBs (plus three other bat species) were recorded on a static unit to the north of this chainage. The unit was located along a treeline / woodland. There was a high level of bat activity at this station. There is also a roost located to the south-east of the static station, where a high level of bat activity was recorded for common and soprano pipistrelles. This shall be tied in with the stream located to the west of the railway to ensure connectivity is retained in the area.

5. Chainage 23+850 – Railway (Static Station F in Tables 7 and 8)

LHBs (plus four other bat species, including *Myotis* species likely to be Daubenton's bat) were recorded on a static unit to the north of this chainage number. The unit was located along the banks of the River Deel. There was a high level of bat activity at this station. The railway line is also located adjacent to the river, providing additional commuting importance to the area.

6. Chainage 25+550 – Treelines (Static Station G in Tables 7 and 8)

Four species of bat, including brown long-eared bats were recorded on a static unit located online. The unit was located along a treeline / woodland. There was a medium level of bat activity at this station. In addition, a very high level of bat activity (five species of bat) was recorded during the walking transects from chainage 24+950 to 26+050. In addition, the railway line is located to the

north of the proposed road development and a soprano pipistrelle roost located in a derelict cottage.

7. Chainage 26+400 – Treelines (Static Station H in Tables 7 and 8)

LHBs (plus three other bat species) were recorded on a static unit to the north of this chainage. The unit was located along a treeline. There was a medium level of bat activity at this station. This is adjacent to a river (running under the proposed road at chainage 26+300). The railway is also located to the north of the proposed road development, so it is important to ensure that connectivity is retained in this area.

8. Chainage 50+150 - Wooded Area At Rathkeale By-pass (Static Station J in Tables 7 and 8)

LHBs (plus four other bat species, including *Myotis* species) were recorded on a static unit to the north of this chainage. The unit was located in small woodland along the Rathkeale By-pass. There was a medium level of bat activity at this station. Additionally, this area has been highlighted by the VWT as important for commuting LHBs.

9. Chainage 51+150 – (Static Station K in Tables 7 and 8)

LHBs (plus four other bat species, including *Myotis* species) were recorded on a static unit just north of this chainage. The unit was located along a treeline / woodland. There was a medium level of bat activity at this station. Additionally, this area has been highlighted by the VWT as important for commuting LHBs.

10. Chainage 51+750 – (Static Station L in Tables 7 and 8)

Four species of bat, including *Myotis* species were recorded on a static unit to the north of this chainage. The unit was located along a treeline / woodland. There was a high level of bat activity at this station. Additionally, this area has been highlighted by the VWT as important for commuting LHBs.

11. Chainage 57+350 – Woodland (Static Station M in Tables 7 and 8)

LHBs (plus three other bat species) were recorded on a static unit just north of this chainage. The unit was located along a treeline / woodland. There was a medium level of bat activity at this station. Additionally, this area has been highlighted by the VWT as important for commuting LHBs. The area is also located adjacent to an area of extensive parkland and woodland (woodland east of Clonshire Equestrian Centre), deemed highly suitable for foraging, roosting and commuting bats.

12. Chainage 58+000 – Railway (Static Station O in Tables 7 and 8)

Six bat species (*Myotis* species and brown long-eared bats) were recorded on a static unit located online. The unit was located the railway line. There was a medium level of bat activity at this station but a very high level of species richness. This area is also located adjacent to an area of extensive parkland, river and woodland, deemed highly suitable for foraging, roosting and commuting bats. A river also flows under the railway which adds to the commuting habitat of the area for bats. This is linked with chainage 58+000, described below.

13. Chainage 58+150 – River Greanagh A (Static Station P in Tables 7 and 8)

LHBs (plus four other bat species, including *Myotis* species) were recorded on a static unit located online. The unit was located beside the river. There was a high level of bat activity at this station. This area is also located adjacent to an area of extensive parkland, river and woodland, deemed highly suitable for foraging, roosting and commuting bats. A river also flows under the railway which adds to the commuting habitat of the area for bats. This is linked with location described at Chainage 58+000, described previously.

14. Chainage 58+700 to 59+600 – Greanagh River B / Curragh Bridge / Railway

Four species of bat including both Natterer's and Daubenton's bats were recorded during walking transects of this area. There was a high level of bat activity and the area is highly connected as a result of the Greanagh River B, railway and extensive treelines / hedgerows, which act as flight corridors.

15. Chainage 60+300 to 61+350 – River Maguie / Railway / Local Roads (Static Station Q in Tables 7 and 8)

Five species, including brown long-eared bats, were recorded during walking transects of this area. There was a high level of bat activity and the area is highly connected as a result of the River Maigue, railway, extensive treelines/hedgerows and local road network, which act as flight corridors.

16. Chainage 62+450 – Railway / Treelines (Static Station N in Tables 7 and 8)

Four species of bat including both Natterer's and Daubenton's bats were recorded during walking transects of this area. There was a medium level of bat activity and the area is highly connected as a result of the railway and extensive treelines/hedgerows, which act as flight corridors. Additionally, this area has been highlighted by the VWT as important for commuting LHBs.

5.4 Foraging Habitat in the Study Area

In light of the results of the surveys, the following areas are considered as potentially important foraging habitats for bat species:

1. Chainage 20+550 – Ballyclogh Bridge / Ballyclogh Junction / Local Roads / Habitats (Static Station D in Tables 7 and 8) /

LHBs (plus five other bat species, including *Myotis* species likely to be Daubenton's bat) were recorded on a static unit adjacent to this chainage. The unit was located on the banks of the river. There was a high level of bat activity at this station. Also, there are roosts located in the buildings adjacent to the bridge. This area is also an important foraging habitat for local bat populations. Additional surveying of the derelict schoolhouse increased the number of recorded bat species to eight species for this area.

2. Chainage 24+950 to Chainage 26+050 – (Static Station G in Tables 7 and 8)

Four species of bat, including brown long-eared bats, were recorded on a static unit located online (Static Station G, which was located along a treeline / woodland). There was a medium level of bat activity at this station. In addition, a very high level of bat activity (five species of bat) was recorded during the walking transects from chainage 24+950 to 26+050. In addition, the railway line is located to the north of the proposed road development. A railway bridge

deemed suitable for roosting bats is also located in this area. Therefore, this whole area may be considered an important foraging and commuting area for bats.

3. Chainage 26+650 to Chainage 27+000 – (Static Station I in Tables 7 and 8)

Four species of bat, including *Myotis* species, were recorded on a static unit located adjacent to the proposed road development and to a woodland (Static Station I). There was a high level of bat activity at this station.

4. Chainage 57+200 to 58+600 – (Static Stations O and P in Tables 7 and 8)

LHBs (plus five other bat species) were recorded on two static units located in this area (Static Stations O and P). Overall there was a high level of bat activity at this area as recorded by both the static stations and walking transects. This area is also located adjacent to an area of extensive parkland, river and woodland, deemed highly suitable for foraging, roosting and commuting bats.

5. Chainage 58+700 to 59+600 – Greanagh River B / Curragh Bridge / Railway / Local Roads

Four species of bat including both Natterer's and Daubenton's bats were recorded during walking transects of this area. There was a high level of bat activity and the area is highly connected as a result of the Greanagh River B, railway and extensive treelines / hedgerows, which act as flight corridors.

6. Chainage 60+700 to 61+350 – River Maigue / Railway / Local Roads (Static Station Q Tables 7 and 8)

Four species of bat including Daubenton's bats were recorded during walking transects of this area. There was a high level of bat activity and the area is highly connected as a result of the River Maigue, railway, extensive treelines / hedgerows and local road network, which act as flight corridors.

5.5 Priority Bat Areas in the Study Area

In light of the collected results of the four seasons bat surveys, Table 22 provides a summary of the sections of the proposed road development deemed to be important for the conservation of local bat populations. It lists the pertinent findings for each location. This information has been used to inform the proposed bat mitigation measures for the proposed road development (Table 23).

Table 21 Priority bat areas in the site of the proposed road development

Bat species: 'Leis' = Leisler's bat; 'SP' = soprano pipistrelle; 'CP' = common pipistrelle; 'LHB' = lesser horseshoe bat; 'BLE' = brown long-eared bat; 'Daub' = Daubenton's bat; 'Natt' = Natterer's bat; '*Myotis*' = *Myotis* species

Chainage	Description	Pertinent Findings of Four Season Bat Surveys				
		Winter Survey	Spring Survey	Summer Survey	Autumn Survey	Tree Survey
2+100 to 2+200	River, treelines, hedgerows	None	Walkabout surveys: CP, SP Statics surveys: LHB, Leis, CP, SP and <i>Myotis</i>	None	None	1 PBR
4+400 to 5+450	River, woodland, scrub, hedgerows, treelines	None	Walkabout surveys: CP, SP, Leis, <i>Myotis</i> Statics surveys: LHB, Leis, CP, SP and <i>Myotis</i> Roost - CP	None	None	None
6+200 to 6+650	Scrub, treelines, woodland, hedgerows	None	Walkabout surveys: CP, SP Statics surveys: LHB, Leis, CP, SP, Daub and <i>Myotis</i>	None	None	3 PBRs
7+150 to 7+250; 10+000 to 10+500; 20+000 to 21+600	Rivers, hedgerows, treelines, buildings, woodland	Roosts: LHB, BLE (Ballycullen Hs.)	Walkabout surveys: CP, SP, Daub, LHB, Leis, <i>Myotis</i> Statics surveys: LHB, Leis, CP, SP, BLE, Natts and <i>Myotis</i>	Walkabout surveys: Leis, SP, Whis, LHB Roosts: Potential in Pill Box Potential roost in derelict school house	Mating site: Leis	10 PBRs
10+900 to 12+000	Rivers, hedgerows, buildings, railway line, treelines	None	Walkabout surveys: CP, SP and Leis Statics surveys: CP, SP, LHB and Leis	Roosts: SP (cottage)	None	None

Chainage	Description	Pertinent Findings of Four Season Bat Surveys				
		Winter Survey	Spring Survey	Summer Survey	Autumn Survey	Tree Survey
24+000 to 27+650	Rivers, hedgerows, buildings, railway line, treelines	Railway bridge (potential roost)	Walkabout surveys: CP, SP, Daub, LHB, Leis, BLE, <i>Myotis</i> Statics surveys: LHB, Leis, CP, SP and <i>Myotis</i>	Roosts: SP (cottage) Walkabout surveys: Leis, CP, SP, BLE Statics surveys: Leis, BLE, CP and <i>Myotis</i>	None	25 PBRs
27+000 to 27+650	Woodland, hedgerows, buildings, railway line, treelines	None	Walkabout surveys: CP, SP Statics surveys: Leis, CP and SP	Walkabout surveys: CP, SP and BLE Statics surveys: Leis and CP	None	4 PBRs
28+250 to 29+250; 50+000 to 50+700	Hedgerows, treelines, rivers, woodland	None	Walkabout surveys: CP, SP Statics surveys: LHB, <i>Myotis</i> , Leis, CP and SP	None	None	1 PBR
51+100 to 52+300	Treelines, hedgerows	None	Walkabout surveys: CP, SP and BLE Statics surveys: LHB, <i>Myotis</i> , Leis, CP, BLE and SP	None	None	1 PBR
53+450 to 54+450	Treelines, hedgerows, woodland	None	Walkabout surveys: CP and Leis	None	None	9 PBRs
56+100 to 56+700	Treelines, hedgerows, woodland, rivers, buildings	LHB (Castle) Potential - bridges	Walkabout surveys: CP, SP and Daub Statics surveys: LHB, <i>Myotis</i> , Leis, CP, BLE and SP	None	None	9 PBRs
60+600 to 62+600	Treelines, hedgerows, woodland, rivers, buildings	None	Walkabout surveys: CP, SP, Leis and Daub Statics surveys: LHB, <i>Myotis</i> , Leis, CP, BLE and SP	Yes – CP, SP (Cottage) CP (Farm building) Walkabout surveys: CP, SP, Leis	Leis	10 PBRs

6. DESCRIPTION OF PREDICTED IMPACTS

The following bat species have been recorded during this four-season bat survey:

- Common pipistrelle, *Pipistrellus pipistrellus*;
- Soprano pipistrelle, *Pipistrellus pygmaeus*;
- Nathusius' pipistrelle, *Pipistrellus nathusii*;
- Leisler's bat, *Nyctalus leisleri*;
- Brown long-eared bat, *Plecotus auritus*;
- Natterer's bat, *Myotis nattereri*;
- Whiskered bat, *Myotis mystacinus*;
- Daubenton's bat, *Myotis daubentonii*; and
- Lesser horseshoe bat, *Rhinolophus hipposideros*.

This represents the full suite of resident bat species in Ireland. All of the above are Annex IV species under the EU Habitats Directive, and all have a 'Favourable' conservation status in Ireland. One species, the lesser horseshoe bat, is afforded extra protection as it is also listed as an Annex II species under the EU Habitats Directive. While the species has 'Favourable' conservation status in Ireland, there are concerns about the Co. Limerick population, due to isolation as a result of possible habitat fragmentation.

The presence of protected species of bat has been given full consideration throughout the route selection and preliminary design stages of the proposed road development. As a result, many of the most important areas of habitat and breeding sites of bats in this part of west Co. Limerick (e.g. Curraghchase and the grounds of Adare Manor) have been avoided.

Bat fauna within the survey area will be affected by both the construction phase and operational phase of the proposed development. Principal impacts of the proposed road development on bat fauna, in general, may be summarised as follows:

- A variety of habitats occur along the route of the proposed road development, which vary in their importance for bats (see Section 5.2). The loss of areas of improved agricultural grassland within the footprint of the proposed road development will have a negligible or minor impact on bats.
- Watercourses are not expected to be significantly impacted by the proposed development and thus bats are likely to continue using them. The dimensions of the bridges and culverts are detailed in Table 22 along with their dimensions and suitability for bat species.

The main impact on bats arises through the loss of hedgerows and treelines along the route of the proposed road development, which are widely used by commuting pipistrelles, *Myotis* species and LHBs. The construction of the proposed realignment will result in the loss of several commuting routes along hedgerows and treelines. This may temporarily affect bats and reconnection of linear features where possible (i.e. along watercourses) will lessen potential impacts. The lesser horseshoe bat population in the Adare area is low and preserving continuity of potential commuting routes at the River Maigue crossing will allow these bats to cross beneath the new carriageway. The location of the proposed road development to the north of Rathkeale and Adare will be approximately 5km distant from the main Limerick Lesser Horseshoe Bat breeding population located at Curraghchase Forest Park. As

noted the Limerick Lesser horseshoe population is suffering from isolation, so it is extremely important to ensure that the landscape post-road construction facilitates positive movement of this bat species through the landscape. It should be noted that the LHB is particularly sensitive to habitat fragmentation, while Leisler's bats and Nathusius' pipistrelles are less sensitive in this respect, since they fly high over the landscape and, as such, are not as reliant on linear habitats to traverse through the landscape. This is considered as a Moderate – Significant Negative impact and maybe reduced to Minor – Moderate Negative impact if such linear features remain in the landscape and mitigation measures are strictly followed in order to ensure landscape connectivity post-road construction.

- Loss or fragmentation of foraging habitats may diminish the available insect prey species and reduce feeding area for bats in some locations. This is considered as a Moderate Negative impact and maybe reduced to a Slight – Moderate Negative impact if such linear features remain in the landscape.
- Bats are often faithful to a particular roost site from one year to the next. Buildings occupied by bats are typically maternity roosts where females congregate to give birth. The loss of such sites can have serious implications for a colony, as there may be no other suitable sites in the area. Indeed, the loss of roosts is believed to be one of the major factors contributing to declines in bat populations throughout Europe. No maternity roosts were identified within any of the buildings immediately adjacent to or within the proposed development boundary during the surveys. A small number of satellite and night roosts were recorded in buildings along the proposed road development. The loss of satellite and night roosts is considered to constitute a Slight Negative Impact.
- Bats will often use trees as roosting sites. PBRs in trees are also an important issue to address, and the proposed road development has been assessed for PBRs. The loss of trees in the landscape as a result of road construction is considered to constitute a Moderate Negative impact.

Mitigation measures, as below (Table 22), have been prescribed to ameliorate the potential impacts of the proposed road development on bat populations.

7. MITIGATION & MONITORING MEASURES

Mitigation is best achieved through avoidance (i.e. preventing the occurrence of negative effects), especially in relation to bat fauna. In this case, many of the most sensitive bat habitats have been avoided through the Route Selection and preliminary design process. However, by its nature as a road construction project, the proposed development will inevitably affect local habitats and, therefore, there will be an impact on local bat populations.

In this section, measures are proposed to avoid or lessen the degree of likely negative impacts on local bat populations. Additionally, measures are proposed with a view to enhancing the landscape for bats. Please note that there is some overlap between the measures proposed in this report in respect of bats, and the biodiversity mitigation measures set out for other specific habitats / species and biodiversity general in Chapter 7 (Biodiversity) of Volume 2 of the EIAR for the proposed road development. For example, some structures which have been earmarked for bat passages have also been proposed to accommodate mammal passages (i.e. passages for mammals other than bats). The mitigation measures prescribed in this report have been incorporated into the mitigation measures set out in Chapter 7.

Proposed mitigation measures for bats are set out in Table 22, below, and are illustrated in Figures 7.25 – 7.47 for the proposed development. The landscape measures detailed below have been built into the proposed landscaping for the proposed road development which is illustrated in Figures 11.1 to 11.23 of Volume 3 of the EIAR.

Table. 22 Proposed Bat Mitigation Measures

Chainage	Description of Site	Action	Bat Mitigation Measures
2+000 to 2+250	Culvert (FRC2), Underpass (UP1). and one no. attenuation pond and associated habitat at Sroolane North. FRC2 coincides with an important bat commuting route.	Mammal and Bat Passage (FRC2), Underpass 1 (UP1), bat box installation, bat tube installation and landscape planting	Proposed culvert FRC2 (at 2+150) has a span of 6.6m, a vertical clearance over the mean water level of 2.5m and a minimum vertical clearance over mean flood level of 1.9m. This clearance shall be sufficient to allow passage of brown long-eared bat and <i>Myotis</i> species. Landscape planting shall be carried out (chainage 2+100 to 2+250) to direct bats towards the culvert (FRC 2) on either side of the river and this planting shall link in with existing linear habitats. Underpass UP1 at 2+000, (4.5m wide x 3.m high) will also facilitate bat passage. One no. rocket bat box shall be installed in the vicinity of the proposed attenuation pond at 2+200. Two no. bat tubes shall be installed in the culvert (FRC2).
3+150 to 3+425	Mammal and Bat Passage (MU 3.4) and associated habitat at Robertstown	Mammal and Bat Passage (MU 3.4), bat tube installation and associated landscaping	A 2m high x 1.8m wide underpass (MU 3.4 at 3+400) shall be put in place to facilitate the passage of bats and other mammals. These dimensions shall facilitate the passage of brown long-eared bat and <i>Myotis</i> species. Landscaping shall be completed (chainage 3+150 to 3+425) to connect existing linear habitats to the bat underpass. Two no. bat tubes shall be installed in the passage.
3+800 to 3+950	Mammal and Bat Passage (MU 3.9) and associated habitat at Rincullia	Mammal and Bat Passage (MU 3.9), bat tube installation, and associated landscaping	A 2m high x 1.8m wide underpass (MU 3.9 at 3+900) shall be put in place to facilitate the passage of bats and other mammals. These dimensions shall facilitate the passage of brown long-eared bat and <i>Myotis</i> species. Landscaping shall be completed (chainage 3+800 to 3+950) to connect existing linear habitats to the bat underpass. Two no. bat tubes shall be installed in the passage
4+170 to 4+450	River bridge (FRC5) and associated habitat at Rincullia/Craggs	Mammal and Bat Passage (FRC5), bat tube installation, and associated landscaping	Proposed river bridge, FRC5 (at 4+440), shall traverse the Ahacronane River with a span of 8.5m. It shall have a vertical clearance above the mean water level of 2.3m and a minimum vertical clearance above the mean flood level of 1.4m. This shall provide sufficient clearance to facilitate the passage of brown long-eared bat and <i>Myotis</i> species. Landscaping shall be completed (chainage 4+170 to 4+450) to connect existing linear habitats to the bridge. Two no. bat tubes shall be installed in the bridge.

Chainage	Description of Site	Action	Bat Mitigation Measures
4+450 to 5+050	Mammal and Bat Passage (MU 5.0), Underpass (UP2).one no. attenuation pond and associated habitat at Craggs, which coincides with an important bat commuting route.	Mammal and Bat Passage (MU 5.0), Underpass (UP2), habitat protection, bat tube installation, bat box installation, and associated landscaping	Woodland, treeline and riverine habitats shall be protected in area. A 3m high x 1.8m wide culvert (MU 5.0 at 5+000) will be put in place to facilitate the passage of mammals and bats. These dimensions shall facilitate the passage of brown long-eared bat and <i>Myotis</i> species. In addition, landscape planting shall be carried out on either side of the culvert (chainage 4+450 and 5+050) to direct bats towards it, and this planting will link in with existing linear habitats. Two no. bat tubes shall be installed in the passage. Underpass 2 at 4+990 (UP2, 4.5m x 4.5m) will also facilitate bat passage. One no. rocket bat box shall be installed in the vicinity of the proposed attenuation pond at 4+600.
7+150 to 7+400	Western side of Ballyclogh Junction at Ballyclogh, one no. attenuation pond, culvert (FRC6) and adjoining habitat	Habitat protection, Mammal and Bat Passage (FRC6), bat roost installation, landscape planting, bat tube installation and bat box installation	Woodland, treeline and riverine habitats shall be protected in area. A 2m wide x 2.5m high culvert (FRC6), embedded by 0.5m such that its actual clear height is 2m, will be put in place at chainage 7+170. It shall allow sufficient clearance to facilitate the passage of LHBs and other mammals. In addition, landscape planting is required (chainage 7+150 to 7+400) to direct bats towards the bridge on either side of the bridge and this planting will link in with existing linear habitats. Known and potential bat roosts shall be protected. Bat tubes (2 units) shall be installed in the culvert to provide roosting sites. One no. rocket bat box shall be installed in the vicinity of the proposed attenuation pond at 7+250. Two no. bat tubes shall be installed in the culvert (FRC6).
7+400 to 10+500	Eastern side of Ballyclogh Junction at Ballyclogh and Ballycullen, and adjoining habitats and culvert (FRC7) and bridge (FRC8)	Habitat protection, landscape planting and bat tube installation	Woodland, treeline and riverine habitats shall be protected in area. Landscape planting is required at the stated chainage to tie in with existing linear habitats. Known and potential bat roosts shall be protected. Bat tubes shall be installed in the culvert (FRC7; 2 no. tubes) and bridge (FRC8; 4 no. tubes) to provide roosting sites.

Chainage	Description of Site	Action	Bat Mitigation Measures
10+800 to 11+000	Culvert (FRC9) on stream, one no. attenuation pond, and associated habitat at Ballycullen	Mammal and Bat Passage (FRC9), habitat protection, bat tube installation, bat box installation and landscape planting	FRC9 (at 10+950) is a proposed 6.3m span bridge with a clearance above mean water level of 2.1m, and a minimum vertical clearance above mean flood level of 1.7m. This clearance shall be sufficient to facilitate passage of brown long-eared bat and <i>Myotis</i> species. In addition, landscape planting shall be required (chainage 10+800 to 11+000) to direct bats towards the bridge, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the bridge. One no. rocket bat box shall be installed in the vicinity of the proposed attenuation pond at 10+900.
11+000 to 12+000	Railbridge (RB01) under railway bridge, Underpass 4 (UP4) and associated habitat at Cloonreask	Mammal and Bat Passage (RB01), Underpass 4 (UP4), habitat protection, bat tube installation and landscape planting	Railway bridge, RB01 (at 11+300), will have a minimum vertical clearance of 5.3m, which will facilitate passage of brown long-eared bat and <i>Myotis</i> species. Underpass at Ch.11+225 (UP4, 4.5m x 4.5m) will also facilitate bat passage. In addition, landscape planting is required (chainage 11+000 to 12+000) to direct bats towards the bridge, and this planting shall be linked in with existing linear habitats.
20+000 to 20+600	Southern side of Ballyclogh Junction and Ballyclogh Bridge at Ballyclogh, and adjoining habitats and culvert (MU 20.4), Underpass 5 (UP 5)	Habitat protection, Mammal and Bat Passage (MU 20.4), Underpass 5 (UP5) bat tube installation, and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. A 3m high x 1.8m wide culvert (MU 20.4 at 20+400) shall be put in place to facilitate the passage of mammals and bats. These dimensions shall facilitate the passage of brown long-eared bat and <i>Myotis</i> species. In addition, landscape planting is required (chainage 20+000 to 20+600) to direct bats towards the bridge on either side of the culvert and this planting will link in with existing linear habitats. Known and potential bat roosts shall be protected. Two no. bat tubes shall be installed in the culvert. Underpass at 20+550 (UP5, 4.5m wide x 3m high) will also facilitate bat passage.

Chainage	Description of Site	Action	Bat Mitigation Measures
20+600 to 21+400	Culvert (FRC11), attenuation pond and associated habitat at Ballyclogh / Lismakeery	Mammal and Bat Passage (FRC11), bat tube installation, bat box installation and landscape planting	FRC11 (at 20+970) is a proposed 8m span stream bridge with a clearance above mean water level of 4.7m and a minimum vertical clearance above mean flood level of 4.5m. This shall provide sufficient clearance to facilitate passage of brown long-eared bat and <i>Myotis</i> species. In addition, landscape planting is required (chainage 20+600 to 21+400) to direct bats towards the culvert, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the culvert (FRC11). One no. rocket bat box shall be installed in the vicinity of the proposed attenuation pond at 20+850.
21+750	Underpass 6	Bat Passage (UP6)	Underpass 6 (4.5 wide x 5m high) will facilitate the passage of bats.
22+950	Woodland habitat (KER 13) at Ballynacaheragh	Bat box installation	One no. rocket bat box shall be installed on a free standing pole or three summer woodcrete bat boxes will be erected on mature trees in the woodland at 22+950.
23+800 to 24+200	Bridge over River Deel (RVB01) and associated habitat at Ballynacaheragh / Milltown North / Boolaglass. Bridge coincides with an important LHB commuting route along the River Deel and the nearby railway line to the north-east	Mammal and Bat (LHB) Passage (RVB01), habitat protection, landscape planting, and bat tube installation	Riparian habitat on either side of the bridge shall be protected, as indicated in Figure 7.33 of Volume 3 of the EIAR. The proposed River Deel bridge (RVB01 at 24+050) shall have a minimum vertical clearance above 100-year flood water level of 19.9m. This shall be sufficient to allow bats (including LHB) to use the space under the bridge and above the river. In addition, landscape planting is required on either side of the bridge (chainage 23+800 – 24+200) to direct bats towards it, and this planting will link in with existing linear habitats. Known and potential bat roosts shall be protected. Bat tubes (4 units) shall be installed in the bridge to provide roosting sites.
24+200 to 24+400	Culvert (FRC14), attenuation pond and associated habitat at Boolaglass. Culvert coincides with an important bat (specifically, LHB) commuting route.	Mammal and Bat (LHB) Passage (FRC14), habitat protection, bat tube installation and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. A 3.2m high x 1.8m wide culvert (FRC14), embedded by 0.5m such that actual clear height is 2.7m, shall be constructed at 24+350. It will allow sufficient clearance to facilitate passage of LHBs. In addition, landscape planting is required on either side of the culvert (chainage 24+200 – 24+400) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the culvert

Chainage	Description of Site	Action	Bat Mitigation Measures
24+400 to 24+675	Culvert (FRC15) over Doohyle Stream, attenuation pond and associated habitat at Boolaglass / Bullaun. Culvert coincides with an important bat (specifically, LHB) commuting route.	Mammal and Bat (LHB) Passage (FRC15), habitat protection, bat tube installation and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. FRC15 (at 24+500) is a proposed minor river bridge over the Doohyle Stream with a vertical clearance of 4.5m above a cycle track and 3m above flood water level. This shall provide sufficient clearance to facilitate passage of LHBs. In addition, landscape planting is required on either side of the culvert (chainage 24+400 to 24+675) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the culvert (FRC15).
24+675 to 25+200	Culvert (FRC16) and associated habitat at Nantinan / Bullaun. Culvert coincides with an important bat (specifically, LHB) commuting route.	Mammal and Bat (LHB) Passage (FRC16), habitat protection, bat box installation, bat tube installation, and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. FRC16 is a proposed 6m span river bridge with a proposed clearance above water level in excess of 2.4m. This shall provide sufficient clearance to facilitate passage of LHBs. In addition, landscape planting is required on either side of the culvert (chainage 24+675 to 25+200) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the bridge. One no. rocket bat box shall be erected on a free standing pole or three summer woodcrete bat boxes will be erected on suitable mature trees in both of the areas of habitat at 24+800 and 25+050,.
25+200 to 26+000	Farm underpass (UP07), attenuation pond and associated habitat at Feeagh / Nantinan	Mammal and Bat Passage (UP07), habitat protection, and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. UP07 (at Ch.25+675) is a proposed 4.5m x 4.5m farm underpass with sufficient space to accommodate the passage of bats. Landscape planting shall be required on either side of the underpass (chainage 25+200 to 26+000) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the underpass (UP07).
26+000 to 26+250	Farm underpass (UP08) and associated habitat at Ardgoul South. Underpass coincides with an important bat (specifically, LHB) commuting route.	Mammal and Bat (LHB) Passage (UP08) and landscape planting	UP08 (at 26+175) is a proposed 4.5m x 4.5m farm underpass with sufficient space to accommodate the passage of bats, including LHBs. In addition, landscape planting shall be required on either side of the underpass (chainage 26+000 to 26+250) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the passage.

Chainage	Description of Site	Action	Bat Mitigation Measures
26+250 to 26+650	Culvert (FRC24) on Stream and associated habitat at Ardgoul South / Graigeen. Culvert coincides with important bat commuting route and foraging areas, and is located near potential roosting sites.	Mammal and Bat Passage (FRC24), bat tube installation and landscape planting	<p>A 1.6m wide x 3m high drainage culvert (FRC24), embedded by 0.5m such that actual clear height is 2.5m, shall be constructed at chainage 26+300. It shall allow sufficient clearance to facilitate passage of LHBs. In addition, landscape planting is required on either side of the culvert (chainage 26+250 to 26+650) to direct bats towards it, and this planting shall be linked in with existing linear habitats.</p> <p>Known and potential bat roosts shall be protected. Bat tubes (2 units) shall be installed in the culvert to provide roosting sites.</p>
26+650 to 27+650	Underbridge (UB04) on Doohyle Stream, two no. attenuation ponds, two no. culverts (MU 27.2; MU 27.5) and associated habitat (woodland) at Graigeen / Ballingarrane. Underbridge coincides with important bat foraging habitat and is located near potential roosting sites.	Mammal and Bat Passage(s) (UB04; MU 27.2 and MU 27.5), habitat protection, bat box installation, bat tube installation, and landscape planting	<p>Woodland habitat in area shall be retained and shall be protected during construction.</p> <p>UB04 (at 27+000) is a proposed 52.5m single span bridge over a regional road and the Doohyle Stream. It shall allow 5.3m vertical clearance above the regional road, which will be sufficient to allow the passage of bats, including brown long-eared bat and <i>Myotis</i> species. In addition, landscape planting is required on either side of the underbridge (chainage 26+650 to 27+650) to direct bats towards it, and this planting shall be linked in with existing linear habitats.</p> <p>One no. rocket bat box shall be installed in the vicinity of the proposed attenuation pond at 26+750.</p> <p>Two no. bat tubes shall be installed in the proposed bridge (UB04).</p> <p>Two proposed Mammal Passages (MU 27.2; MU 27.5) will have minimum heights of 2m to facilitate passage of LHBs.</p>
27+650 to 28+200	Important bat (specifically, LHB) commuting area at Ballingarrane, Underpass 9 (UP9).	Landscape planting, Underpass 9 (UP9)	Landscape along alignment, to act as flight corridor for LHB. This planting shall link in with existing linear habitats and with Underpass 9 at Ch.20+075 (UP9, 4.5m x 4.5m) which will also facilitate bat passage.

Chainage	Description of Site	Action	Bat Mitigation Measures
28+200 to 28+550	Minor bridge (FRC26) over Doohyle Stream, two no. attenuation ponds and associated habitat at Ballingarrane / Kyletaun	Mammal and Bat Passage (FRC26), habitat protection, bat box installation, bat tube installation, and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. FRC26 (at 28+200) is a proposed single span (26m) river bridge which traverses the Doohyle Stream and a section of the proposed road development for the Great Southern Trail greenway. It will have a minimum vertical clearance of 2.7m over the cycle path below, which is sufficient for the passage of bats, including brown long-eared bat and <i>Myotis</i> species. In addition, landscape planting is required on either side of the bridge (chainage 28+200 to 28+550) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. rocket bat boxes shall be installed in the vicinity of the proposed attenuation ponds at 28+400. Two no. bat tubes shall be installed in the bridge (FRC26).
28+550 to 29+250	Underpass (UP10), two no. attenuation ponds and associated habitat at Kyletaun / Rathkeale	Bat (LHB) Passage (UP10), habitat protection and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. Retained interests (stream and wet grassland) to be protected during construction. UP10 (at 29+150) is a proposed 4.5m x 4.5m farm underpass with sufficient space to accommodate the passage of bats, including LHBs. In addition, appropriate landscape planting is required on either side of the underpass (chainage 28+550 to 29+250) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the underpass (UP10).
50+000 to 50+900	Alignment east of Rathkeale Junction, attenuation pond, culvert (M21-C1) and associated habitat at Rathkeale / Wolfesburgess East	Mammal and Bat Passage (M21-C1), bat tube installation, and landscape planting	M21-C1 (at 50+750) is a proposed 13.5m clear span bridge with a vertical clearance of 8.2m above flood water level and 7.1m above the proposed cycle track. This shall provide sufficient clearance to allow the passage of bats, including brown long-eared bat and <i>Myotis</i> species. In addition, landscape planting is required on either side of the culvert (chainage 50+000 to 50+900) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the culvert (M21-C1).

Chainage	Description of Site	Action	Bat Mitigation Measures
50+900 to 51+525	Mammal and Bat (LHB) Passage (MU 51.3), attenuation pond and associated habitat at Wolfesburgess East / Blossomhill. Passage coincides with an important bat (specifically, LHB) commuting route.	Mammal and Bat (LHB) Passage (MU 51.3), habitat protection, bat box installation, and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. A 3m wide x 1.8m high drainage culvert (MU 51.3 at 51+300) shall be constructed to facilitate passage of bats, including LHBs. In addition, appropriate landscape planting is required on either side of the passage (chainage 50+900 to 51+525) to direct bats towards it, and this planting shall be linked in with existing linear habitats. One no. rocket bat box shall be installed in the vicinity of the proposed attenuation pond at 51+050. Two no. bat tubes shall be installed in the passage.
51+525 to 52+300	Underpasses (UP11A, UP11B, UP12A and UP12B) and associated habitat at Blossomhill / Clogh West	Bat (LHB) Passages (UP11A, UP11B, UP12A and UP 12B), habitat protection, bat tube installation and landscape planting	Existing riparian habitat in the area shall be retained and protected during construction. UP11A (at 51+800) and UP 11B (at 51+840) are 4.5m x 3m high farm underpasses with sufficient space to accommodate the passage of bats, including LHBs. There shall be no lighting in the immediate vicinity of underpass, to allow for passage of LHBs. In addition, appropriate (i.e. scrub-woodland) landscape planting is required on either side of the underpass (chainage 51+525 to 52+300) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Two no. bat tubes shall be installed in the underpasses (UP11A and UP11B). UP12A and UP12B (at chainage 52+150) are 4.5m high x 4.5m wide farm underpasses with sufficient space to accommodate passage of mammals and bats (including LHBs). Approach mammal fencing shall be erected. Two no. bat tubes shall be installed in the proposed underpasses.
53+450 to 54+450	Mammal Underpass (MU 53.7), two no. attenuation ponds and associated habitat at Clogh East / Ballycannon / Croagh	Habitat protection, bat box installation, and landscape planting	Woodland, treeline and riverine habitats shall be protected in area. Landscape planting is provided on either side of the alignment (chainage 52+300 to 54+450) to direct bats, and this planting shall be linked in with existing linear habitats. Two no. rocket bat boxes shall be installed in the vicinity of the proposed attenuation ponds at 53+800 and 54+300.

Chainage	Description of Site	Action	Bat Mitigation Measures
54+450 to 56+000	Section of alignment and associated habitat at Croagh / Graigue, Underpass 13 (UP13)	Landscape planting, UP13	Appropriate landscape planting shall be carried out on north-western side of alignment between stated chainage. UP13 (at 55+550 on the Croagh link road) is a proposed 4.5m x 4.5m underpass with sufficient space to accommodate the passage of bats, including LHBs. In addition, appropriate landscape planting is required on either side of the underpass to direct bats towards it, and this planting shall be linked in with existing linear habitats.
56+000 to 58+600	Railbridge (RB02), river bridges (M21-C3 and RVB02), two underpasses (UP14A, UP14B and UP15) four no. attenuation ponds and associated habitat at Graigue / Clonshire More / Gortnagrour / Clonshire Beg / Rower More / Tuogh (in vicinity of Clonshire Castle). Area coincides with important bat (specifically LHB) commuting routes and areas with potential roost sites.	Bat (LHB) Passage (RB02), Mammal and bat passage (M21-C3), UP14A, UP14B and UP15, habitat protection, roost protection, bat box installation, bat tube installation, and landscape planting	<p>Scrub, hedgerows and treeline habitats shall be protected in area.</p> <p>Known and potential roost sites shall be protected and retained.</p> <p>Appropriate (i.e. scrub woodland) compensatory landscape planting shall be carried out between chainage 56+000 and 58+600.</p> <p>UP14A (3m wide x 2.6m high), UP14B (3m x 3m) (at 56+320) and UP15 (at 56+740, 4.5m x 4.5m) are proposed underpasses with sufficient space to accommodate the passage of bats, including LHBs.</p> <p>The proposed M21-C3 bridge over the Clonshire River (at 56+575) shall have a minimum vertical clearance of 6.8m from the top of the riverbank, and a setback of >6.5m on both sides of the channel. This design shall allow for the passage of bats and other mammals. Two no. bat tubes shall be installed in the proposed bridge (M21-C3).</p> <p>Proposed railway bridge (RB02 at 58+000) shall have a clear span of 10.6m and a minimum vertical clearance of 5.3m, facilitating the passage of bats, including LHBs.</p> <p>Two no. rocket bat boxes shall be installed in the vicinity of the proposed attenuation ponds at 57+350 and 58+200, respectively.</p> <p>RVB02 (at chainage 58+175) is a 36m single span river bridge with a min. vertical clearance from 100-year flood water level of 4.10m OD. This shall allow sufficient clearance for passage of bats and other mammals. Two no. bat tubes shall be installed in the proposed bridge.</p>

Chainage	Description of Site	Action	Bat Mitigation Measures
58+800 to 59+650	Greanagh River Bridge (RVB03), Underpass 16 and Underpass 17, two no. attenuation ponds and associated habitat at Tuogh / Kilknockan. Area coincides with an important bat commuting route.	Bat (LHB) Passage (RVB03), UP16, UP17 habitat protection, bat tube installation, and landscape planting	Woodland, treeline and riparian habitats shall be protected in area. RVB03 (at 59+250) is a proposed three-span river bridge (23m; 35m; 23m) with a minimum clearance above 100-year flood water level of 4.10m. This shall provide sufficient clearance for bats, including LHBs. In addition, appropriate (i.e. scrub woodland) landscape planting is required on either side of the bridge (chainage 58+800 to 59+650) to direct bats towards it, and this planting shall be linked in with existing linear habitats. UP16 (at 58+940, 4.5m x 3m high) and UP 17 (at 59+425, 4.5m x 4.5m) are proposed underpasses with sufficient space to accommodate the passage of bats, including LHBs. Known and potential bat roosts shall be protected. Bat tubes (2 units) shall be installed in the bridge to provide roosting sites.
60+600 to 61+075	River Maigue Bridge (RVB04), one no. attenuation pond and associated habitat at Islandea. Area coincides with an important bat commuting route.	Bat (LHB) Passage (RVB04), habitat protection, bat tube installation, and landscape planting	Woodland, treeline and riparian habitats shall be protected in area. RVB04 (at 60+950) is a proposed three-span river bridge (58m; 94m; 58m) with a minimum clearance over 100-year flood water level of 4.24m. This shall provide sufficient clearance for bats, including LHBs. In addition, appropriate (i.e. scrub woodland) landscape planting shall be required on either side of the bridge (chainage 60+600 to 61+075) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Known and potential bat roosts shall be protected. Bat tubes (2 units) shall be installed in the bridge to provide roosting sites.
61+075 to 61+600	Railbridge (RB03), Underpass 18, one no. attenuation pond and associated habitat at Ardshanbally. Area coincides with an important bat commuting route.	Mammal and Bat (LHB) Passage (RB03), UP18, habitat protection, bat box installation, bat tube installation, and landscape planting	Woodland, treeline and riparian habitats shall be protected in area. RB03 (at 61+250) is a proposed 10.6m clear span railway bridge with a minimum vertical clearance of 5.3m, which shall provide sufficient clearance for passage of bats, including LHBs. In addition, appropriate (i.e. scrub woodland) landscape planting shall be required on either side of the bridge (chainage 61+075 to 61+600) to direct bats towards it, and this planting shall be linked in with existing linear habitats. Known and potential bat roosts shall be protected. UP18 (at 61+360, 4.5m x 4.5m) is a proposed underpass with sufficient space to accommodate the passage of bats, including LHBs. Bat tubes (2 units) shall be installed in the underpass to provide roosting sites. Three no. rocket bat boxes shall be installed on free standing poles or nine summer woodcrete bat boxes will be erected on suitable mature trees in the vicinity of the proposed attenuation pond at 61+250.

Chainage	Description of Site	Action	Bat Mitigation Measures
61+600 to 64+950	Section of alignment and associated habitat at Ardshanbally / Mondellihy / Kilgobbin / Rineroe / Monearla / Ballyloughnan / Ballycarrane	Landscape planting, bat box installation and habitat protection	Appropriate (i.e. scrub woodland) landscape planting and habitat protection shall be carried out along the alignment between stated chainage, as indicated on Figures 7.44 – 7.46. One no. rocket bat box will be erected on a free-standing pole or three summer woodcrete bat boxes will be erected on suitable mature trees in the vicinity of the proposed attenuation pond at 61+250.

7.1 General Bat Mitigation Measures

7.1.1 Avoidance / Prevention of Impacts

1. Treelines, hedgerows or other linear habitats that have been earmarked for protection (as illustrated in Figs. 7.25 – 7.47) shall remain in-situ and remain protected from the construction of access link roads and other supporting infrastructure construction where possible.
2. Habitats identified as important foraging areas for bats (refer to Section 5.4) shall be protected from damage e.g. scrub areas (known as bat habitats).

7.1.2 Reduction of Impacts

1. Re-planting of Linear Habitats / Landscape Planting

A large number of hedgerows / scrub / treelines will be removed or bisected as a result of the construction of the proposed development. At these points, it is important to provide alternative flight paths or reinstate such features for commuting bats, especially in relation to chainage numbers listed in Table 22, above. The landscape planting proposed to create alternative flight paths are listed in Table 22 and illustrated in Figs. 7.25 – 7.47 of Volume 3 of the EIAR for the proposed development (Landscape Mitigation).

Landscape planting shall be undertaken using shrub and tree specimens (native shrub and tree species of Irish provenance) to re-establish linear vegetation. To ensure that bats adopt the newly instated commuting routes as early as possible, this landscaping shall be in place as early as possible and ideally prior to road construction and prior to interruption / removal of traditional bat commuting routes (preferably 2-3 seasons prior to works) where possible.

All areas for habitat protection shall be required to be fenced off to a distance equal to the outer canopy.

2. Mature Trees

A survey of all trees along the proposed road development was undertaken. A total of 103 trees were deemed as PBRs, the majority of which have a Category 2 value.

Phase 2 inspections will be undertaken within the CPO line prior to construction, once a mark for felling is confirmed. The Phase 2 inspection will generally involve a closer examination of individual trees using a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope) and where required and / or possible, height surveys, to be completed using a ladder. If a tree is deemed to be a roost site then further surveying, involving dusk and dawn surveys of the actual trees, may be recommended to determine what bat species are present, etc.

In accordance with Section 40 of the Wildlife Act (1976; as updated 2019), tree felling shall not be carried out during the bird nesting season (1st of March – 31st of August, inclusive). Additionally, in order to avoid periods when bats are hibernating or most active, tree felling shall be restricted to the months of September, October and November only. When tree felling is to be carried out, trees in question shall be subject to a detailed inspection by a suitably qualified ecologist / bat specialist prior to felling, and shall be felled according to PBR value. Any trees (Category 1 value and potentially some Category 2 trees, depending on the results of Phase 2 surveys) showing crevices, hollows, etc., shall be removed only while a bat specialist is present to deal with any bats

found / disturbed. Such animals shall be kept in a box until dusk and released on-site.

A bat expert will survey all PBR trees due for removal prior to construction works commencing.

Large mature trees shall be felled carefully; gradual dismantling shall be carried out by a competent and experienced tree surgeon(s), under the supervision of a bat specialist. Care shall be taken when removing branches, as removal of loads may cause cracks or crevices to close, crushing any animals contained within. These cracks shall be wedged open prior to load removal. Dead branches shall be lowered to the ground using ropes to avoid impacts which may injure or kill bats contained within.

Any ivy-covered trees (generally applies to Category 2 trees with heavy ivy growth) which require felling will be left to lie for 24 hours after cutting to allow any bats beneath the ivy cover to escape.

Bat boxes will be erected to compensate for trees marked as PBRs which are felled. The number of bat boxes to be erected shall depend on the number of PBRs to be felled and their respective values, as assigned herein. For every individual Category 1 tree felled, one no. bat box shall be erected (1:1); for every 6 Category 2 trees felled, one no. bat box shall be erected (6:1). Accordingly, the erection of 19 no. bat boxes (woodcrete or woodstone summer bat boxes) is being recommended. As these type of bat boxes are best erected on mature trees, an alternative is to erect Habitat Double Chamber Rocket Box ('rocket box' hereafter; see Appendix A), a free standing maternity bat box. Rocket boxes shall be located in suitable areas within the CPO (i.e. as set out in Table 22, above). In order to create roosting opportunities, equivalent to the recommended 19 no. summer bat boxes, 6 no. double-chamber rocket boxes would suffice.

3. Buildings to be Removed

A small number of buildings are proposed to be demolished to facilitate the construction of the proposed development. The buildings surveyed in 2018 (Table 9) identified two satellite roosts and two night roosts and another building that has potential for roosting bats. An NPWS Derogation Licence has been obtained to remove these buildings. A set of mitigation measures and roost compensation have been submitted with the Derogation Licence application. The following is required:

- For each of the buildings / structures identified above as known / potential bat roosts, the Contractor shall prepare a demolition plan to ensure the safe removal of bats, with following considered:
 - Undertake demolition works outside the main summer season (avoid May to August) and avoid cold winter months (December and January);
 - Provide alternative roosting sites prior to demolition within areas of the proposed development which will not be impacted by construction. The type of alternative roosts depends on the roost types recorded. The roosts types recorded were satellite or nights roosts. Alternative roosts include the erection of double-chamber rocket bat boxes (free standing structures) at numerous locations along the length of the proposed road development. Bat tubes will

also be installed as part of culvert and bridges proposed as part of the development. One rocket bat box per structure to be removed, is recommended and is listed in Table 2.

- Re-survey structures / buildings in question prior to demolition to determine if bats are present. Undertake a dusk and dawn survey and internal inspection of the structure as deemed appropriate by the bat specialist.
- The demolition plan will involve a series of steps in order to reduce the suitability of the structure as a roost site (i.e. partial removal of roof, clearance of vegetation, dismantling of sections (by hand) and supervision by a bat specialist).
- In consultation with the demolition contractor, a slow dismantling of structures will be undertaken. The dismantling will change the internal environment of the areas where bats have been found roosting by changing the internal temperature and increasing light level. General scope of a demolition plan would include the following:
 - Buildings with rooves:
 - Prior to demolishment, undertake dusk / dawn surveys to determine if the buildings are being used by bats.
 - During the daytime, remove sections of the roof structures to increase lighting and reduce temperatures within and adjacent to buildings used by roosting bats. The ridge tiles and a selection of main roof tiles / slates will be removed in the presence of a bat specialist and removal will be undertaken by hand (with each tile / slate checked for clinging bats).
 - The building / structure is left open overnight.
 - Undertake dusk / dawn surveys to determine if the buildings are being used by bats.
 - Examination of internal spaces to ensure that no bats are present during demolition the following day.
 - Removal of remaining sections, in the presence of a bat specialist.
 - Stone structures / ruins:
 - Undertake dusk / dawn surveys to determine if the buildings are being used by bats.
 - Examine the stonework crevices with an endoscope to determine if bats are present. Crevices found to have bats present will be marked as shown in Plates 2a and b.
 - Each crevice that is deemed empty will be blocked up with bubble wrap to prevent bat entering until the structure is to be demolished. Alternatively, once sections of the structure are deemed bat free, wrap in hessian material (see Plates 5a and b) to prevent bats from roosting in the walls post-inspection.
 - Once the ruin is deemed bat free, remove in the presence of a bat specialist.
 - Farm buildings (i.e. corrugated iron barns):

Note: This refers to the farm buildings i.e. Building No. 8 in Table 1, which is a large corrugated barn with timber partitions (including insulation) and

roof insulation where *Pipistrellus* droppings were recorded. The following steps are recommended for this type of structure:

- Undertake dusk / dawn surveys to determine if the buildings are being used by bats.
- Remove the timber and insulation partitions by hand in the presence of a bat specialist.
- Check any potential crevices with an endoscope.
- Remove sections of the corrugated sheets to change the internal temperature of the building and leave overnight.
- Undertake a Dawn survey and if deemed bat free, remove the remaining structure.



Figures 27a, b

Crevices containing bats circled in water-based red paint



Plates 28a, b

Example of hessian material curtains for sealing bridge arches

4. Protection of Habitats

Any semi natural habitats adjacent to proposed road development (and situated in the lands to be acquired) shall be protected, where possible. Working areas shall be clearly defined prior to the commencement of construction or fenced to ensure they are kept to a minimum.

5. Lighting

Nocturnal mammals are affected by lighting. Therefore, it is important that lighting installed along the proposed road development is completed with sensitivity for local wildlife while still providing the necessary lighting for human usage. Lighting will be avoided where possible as it deters some bat species from foraging. It is important to maintain dark zones for foraging bats in areas where lighting is not necessary. This is particularly important at river crossings and in vicinity of proposed mammal and bat passages. Lighting will be avoided in the areas listed in Table 22 where bat mitigation measures are being installed. This is particularly important for the following bat species: LHB, brown long-eared bat, Natterer's bat, Daubenton's bat and whiskered bat. Lighting along the proposed road development will be limited to junctions and the associated slip roads.

General principles for the installation of lighting as part of the proposed development are as follows:

- Lighting will be limited to junctions and roundabouts to avoid impacts on ecological features;
- Any lighting shall be minimal and of a type that will not cause a spillage of light on to the water surface of rivers or in vicinity of bat habitats, commuting routes and / or roosting areas.
- Artificial lights shining on bat roosts, their access points and / or the flight paths away from roosts **must always be avoided**. This includes alternative roosting sites such as bat boxes.
- Lighting design will be flexible and shall fully take into account the presence of protected species. Therefore, appropriate lighting will be used along the proposed road development and adjacent areas with more sensitive lighting regimes deployed in wildlife sensitive areas.
- Dark buffer zones will be used as a good way to separate habitats or features from lighting by forming a dark perimeter around them. This will be used for habitat features noted as foraging areas for bats.
- Buffer zones will be used to protect dark buffer zones and shall rely on ensuring light levels (levels of illuminance measured in lux) within a certain distance of a feature do not exceed certain defined limits (BCT, 2018 – see details below). The buffer zone can be further subdivided into zones of increasing illuminance limit radiating away from the feature or habitat that requires to be protected.
- Luminaire design is extremely important to achieve an appropriate lighting regime. Luminaires come in a myriad of different styles, applications and specifications, which a lighting professional can help to select. The following will be considered when choosing luminaires. This is taken from the most recent BCT Lighting Guidelines (Institution of Lighting Professionals, 2018).
 - All luminaires used will lack UV/IR elements to reduce impact.
 - LED luminaires will be used as they are highly directional, of lower intensity, and provide good colour rendition and dimming capability.
 - A warm white spectrum (<2700 Kelvins is achieved to reduce the blue light component of the LED spectrum).
 - Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.

- The use of specialist bollard or low-level downward directional luminaires shall be considered in bat sensitive areas to retain darkness above.
- Column heights will be carefully considered to minimise light spill. The shortest column height allowed shall be used, where possible.
- Only luminaires with an upward light ratio of 0% and with good optical control will be used.
- Luminaires will always be mounted on the horizontal, i.e. no upward tilt.
- Any external security lighting will be set on motion-sensors and short (1 minute) timers.
- As a last resort, accessories such as baffles, hoods or louvres will be used to reduce light spill and direct it only to where it is needed.

In particular, lighting shall not shine onto important commuting and foraging areas identified for local bat populations.

- No spotlight will be permitted on the underside of bridges, culverts, *etc.*, or on the side panels of named structures.
- No lighting will be permitted adjacent to locations of bat tubes, bat boxes and rocket bat boxes or at other bat roosting mitigation measures recommended to be incorporated into the proposed road development.

6. Maintain Roosts = No Disturbance to Roosts

With the exception of those buildings currently proposed to be demolished to facilitate the construction of the proposed development, buildings located close to the proposed road development will not be disturbed during construction works.

7. Limit Work Spaces and Lighting During Construction

Open areas required to facilitate road works along the proposed road development shall be limited to areas where tree felling and hedgerow removal is not required. Lighting of such work spaces can also disrupt traditional foraging grounds for bats and, therefore, shall be limited and shall not occur during the foraging period (from 30 minutes prior to sunset until 30 minutes after sunrise). Works at night-time will be avoided in areas where foraging bats are concentrated. All other areas shall be screened to prevent lighting spilling out onto adjacent habitats and lighting used shall be directional onto works.

8. Existing Bridges

A bat survey of any existing bridges or underpasses, where impacted by the proposed road development, shall be undertaken prior to the construction phase to determine if bats are roosting within such structures prior to construction works commencing.

9. Culverts / Underpasses / New Bridges

It is essential that the height of any proposed bridges and culverts are high enough to encourage bats species to fly under the road. The underpass height requirements are dictated by the preferred flight height of the different bat species:

- Natterer's bat, whiskered bat, brown long-eared bat, LHB and Daubenton's bat will be catered for by a minimum height of 2 – 3m in relation to underpasses.
- Common and soprano pipistrelle require a minimum height of 4 – 6m in relation to underpasses.

The above requirements have been accommodated where possible across the proposed road development, as detailed in Table 22. In addition, bat tubes will be installed in a number of structures, as outlined in Table 22, to provide alternative roosting sites for bats. Two bat tubes per structure, where possible, will be accommodated.

8. RESIDUAL IMPACTS

A large array of bat mitigation measures have been incorporated into the proposed road development, including additional enhancement works such as provision of alternative roosting sites, underpasses and landscaping. These measures are essential to ensure that the connectivity of the landscape is retained for local bat populations particularly LHBs. Assuming the correct implementation of the prescribed mitigation measures, the nature of the impact of the proposed development on bats is likely to be reduced to Minor Negative.

9. DIFFICULTIES ENCOUNTERED

The conclusions of this assessment are based on the results of the Four Season Bat Survey. The survey bias associated with the Four Season Bat Survey is as follows:

- Walking transects for the spring survey were undertaken along access tracks, railway lines and traversing fields. Occasionally it was difficult to access all fields along the proposed road development in the hours of darkness.
- Walking transects for the spring survey started each night prior to sunset. Different species emerge from roosts at different times depending on the ambient light levels (as discussed in Section 1.4.4). Therefore, late emerging bats may have been missed in areas walked at the start of the survey night. However, it is considered that the data obtained during the surveys provides a good snapshot of bat activity for much of the proposed road development. Additionally, execution of extensive static unit surveillance has bolstered the comprehensiveness of the results presented herein.
- Surveying was primarily concentrated within the site of the proposed development (i.e. development boundary). Therefore, little data was obtained on bat roosting sites in the adjacent landscape.
- Due to the generally poor weather conditions experienced during the winter survey, a limited number of buildings were checked.

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Sources used for description and assessments included in the report (Annex IV (10) including mapping and spatial data.

APPENDIX A: Information on Bat Boxes

Table A Details of recommended bat boxes

	Name	Description	Available to purchase here
A	Habibat Double Chambered Rocket Box	<i>Pole-mountable bat box to provide extensive roosting space</i>	https://www.nhbs.com/habibat-double-chambered-rocket-box
B	Schwegler Woodcrete Bat Box	Summer bat boxes to be erected on mature trees or telegraph poles	https://www.nhbs.com/4/woodcrete-and-woodstone-bat-boxes

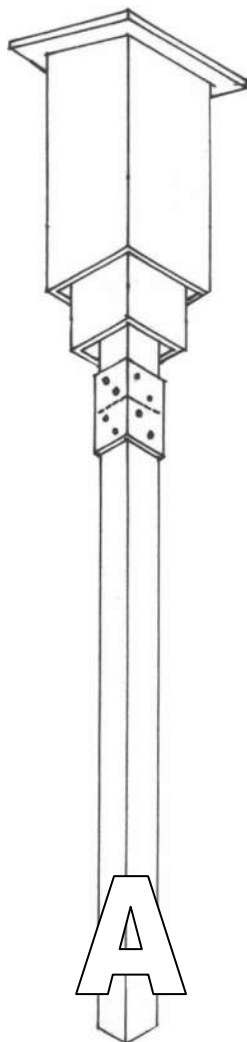


Figure A Habibat Double Chambered Rocket Box (A;left) and Schwegler Woodcrete Bat Box (B; right)

APPENDIX B: Mapping Data – Winter / Spring Survey, 2018

Table B: Excel file data used to prepare maps for spring survey results, 2018

Note: Chainage numbers reflect those at the time of surveying.

Bat species: 'CP' = common pipistrelle; 'SP' = soprano pipistrelle; 'Leis' = Leisler's bat; 'LHB' = lesser horseshoe bat; 'BLE' = brown long-eared bat; 'Daub' = Daubenton's bat; 'Natt' = Natterer's bat; 'nath pip' = Nathusius' pipistrelle; 'My' = *Myotis* species

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
1	23/04/2018	Dusk Walking Transect	Section A	1+100	Ardaneer	Online	CP
2	23/04/2018	Dusk Walking Transect	Section A	1+200	Ardaneer	Online	CP, SP
3	23/04/2018	Dusk Walking Transect	Section A	1+250	Ardaneer	Online	SP
4	23/04/2018	Dusk Walking Transect	Section A	1+300	Ardaneer	Online	SP
5	23/04/2018	Dusk Walking Transect	Section A	1+500	Ardaneer	Online	CP
6	23/04/2018	Dusk Walking Transect	Section A	1+900	Ardaneer	Offline	CP
7	23/04/2018	Dusk Walking Transect	Section A	2+100	Ardaneer	Online	SP, CP
8	23/04/2018	Dusk Walking Transect	Section A	2+150	Ardaneer	Online	CP
9	23/04/2018	Dusk Walking Transect	Section A	2+250	Sroolane North	Offline	SP
10	23/04/2018	Dusk Walking Transect	Section A	2+350	Sroolane North	Offline	SP, CP
11	23/04/2018	Dusk Walking Transect	Section A	2+400	Sroolane North	Online	SP
12	23/04/2018	Dusk Walking Transect	Section A	2+350	Sroolane North	Offline	SP, CP
13	23/04/2018	Dusk Walking Transect	Section A	2+400	Sroolane North	Online	CP, Leis
14	23/04/2018	Dusk Walking Transect	Section A	2+500	Sroolane North	Offline	SP, CP, Leis
15	23/04/2018	Dusk Walking Transect	Section A	2+600	Sroolane North	Online	SP, Leis
16	23/04/2018	Dusk Walking Transect	Section A	2+850	Robertstown	Offline	SP
17	23/04/2018	Dusk Walking Transect	Section A	2+900	Robertstown	Online	SP
18	23/04/2018	Dusk Walking Transect	Section A	3+100	Robertstown	Offline	SP
19	23/04/2018	Dusk Walking Transect	Section A	3+150	Robertstown	Offline	SP
20	23/04/2018	Dusk Walking Transect	Section A	3+150	Robertstown	Online	SP
21	23/04/2018	Dusk Walking Transect	Section A	3+300	Robertstown	Online	CP, SP

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
22	23/04/2018	Dusk Walking Transect	Section A	3+350	Robertstown	Offline	CP, SP
23	23/04/2018	Dusk Walking Transect	Section A	3+550	Robertstown	Offline	CP
24	23/04/2018	Dusk Walking Transect	Section A	3+600	Robertstown	Offline	Leis
25	24/04/2018	Dusk Walking Transect	Section A	4+150	Rincullia	Online	SP
26	24/04/2018	Dusk Walking Transect	Section A	4+200	Rincullia	Online	SP, CP
27	24/04/2018	Dusk Walking Transect	Section A	4+250	Rincullia	Offline	SP, CP
28	24/04/2018	Dusk Walking Transect	Section A	4+250	Rincullia	Offline	SP, CP
29	24/04/2018	Dusk Walking Transect	Section A	4+200	Rincullia	Offline	SP, CP
30	24/04/2018	Dusk Walking Transect	Section A	4+650	Rincullia	Offline	SP, My, Leis
31	24/04/2018	Dusk Walking Transect	Section A	4+650	Rincullia	Offline	SP, CP, My, Leis
A	23/04/2018	Static recording station	Section A	2+100	Sroolane North	Offline	Leis, CP, SP, My, LHB
B	23/04/2018	Static recording station	Section A	4+350	Rincullia	Offline	Leis, CP, SP
C	23/04/2018	Static recording station	Section A	5+150	Rincullia	Offline	Leis, CP, SP, My, LHB
32	23/04/2018	Dusk Walking Transect	Section A	5+300	Craggs	Online	CP
33	23/04/2018	Dusk Walking Transect	Section A	5+450	Mulderricksfield	Online	CP
34	23/04/2018	Dusk Walking Transect	Section A	5+750	Mulderricksfield	Online	SP, CP
35	23/04/2018	Dusk Walking Transect	Section A	5+950	Mulderricksfield	Online	CP
36	23/04/2018	Dusk Walking Transect	Section A	6+000	Mulderricksfield	Online	Leis
37	23/04/2018	Dusk Walking Transect	Section A	6+250	Ballyclogh	Offline	SP, CP, Leis - High level of activity
38	23/04/2018	Dusk Walking Transect	Section A	6+750	Ballyclogh	Offline	SP, CP
39	23/04/2018	Dusk Walking Transect	Section A	6+650	Ballyclogh	Online	Leis
40	23/04/2018	Dusk Walking Transect	Section A	6+800	Ballyclogh	Online	CP
41	23/04/2018	Dusk Walking Transect	Section A	6+850	Ballyclogh	Offline	Leis
42	23/04/2018	Dusk Walking Transect	Section A	6+900	Ballyclogh	Offline	CP
43	23/04/2018	Dusk Walking Transect	Section A	7+000	Ballyclogh	Offline	CP

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
44	23/04/2018	Dusk Walking Transect	Section A	7+150	Ballyclogh	Offline	SP
45	23/04/2018	Dusk Walking Transect	Section A	7+150	Ballyclogh	Online	SP
46	23/04/2018	Dusk Walking Transect	Section A	7+100	Ballyclogh	Online	SP, CP
47	23/04/2018	Dusk Walking Transect	Section A	7+300	Ballyclogh	Offline	SP
48	23/04/2018	Dusk Walking Transect	Section A	10+500	Ballyclogh	Online	SP, CP
49	23/04/2018	Dusk Walking Transect	Section A	10+500	Ballyclogh	Online	CP
50	23/04/2018	Dusk Walking Transect	Section A	10+500	Ballyclogh	Offline	SP
51	23/04/2018	Dusk Walking Transect	Section A	20+150	Ballyclogh	Offline	Leis
52	23/04/2018	Dusk Walking Transect	Section A	20+150	Ballyclogh	Offline	Leis
53	23/04/2018	Dusk Walking Transect	Section A	20+400	Ballyclogh	Offline	CP, SP, BLE, My - High level of activity
54	23/04/2018	Dusk Walking Transect	Section A	20+550	Ballyclogh	Online	CP, SP, Daub, BLE
D	23/04/2018	Static recording station	Section A	20+550	Ballyclogh Bridge	Online	CP, SP, Daub, Leis, LHS, My
55	23/04/2018	Dusk Walking Transect	Section B	10+250	Ballycullen	Offline	CP
56	23/04/2018	Dusk Walking Transect	Section B	10+350	Ballycullen	Offline	SP
57	23/04/2018	Dusk Walking Transect	Section B	10+400	Ballycullen	Online	SP, CP
58	23/04/2018	Dusk Walking Transect	Section B	10+700	Ballycullen	Offline	SP
59	23/04/2018	Dusk Walking Transect	Section B	10+550	Ballycullen	Offline	Leis
60	23/04/2018	Dusk Walking Transect	Section B	10+700	Ballycullen	Offline	SP
61	23/04/2018	Dusk Walking Transect	Section B	10+950	Ballycullen	Offline	SP
62	24/04/2018	Dusk Walking Transect	Section B	10+950	Ballycullen	Online	SP, Leis
63	24/04/2018	Dusk Walking Transect	Section B	11+050	Ballycullen	Online	CP
64	24/04/2018	Dusk Walking Transect	Section B	11+200	Ballycullen	Offline	SP, CP
E	23/04/2018	Static recording station	Section B	11+300	Ballycullen	Online	LHB, Leis, Cp, SP
65	24/04/2018	Dusk Walking Transect	Section B	11+500	Cloonreask	Online	Leis
66	24/04/2018	Dusk Walking Transect	Section B	11+650	Cloonreask	Offline	SP

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
67	24/04/2018	Dusk Walking Transect	Section B	11+750	Cloonreask	Online	Leis
68	24/04/2018	Dusk Walking Transect	Section B	11+900	Cloonreask	Offline	CP
69	24/04/2018	Dusk Walking Transect	Section B	11+350	Cloonreask	Offline	SP
70	24/04/2018	Dusk Walking Transect	Section B	11+400	Cloonreask	Offline	Leis
71	24/04/2018	Dusk Walking Transect	Section B	11+900	Cloonreask	Offline	SP, CP - high level of activity
72	24/04/2018	Dusk Walking Transect	Section C	20+700	Ballycullen	Online	SP
73	24/04/2018	Dusk Walking Transect	Section C	20+900	Ballycullen	Offline	SP, CP, Leis, My
74	24/04/2018	Dusk Walking Transect	Section C	20+950	Ballycullen	Online	SP
75	24/04/2018	Dusk Walking Transect	Section C	21+200	Ballycullen	Online	SP, My, Leis
76	24/04/2018	Dusk Walking Transect	Section C	21+350	Ballycullen	Online	Leis
77	24/04/2018	Dusk Walking Transect	Section C	21+600	Ballycullen	Offline	Leis
78	24/04/2018	Dusk Walking Transect	Section C	21+600	Ballycullen	Offline	CP, SP
79	24/04/2018	Dusk Walking Transect	Section C	21+600	Ballycullen	Offline	CP
80	24/04/2018	Dawn Walking Transect	Section A	1+000	Ardaneer	Offline	Leis
81	24/04/2018	Dawn Walking Transect	Section A	1+000	Ardaneer	Offline	CP
82	24/04/2018	Dusk Walking Transect	Section C	22+100	Baunreagh	Online	CP
83	24/04/2018	Dusk Walking Transect	Section C	22+200	Baunreagh	Online	CP
84	24/04/2018	Dusk Walking Transect	Section C	23+050	Ballynacheragh	Online	CP
85	24/04/2018	Dusk Walking Transect	Section C	22+950	Ballynacheragh	Offline	Leis
86	24/04/2018	Dusk Walking Transect	Section C	23+150	Ballynacheragh	Offline	Leis
87	24/04/2018	Dusk Walking Transect	Section C	23+150	Ballynacheragh	Offline	Leis
88	24/04/2018	Dusk Walking Transect	Section C	23+100	Ballynacheragh	Online	SP
89	24/04/2018	Dusk Walking Transect	Section C	23+200	Milltown North	Online	SP
90	24/04/2018	Dusk Walking Transect	Section C	23+100	Milltown North	Offline	Leis
91	24/04/2018	Dusk Walking Transect	Section C	23+300	Milltown North	Offline	Leis

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
92	24/04/2018	Dusk Walking Transect	Section C	23+550	Milltown North	Online	CP, SP, Leis
93	24/04/2018	Dusk Walking Transect	Section C	23+850	Milltown North	Offline	Leis
94	24/04/2018	Dusk Walking Transect	Section C	23+600	Milltown North	Online	Daubs, SP, Leis - very high level of bat activity
95	24/04/2018	Dusk Walking Transect	Section C	24+050	Milltown North	Online	Leis
96	24/04/2018	Dusk Walking Transect	Section C	23+050	Ballynacheragh	Online	Leis
97	24/04/2018	Dusk Walking Transect	Section C	22+750	Ballynacheragh	Offline	CP
F	24/04/2018	Static recording station	Section C	23+850	Milltown North	Offline	CP, SP, Daub, Leis, LHS, My
G	24/04/2018	Static recording station	Section C	25+550	Feeagh	Online	SP, CP, Leis, BLE
H	24/04/2018	Static recording station	Section C	26+400	Graigeen	Offline	LHB, Leis, CP, SP
I	24/04/2018	Static recording station	Section C	26+900	Graigeen	Online	SP, CP, Leis, My
98	24/04/2018	Dusk Walking Transect	Section C	25+800	Feeagh	Offline	SP
99	24/04/2018	Dusk Walking Transect	Section C	25+650	Feeagh	Online	CP, SP
100	24/04/2018	Dusk Walking Transect	Section C	25+500	Feeagh	Offline	Leis
101	24/04/2018	Dusk Walking Transect	Section C	25+450	Feeagh	Online	CP
102	24/04/2018	Dusk Walking Transect	Section C	25+400	Feeagh	Online	Leis
103	24/04/2018	Dusk Walking Transect	Section C	25+200	Feeagh	Online	SP
104	24/04/2018	Dusk Walking Transect	Section C	25+050	Feeagh	Offline	CP
105	24/04/2018	Dusk Walking Transect	Section C	25+050	Feeagh	Online	Daub, SP
106	24/04/2018	Dusk Walking Transect	Section C	25+250	Feeagh	Offline	SP
107	24/04/2018	Dusk Walking Transect	Section C	25+400	Feeagh	Offline	Daub, SP, CP, BLE, My - v. high level of bat activity
108	24/04/2018	Dusk Walking Transect	Section C	25+550	Feeagh	Offline	Daub, SP, CP, BLE, My - v. high level of bat activity
109	24/04/2018	Dusk Walking Transect	Section C	25+800	Feeagh	Online	SP
110	24/04/2018	Dusk Walking Transect	Section C	25+900	Feeagh	Online	Leis

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
111	24/04/2018	Dusk Walking Transect	Section C	25+650	Feeagh	Offline	CP
112	24/04/2018	Dusk Walking Transect	Section C	25+800	Feeagh	Offline	SP, My
113	24/04/2018	Dusk Walking Transect	Section C	25+900	Ardgoul South	Online	Leis
114	24/04/2018	Dusk Walking Transect	Section C	26+250	Ardgoul South	Offline	CP
115	24/04/2018	Dusk Walking Transect	Section C	26+400	Ardgoul South	Offline	SP
116	24/04/2018	Dusk Walking Transect	Section C	26+550	Ardgoul South	Offline	CP
117	24/04/2018	Dusk Walking Transect	Section C	26+700	Ardgoul South	Offline	CP
118	24/04/2018	Dusk Walking Transect	Section C	26+750	Graigeen	Offline	CP
119	24/04/2018	Dusk Walking Transect	Section C	26+850	Graigeen	Online	CP
120	24/04/2018	Dusk Walking Transect	Section C	26+450	Graigeen	Offline	SP, CP
121	24/04/2018	Dusk Walking Transect	Section C	26+450	Graigeen	Offline	SP
122	24/04/2018	Dusk Walking Transect	Section C	26+950	Graigeen	Online	CP, SP
123	24/04/2018	Dusk Walking Transect	Section C	27+100	Graigeen	Online	SP
124	25/04/2018	Dawn Walking Transect	Section C	27+600	Ballingarrane	Offline	CP
125	25/04/2018	Dawn Walking Transect	Section C	28+150	Ballingarrane	Offline	SP
126	25/04/2018	Dawn Walking Transect	Section C	27+600	Ballingarrane	Online	CP
127	25/04/2018	Dawn Walking Transect	Section C	27+700	Ballingarrane	Offline	CP
128	25/04/2018	Dusk Walking Transect	Section C	28+700	Rathkeale	Online	SP
129	25/04/2018	Dusk Walking Transect	Section C	29+100	Rathkeale	Online	SP
130	25/04/2018	Dusk Walking Transect	Section D	50+250	Rathkeale	Offline	CP
131	25/04/2018	Dusk Walking Transect	Section D	50+550	Rathkeale	Online	CP
132	25/04/2018	Dusk Walking Transect	Section D	50+850	Wolfesburgess East	Online	SP
133	25/04/2018	Dusk Walking Transect	Section D	51+100	Wolfesburgess East	Online	SP
134	25/04/2018	Dusk Walking Transect	Section D	51+150	Wolfesburgess East	Online	BLE
J	25/04/2018	Static recording station	Section C	50+150	Rathkeale	Online	MY, SP, CP, Leis, LHB

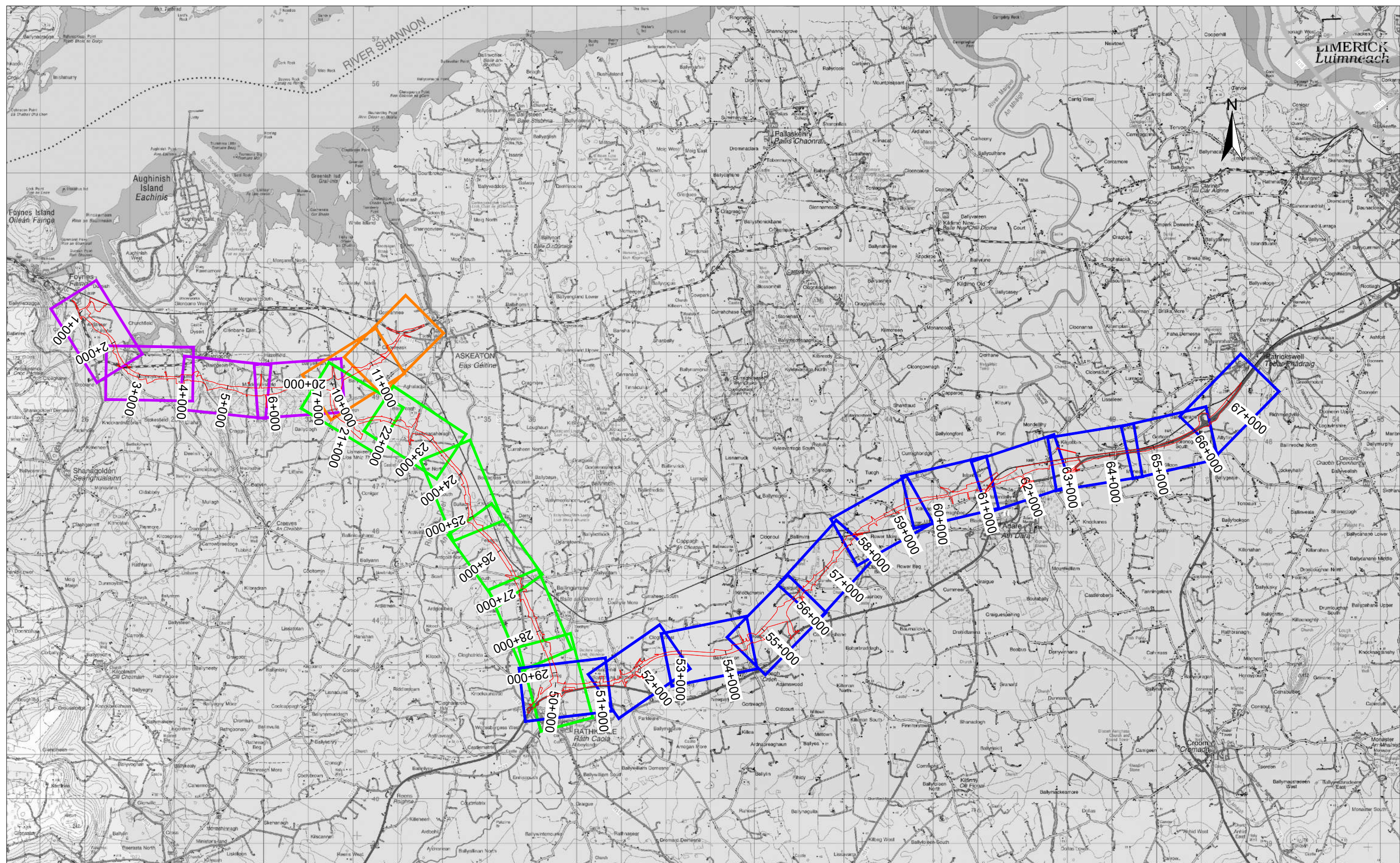
Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
K	25/04/2018	Static recording station	Section D	51+150	Wolfesburgess East	Online	SP, CP, Leis, LHB
L	25/04/2018	Static recording station	Section D	51+750	Blossomhill	Online	Leis, SP, CP, BLE
M	25/04/2018	Static recording station	Section D	57+350	Clonshire More	Offline	SP, CP, Leis, LHB
N	25/04/2018	Static recording station	Section D	62+450	Clonshire More	Offline	SP, Leis, CP, My, BLE, Daub, Nath pip
135	25/04/2018	Dusk Walking Transect	Section D	51+850	Blossomhill	Offline	SP
136	25/04/2018	Dusk Walking Transect	Section D	51+900	Blossomhill	Offline	SP
137	25/04/2018	Dusk Walking Transect	Section D	52+700	Amogan Beg	Offline	CP
138	25/04/2018	Dusk Walking Transect	Section D	53+100	Amogan Beg	Offline	CP, Leis
139	25/04/2018	Dusk Walking Transect	Section D	53+450	Amogan Beg	Offline	CP
140	25/04/2018	Dusk Walking Transect	Section D	53+850	Ballycannon	Online	Leis
141	25/04/2018	Dusk Walking Transect	Section D	53+850	Clough East	Offline	CP
142	25/04/2018	Dusk Walking Transect	Section D	54+250	Clough East	Offline	CP
143	25/04/2018	Dusk Walking Transect	Section D	54+450	Clough East	Online	CP
144	25/04/2018	Dusk Walking Transect	Section D	54+650	Clough East	Offline	Leis
145	25/04/2018	Dusk Walking Transect	Section D	55+000	Clough East	Offline	Leis
O	29/04/2018	Static recording station	Section D	58+000	Gortnagrour	Online	Leis, Cp, SP, My, LHB
P	29/04/2018	Static recording station	Section D	58+150	Gortnagrour	Online	Leis, Cp, SP, My, LHB
Q	29/04/2018	Static recording station	Section D	61+100	Islandea	Offline	Leis, Cp, SP, My, LHB
R	29/04/2018	Static recording station	Section D	62+050	N21 - corner of field		SP, CP
S	29/04/2018	Static recording station	Section D	63+150	Railway line		SP, CP
146	29/04/2018	Dusk Walking Transect	Section D	56+900	Clonshire More	Online	CP
147	29/04/2018	Dusk Walking Transect	Section D	57+250	Clonshire More	Online	SP
148	29/04/2018	Dusk Walking Transect	Section D	57+700	Clonshire Beg	Offline	SP, CP
149	29/04/2018	Dusk Walking Transect	Section D	57+800	Clonshire Beg	Offline	SP
150	29/04/2018	Dusk Walking Transect	Section D	57+850	Clonshire Beg	Offline	CP

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
151	29/04/2018	Dusk Walking Transect	Section D	57+950	Clonshire Beg	Online	CP, SP
152	29/04/2018	Dusk Walking Transect	Section D	58+050	Clonshire Beg	Offline	CP
153	29/04/2018	Dusk Walking Transect	Section D	58+150	Clonshire Beg	Offline	CP
154	29/04/2018	Dusk Walking Transect	Section D	58+150	Rower More	Offline	CP, SP, Daub
155	29/04/2018	Dusk Walking Transect	Section D	58+200	Rower More	Offline	SP, CP
156	29/04/2018	Dusk Walking Transect	Section D	58+300	Rower More	Offline	SP, CP
157	29/04/2018	Dusk Walking Transect	Section D	58+300	Rower More	Offline	CP
158	29/04/2018	Dusk Walking Transect	Section D	58+400	Rower More	Offline	SP
159	29/04/2018	Dusk Walking Transect	Section D	58+500	Rower More	Offline	SP
160	29/04/2018	Dusk Walking Transect	Section D	58+550	Rower More	Offline	CP
161	29/04/2018	Dusk Walking Transect	Section D	58+700	Rower More	Offline	SP
162	29/04/2018	Dusk Walking Transect	Section D	58+850	Rower More	Offline	My, Natt, SP
163	29/04/2018	Dusk Walking Transect	Section D	58+900	Rower More	Offline	SP, CP
164	29/04/2018	Dusk Walking Transect	Section D	58+900	Rower More	Offline	CP, Daub
165	29/04/2018	Dusk Walking Transect	Section D	58+950	Rower More	Offline	CP, SP
166	29/04/2018	Dusk Walking Transect	Section D	59+000	Rower More	Offline	CP
167	29/04/2018	Dusk Walking Transect	Section D	59+050	Rower More	Offline	Daub, CP
168	29/04/2018	Dusk Walking Transect	Section D	59+050	Rower More	Offline	CP
169	29/04/2018	Dusk Walking Transect	Section D	59+100	Kilknockan	Offline	SP
170	29/04/2018	Dusk Walking Transect	Section D	59+170	Kilknockan	Offline	SP
171	29/04/2018	Dusk Walking Transect	Section D	59+200	Kilknockan	Offline	SP, CP
172	29/04/2018	Dusk Walking Transect	Section D	59+300	Kilknockan	Offline	SP
173	29/04/2018	Dusk Walking Transect	Section D	59+350	Kilknockan	Offline	CP
174	29/04/2018	Dusk Walking Transect	Section D	59+450	Kilknockan	Offline	CP
175	29/04/2018	Dusk Walking Transect	Section D	59+550	Kilknockan	Offline	CP, SP

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
176	29/04/2018	Dusk Walking Transect	Section D	59+500	Kilknockan	Offline	SP
177	29/04/2018	Dusk Walking Transect	Section D	59+550	Kilknockan	Offline	SP, Cp
178	29/04/2018	Dusk Walking Transect	Section D	59+600	Kilknockan	Offline	CP
179	29/04/2018	Dusk Walking Transect	Section D	59+650	Kilknockan	Offline	CP, Leis
180	29/04/2018	Dusk Walking Transect	Section D	59+650	Kilknockan	Offline	SP
181	29/04/2018	Dusk Walking Transect	Section D	59+800	Kilknockan	Offline	CP
182	29/04/2018	Dusk Walking Transect	Section D	59+850	Kilknockan	Online	SP
183	29/04/2018	Dusk Walking Transect	Section D	59+900	Kilknockan	Offline	CP
184	29/04/2018	Dusk Walking Transect	Section D	59+900	Kilknockan	Offline	SP
185	29/04/2018	Dusk Walking Transect	Section D	60+100	Kilknockan	Offline	SP
186	29/04/2018	Dusk Walking Transect	Section D	60+100	Kilknockan	Offline	CP
187	29/04/2018	Dusk Walking Transect	Section D	60+100	Curraghbeg	Offline	CP
188	29/04/2018	Dusk Walking Transect	Section D	60+150	Curraghbeg	Offline	CP
189	29/04/2018	Dusk Walking Transect	Section D	60+250	Curraghbeg	Online	SP, CP
190	29/04/2018	Dusk Walking Transect	Section D	60+300	Curraghbeg	Offline	CP
191	29/04/2018	Dusk Walking Transect	Section D	60+300	Curraghbeg	Offline	CP
192	29/04/2018	Dusk Walking Transect	Section D	60+300	Curraghbeg	Offline	CP
193	29/04/2018	Dusk Walking Transect	Section D	60+450	Curraghbeg	Offline	CP
194	29/04/2018	Dusk Walking Transect	Section D	60+600	Curraghbeg	Offline	CP
195	29/04/2018	Dusk Walking Transect	Section D	60+750	Islandea	Offline	SP
196	29/04/2018	Dusk Walking Transect	Section D	60+900	Islandea	Offline	CP
197	29/04/2018	Dusk Walking Transect	Section D	60+950	Islandea	Offline	SP, CP
198	29/04/2018	Dusk Walking Transect	Section D	60+900	Islandea	Online	SP, CP, Leis
199	29/04/2018	Dusk Walking Transect	Section D	60+700	Islandea	Online	SP
200	29/04/2018	Dusk Walking Transect	Section D	60+700	Islandea	Offline	SP

Code	Date	Survey Type	Section	Chainage No.	Location (Townland)	Road Alignment	Bat Species
201	29/04/2018	Dusk Walking Transect	Section D	60+750	Islandea	Offline	SP, Daub - continuous bat activity
202	29/04/2018	Dusk Walking Transect	Section D	61+050	Islandea	Offline	SP, Daub - continuous bat activity
203	29/04/2018	Dusk Walking Transect	Section D	60+800	Islandea	Online	SP, Daub - continuous bat activity
204	29/04/2018	Dusk Walking Transect	Section D	60+900	Ardshanbally	Offline	SP, Daub - continuous bat activity
205	29/04/2018	Dusk Walking Transect	Section D	61+000	Ardshanbally	Offline	SP, Daub, CP - continuous bat activity
206	29/04/2018	Dusk Walking Transect	Section D	61+150	Ardshanbally	Offline	SP, Daub - continuous bat activity
207	29/04/2018	Dusk Walking Transect	Section D	61+250	Ardshanbally	Offline	SP, Daub, Leis, CP - continuous bat activity
208	29/04/2018	Dusk Walking Transect	Section D	61+550	Ardshanbally	Offline	Leis. CP, SP, My - continuous bat activity
209	29/04/2018	Dusk Walking Transect	Section D	61+400	Ardshanbally	Offline	Leis. CP, SP, My
210	29/04/2018	Dusk Walking Transect	Section D	61+200	Ardshanbally	Offline	CP
211	29/04/2018	Dusk Walking Transect	Section D	61+350	Ardshanbally	Online	CP
212	29/04/2018	Dusk Walking Transect	Section D	61+650	Ardshanbally	Offline	SP, CP
213	29/04/2018	Dusk Walking Transect	Section D	62+000	Ardshanbally	Offline	CP, SP, BLE
214	29/04/2018	Dusk Walking Transect	Section D	62+100	Ardshanbally	Offline	CP, SP
215	29/04/2018	Dusk Walking Transect	Section D	62+000	Ardshanbally	Online	CP
216	29/04/2018	Dusk Walking Transect	Section D	62+100	Ardshanbally	Online	SP
217	29/04/2018	Dusk Walking Transect	Section D	62+300	Ardshanbally	Online	SP, CP
218	30/04/2018	Dusk Walking Transect	Section D	52+500	Ardshanbally	Offline	Leis
219	30/04/2018	Dusk Walking Transect	Section D	62+550	Ardshanbally	Offline	CP
220	30/04/2018	Dusk Walking Transect	Section D	62+750	Ardshanbally	Online	CP, SP
221	30/04/2018	Dusk Walking Transect	Section D	52+850	Ardshanbally	Online	CP
222	30/04/2018	Dusk Walking Transect	Section D	62+050	Ardshanbally	Online	CP
223	30/04/2018	Dusk Walking Transect	Section D	62+600	Ardshanbally	Online	CP

APPENDIX C: Mapping – Winter / Spring Survey, 2018



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Turasóireachta agus Spóirt
Department of Transport,
Tourism and Sport



Bonneagar Iompair Éireann
Transport Infrastructure Ireland



Comhairle Cathrach
& Contae Luimnigh
Limerick City
& County Council



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Project

Foynes to Limerick Road
(including Adare Bypass)

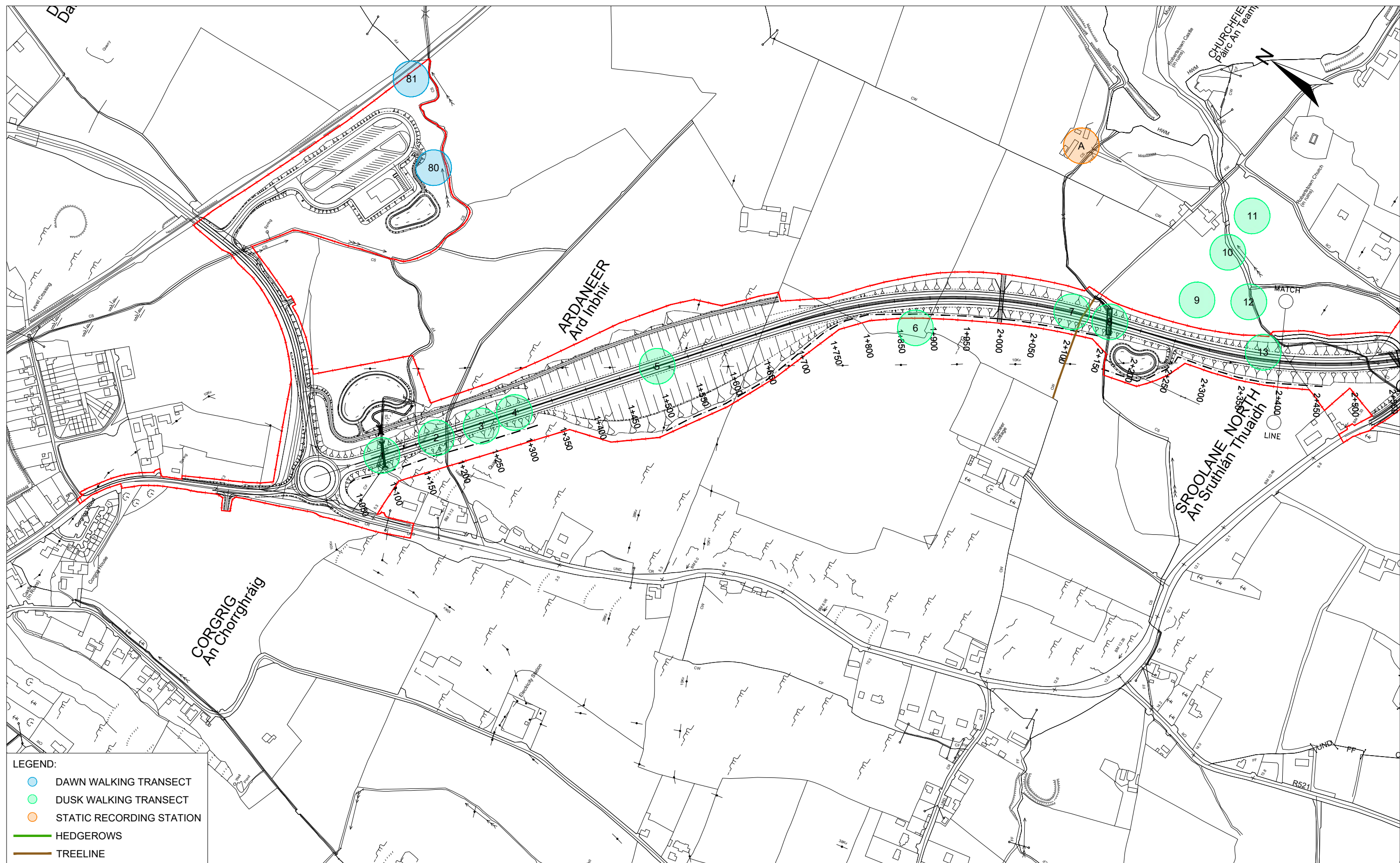
Environmental Impact
Assessment Report

Drawing Title:

BAT SURVEY - WINTER / SPRING RESULTS 2018
SHEET LAYOUT

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Approved: SMG	Date: December 2019	Rev: -

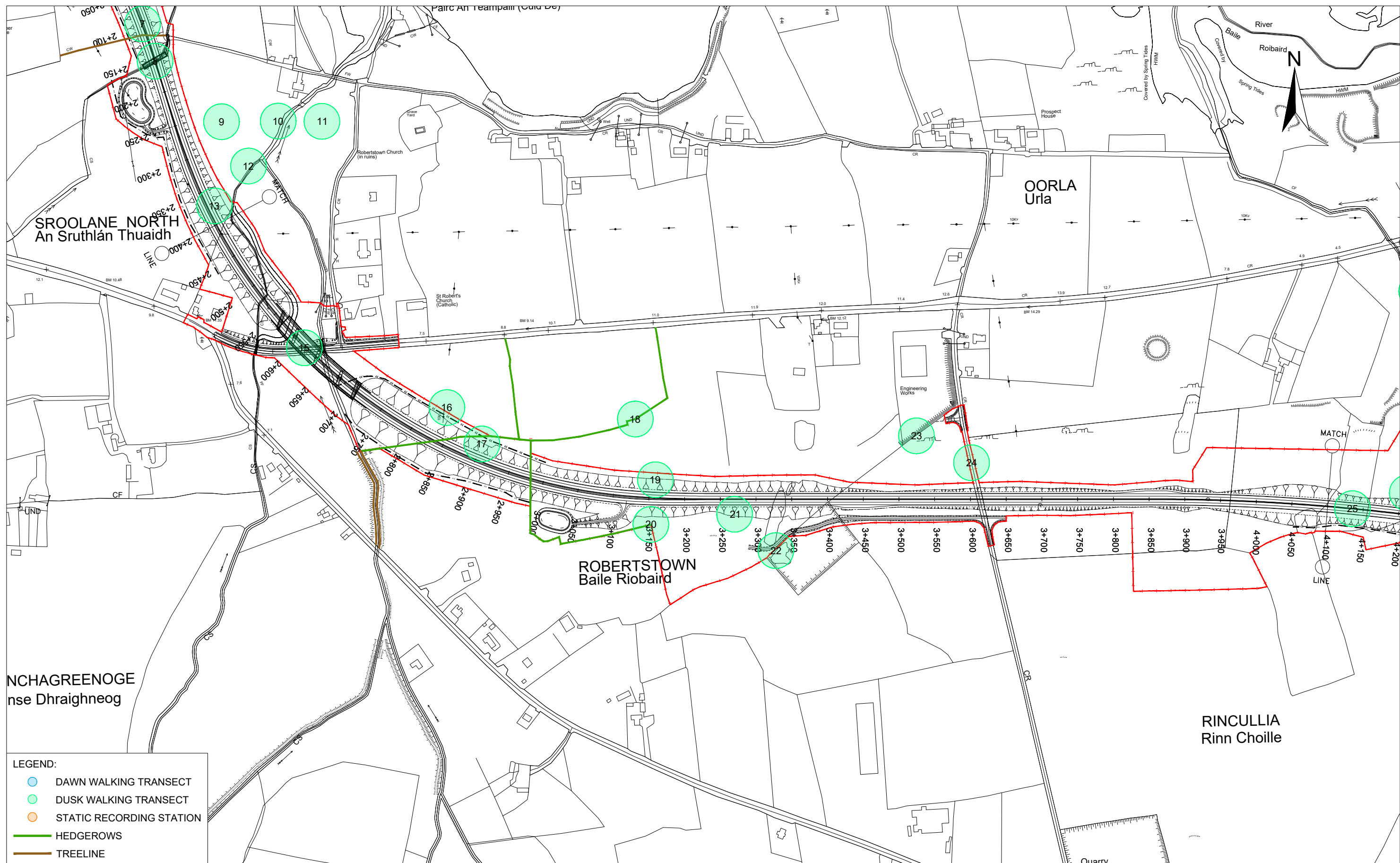
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Project

**Foynes to Limerick Road
(including Adare Bypass)**

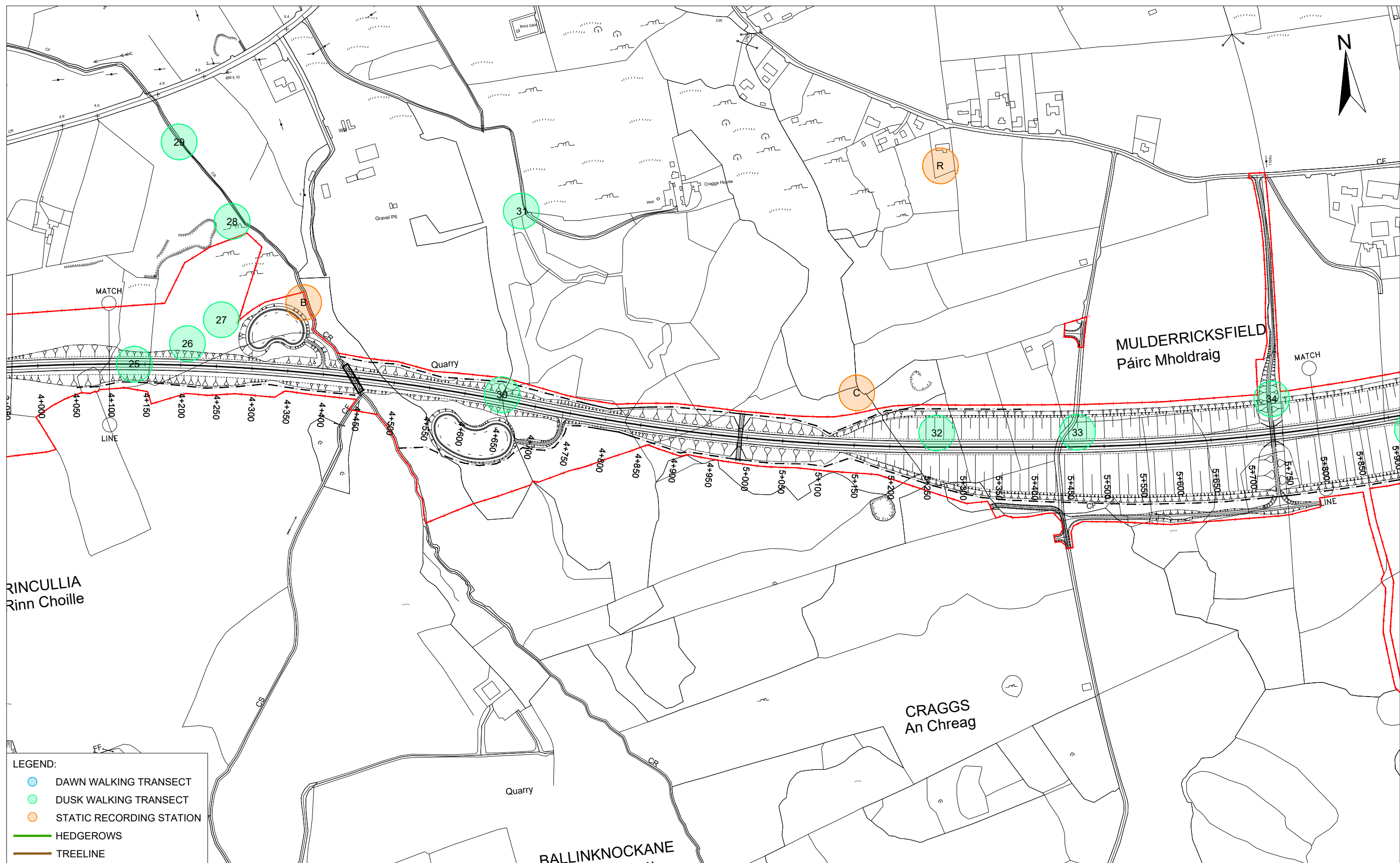
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**BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION A
SHEET 2 OF 4**

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Approved: SMG	Date: December 2019	Rev: -

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Foynes to Limerick Road
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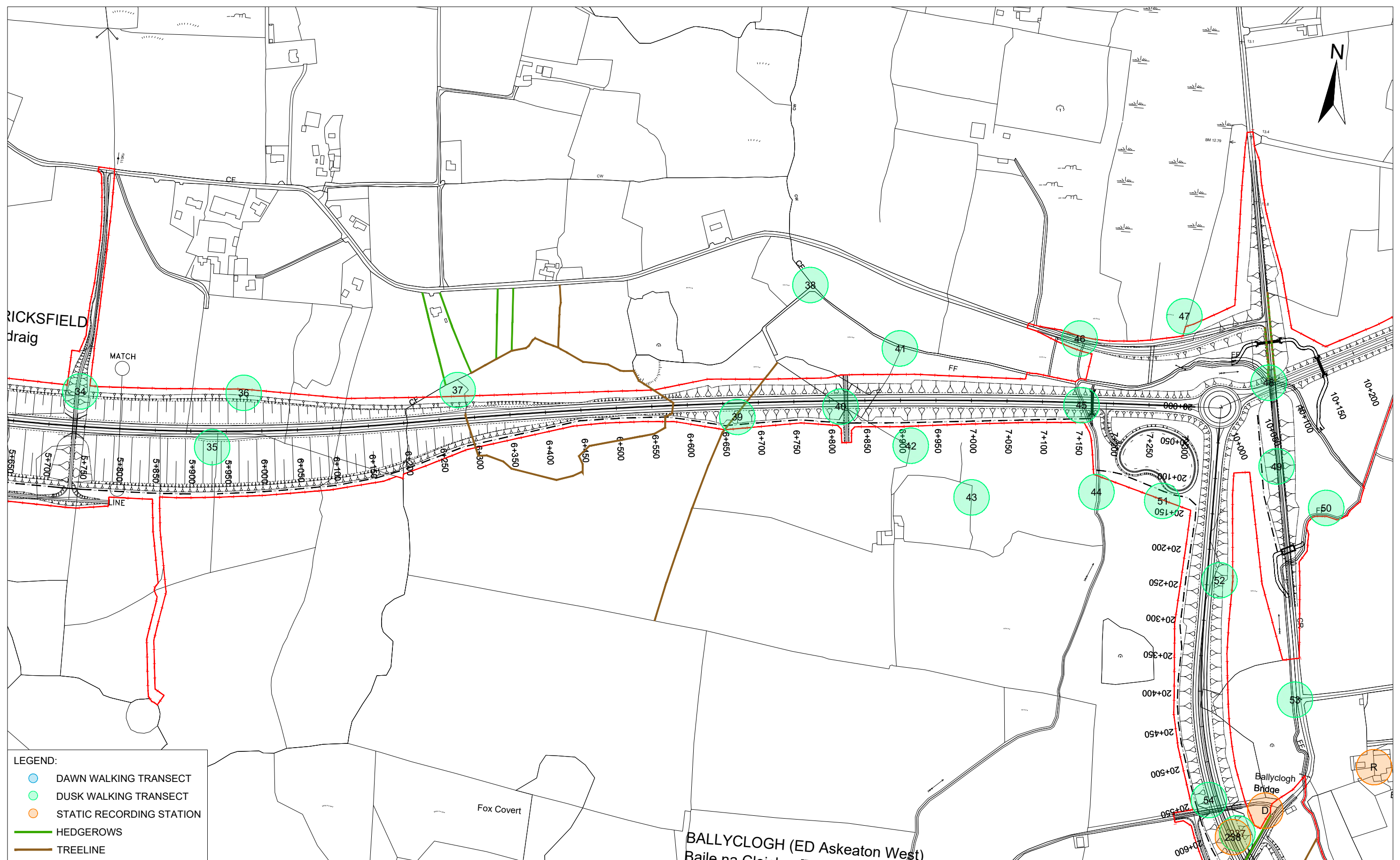
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Assessment Report

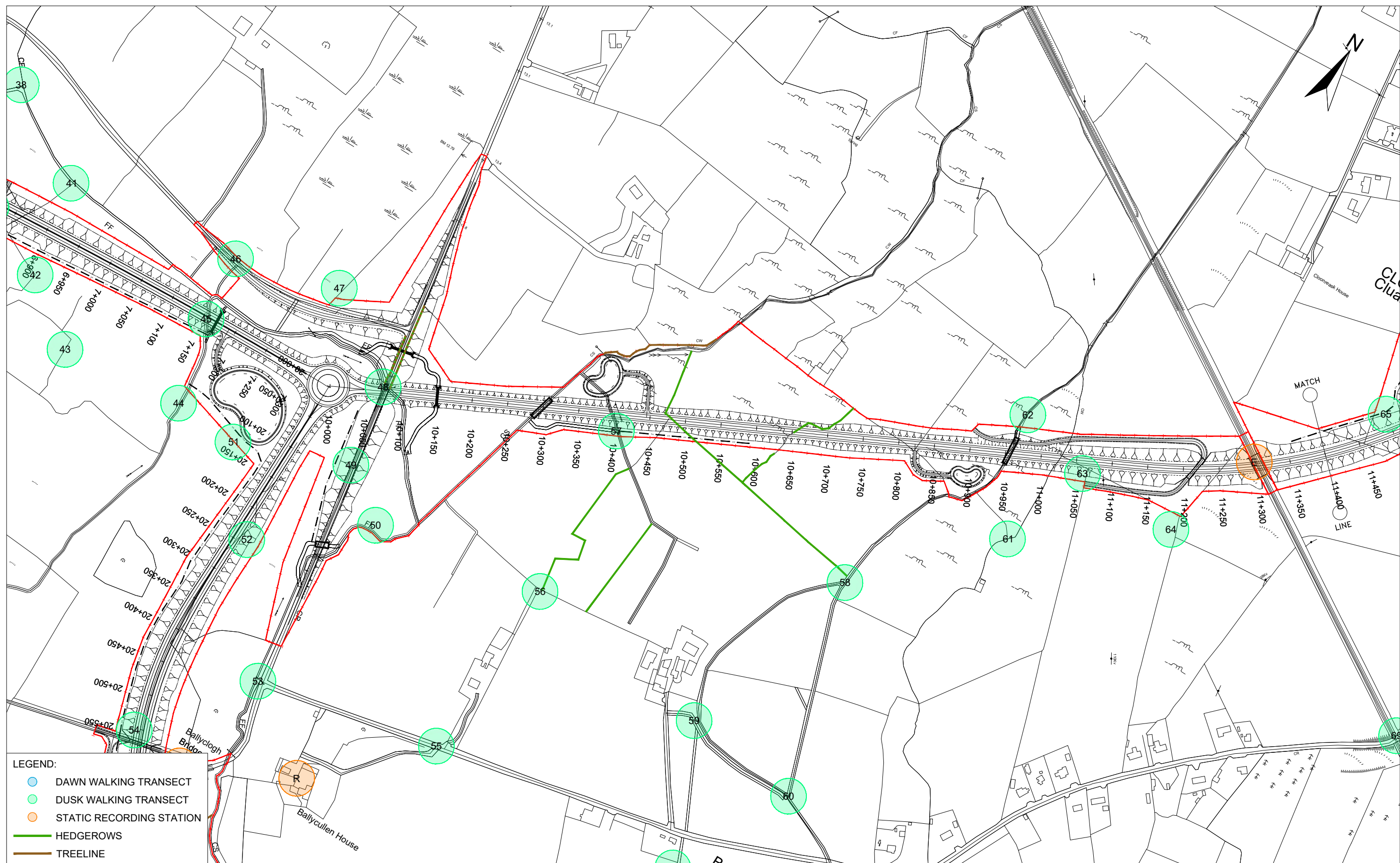
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BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION A
SHEET 3 OF 4

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Approved: SMG	Date: December 2019	Rev: -

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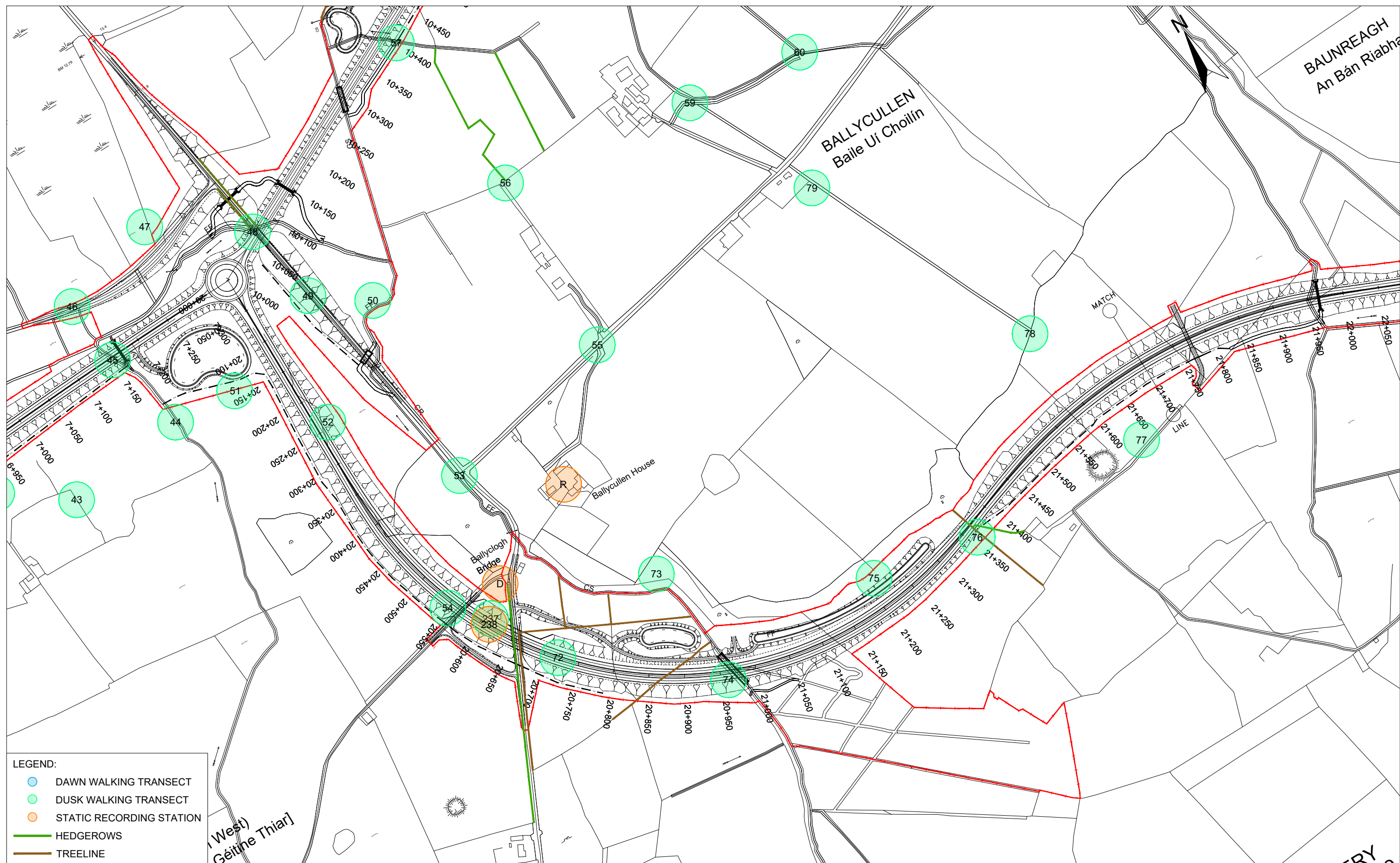




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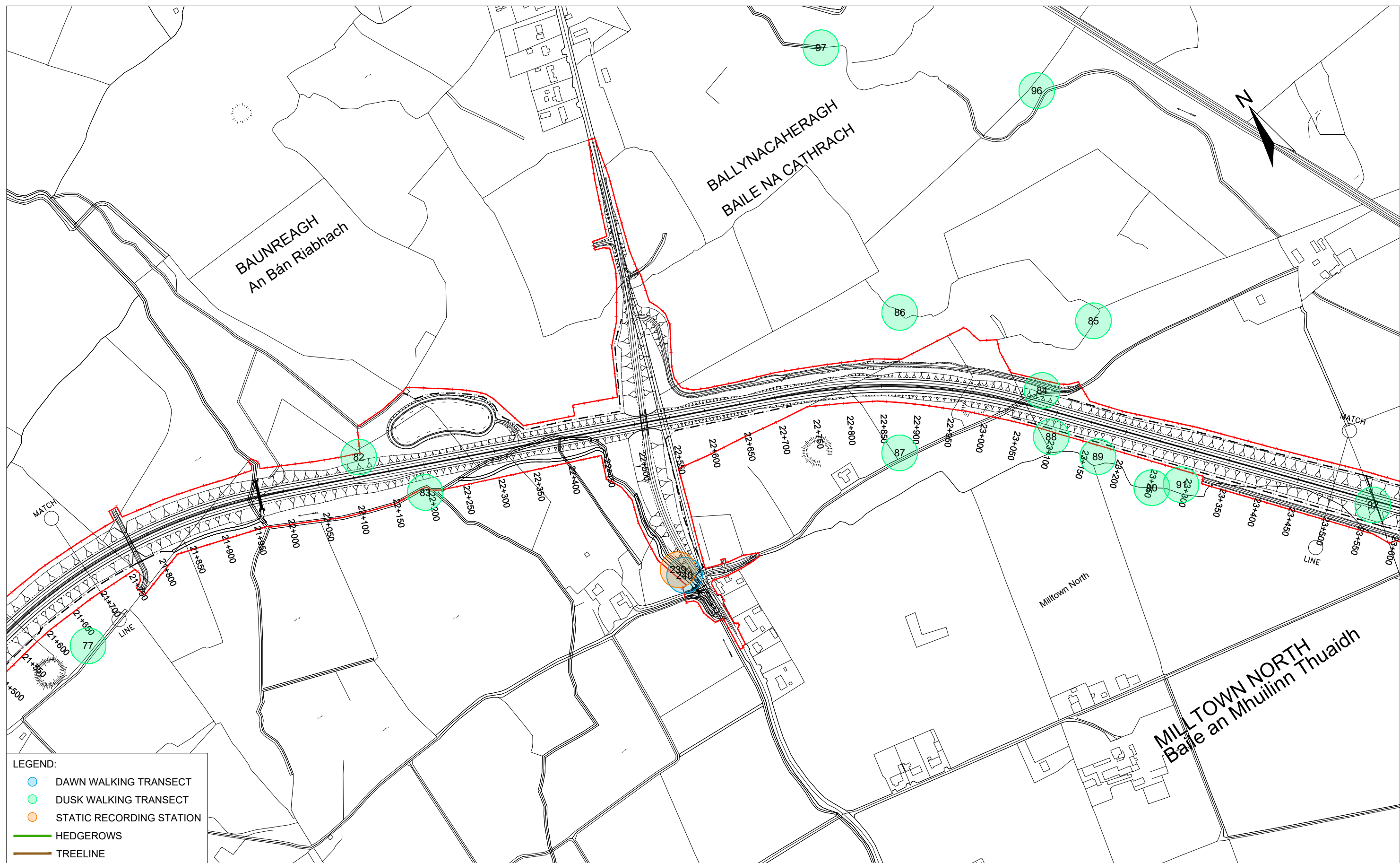
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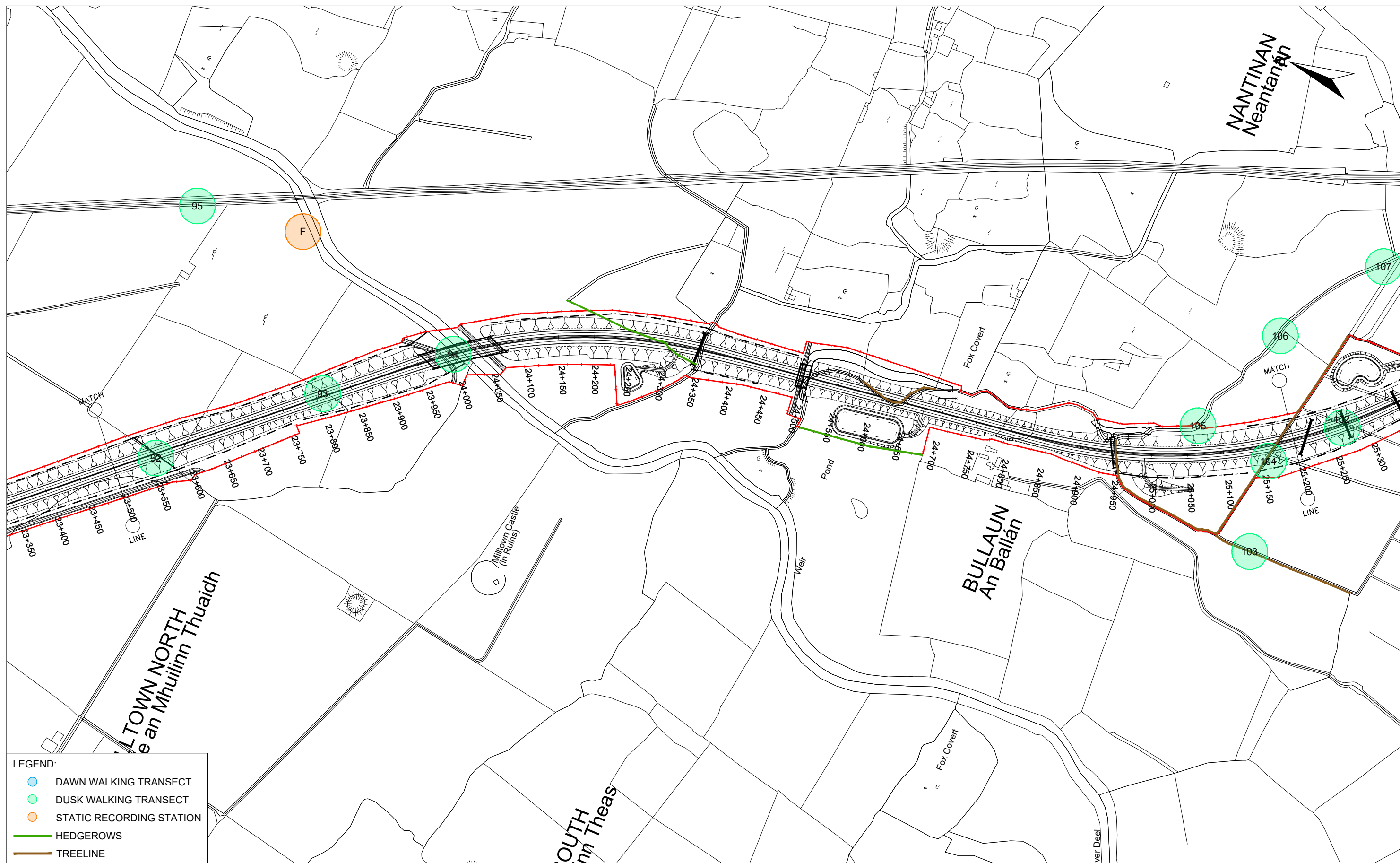
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- DUSK WALKING TRANSECT
- STATIC RECORDING STATION
- HEDGEROWS
- TREELINE

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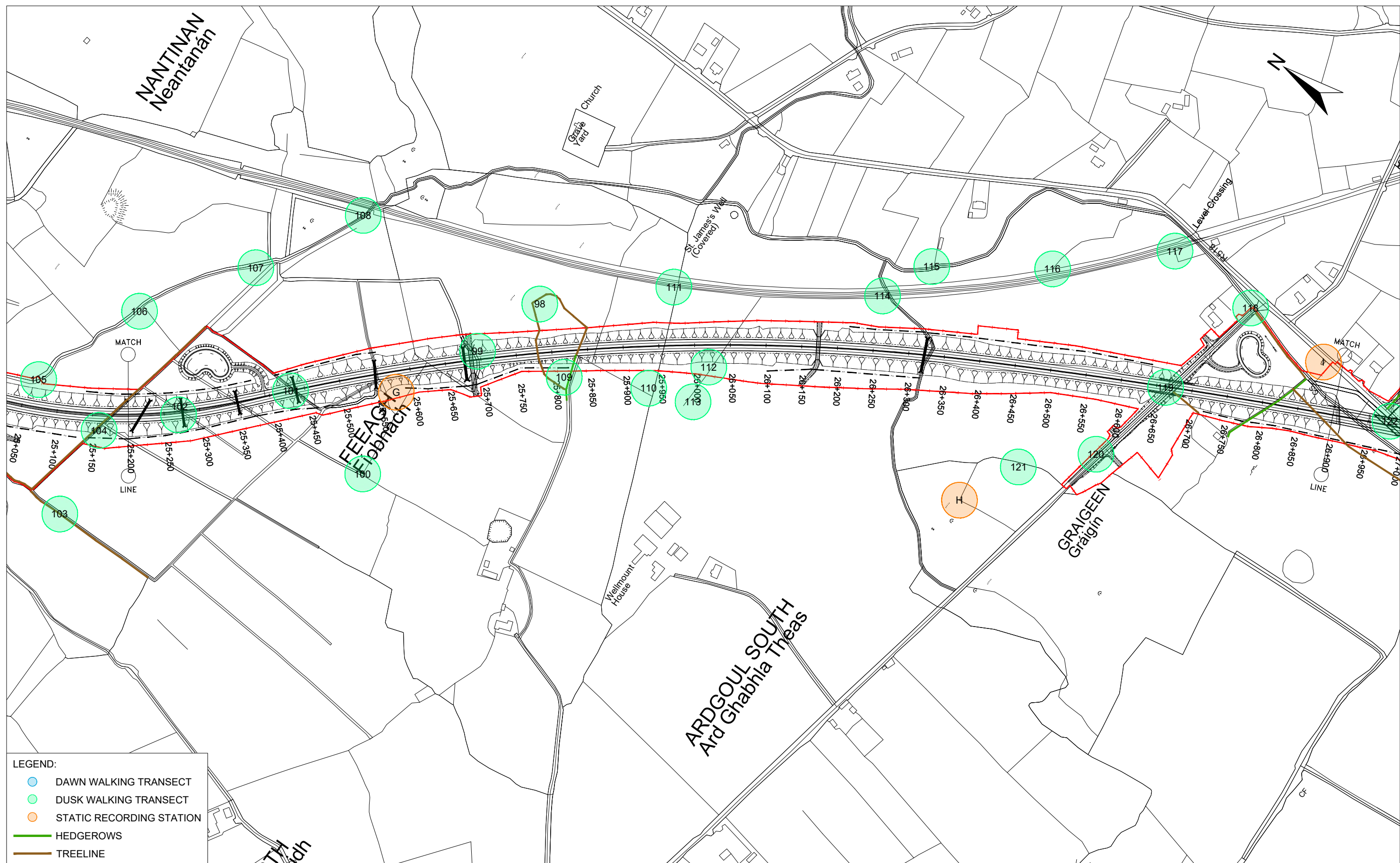
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- STATIC RECORDING STATION
- HEDGEROWS
- TREELINE

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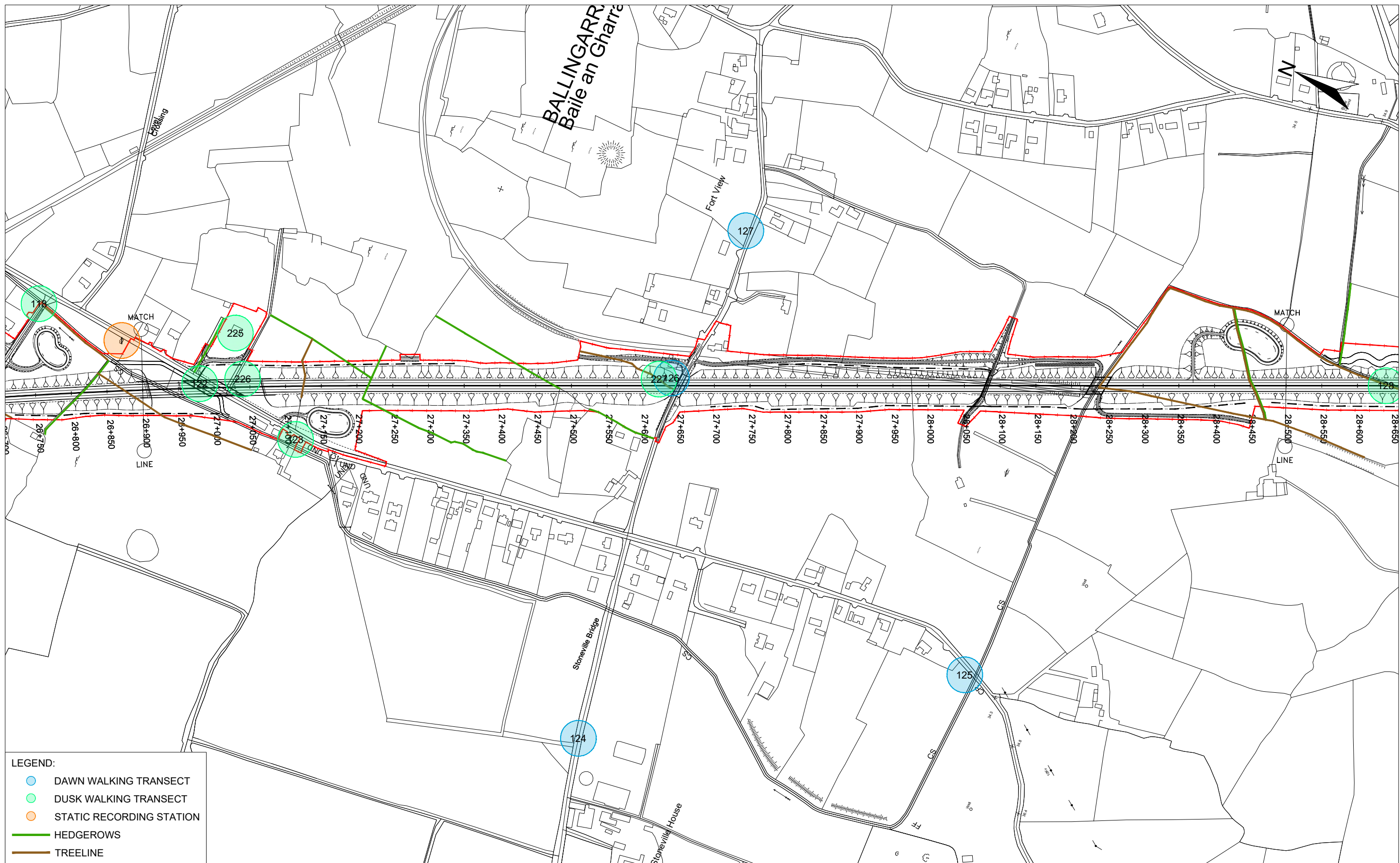
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Drawing Title:

**BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION C
SHEET 4 OF 6**

Designed: Dr TA	File:	Status: E.I.A.R. A7.1
Drawn: LA	Job No: 14.131	
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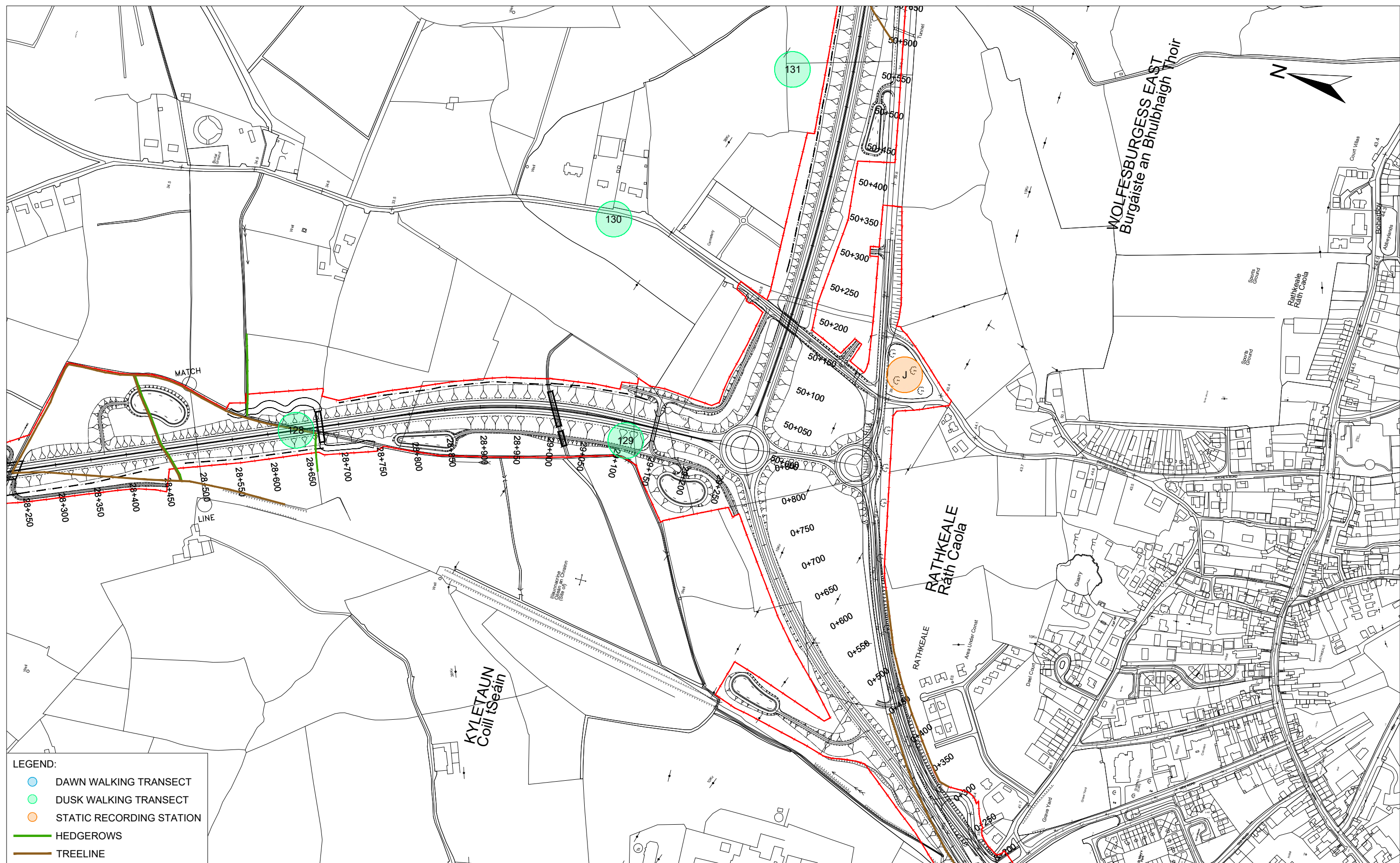
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Drawing Title:

**BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION C
SHEET 5 OF 6**

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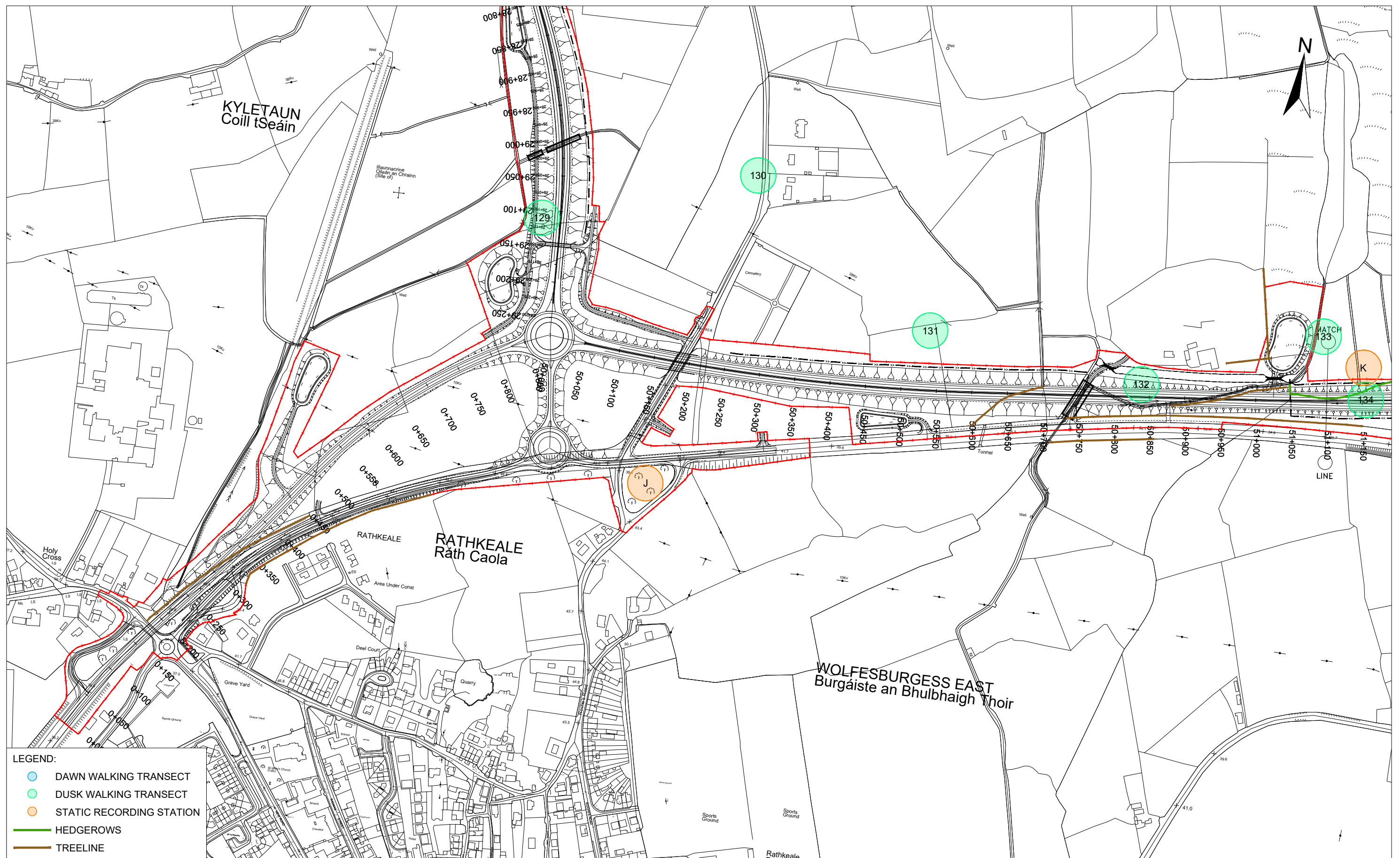
Project
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Assessment Report**

Drawing Title:
**BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION C
SHEET 6 OF 6**

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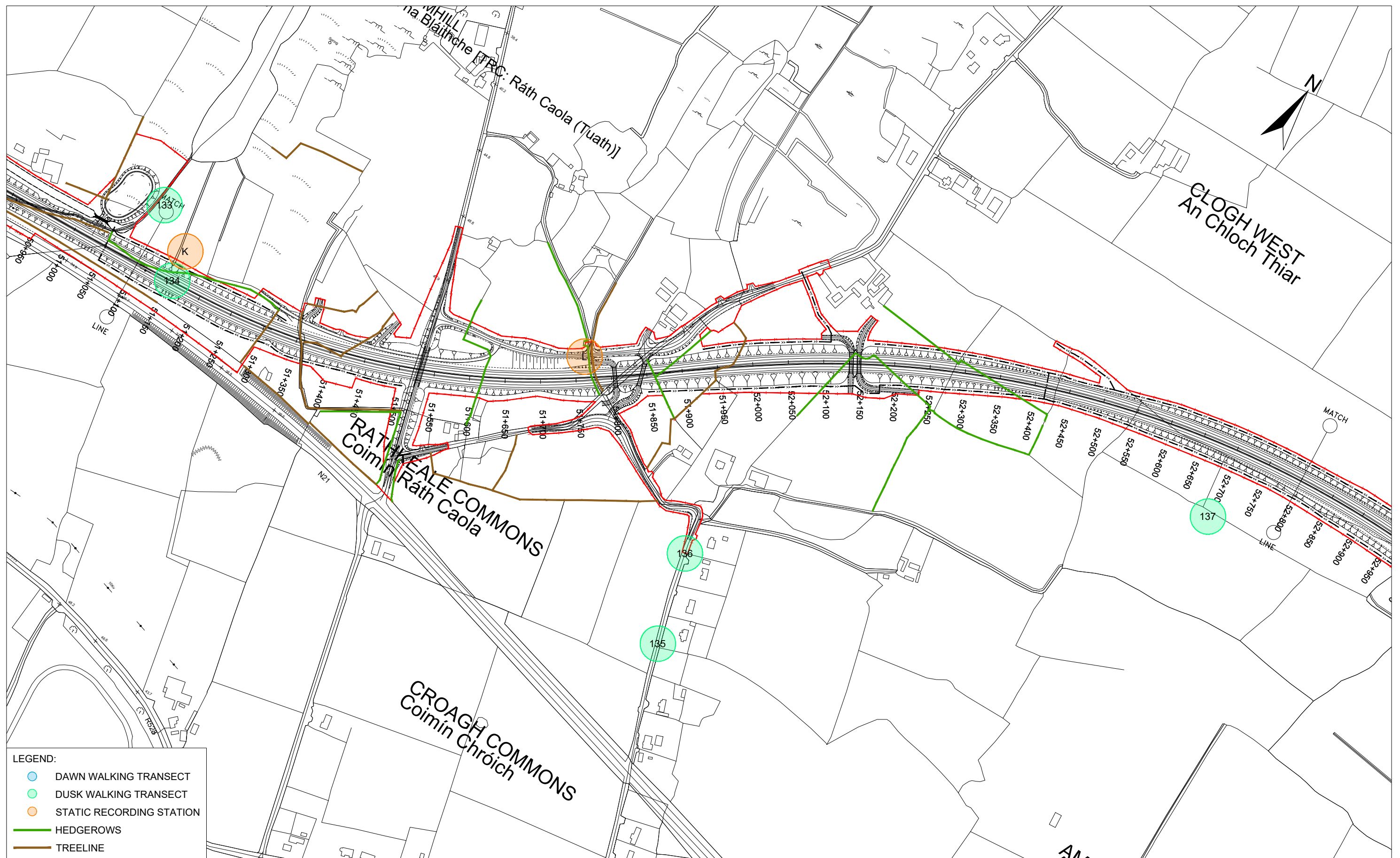
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Drawing Title:

BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION D
SHEET 1 OF 11

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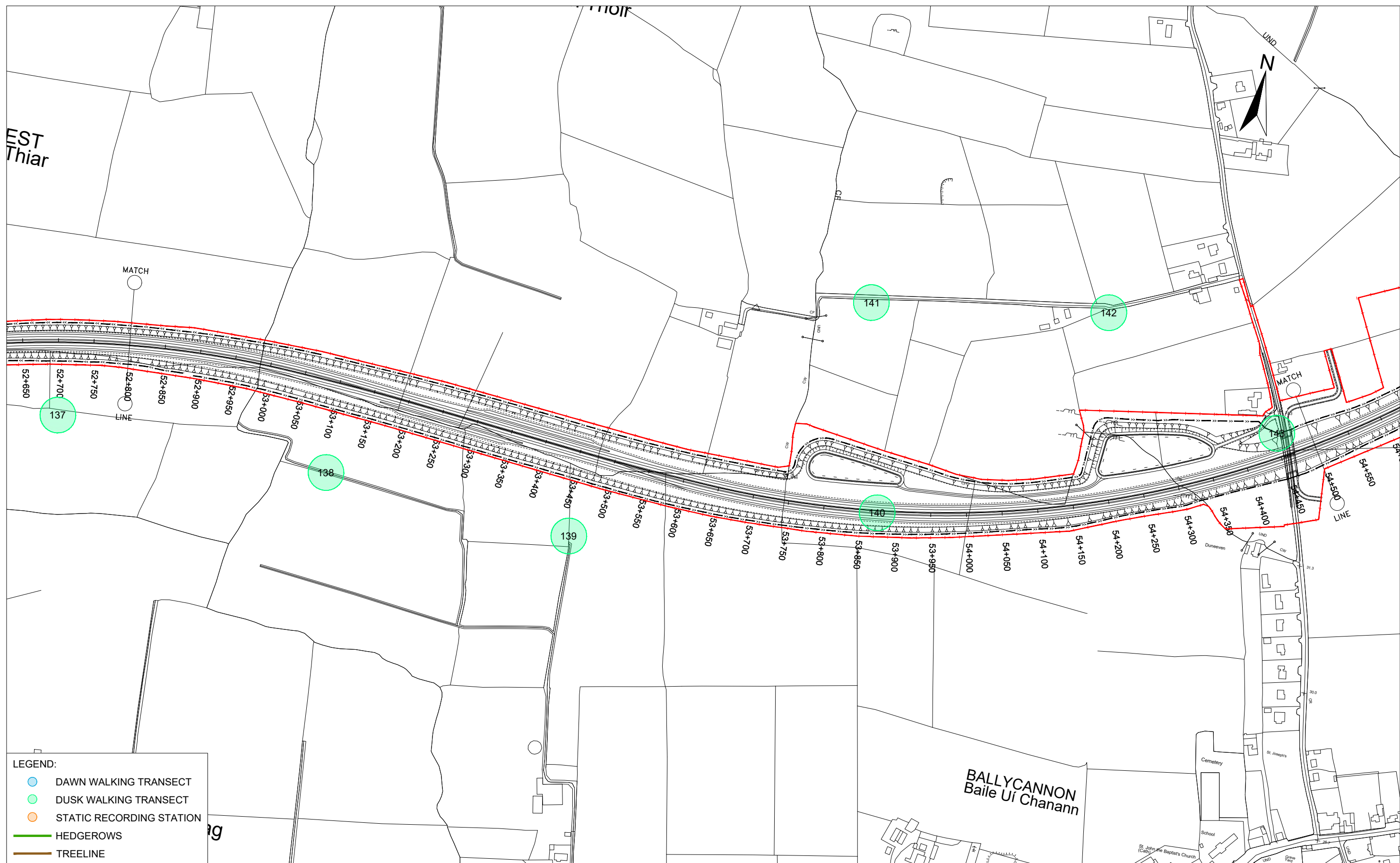


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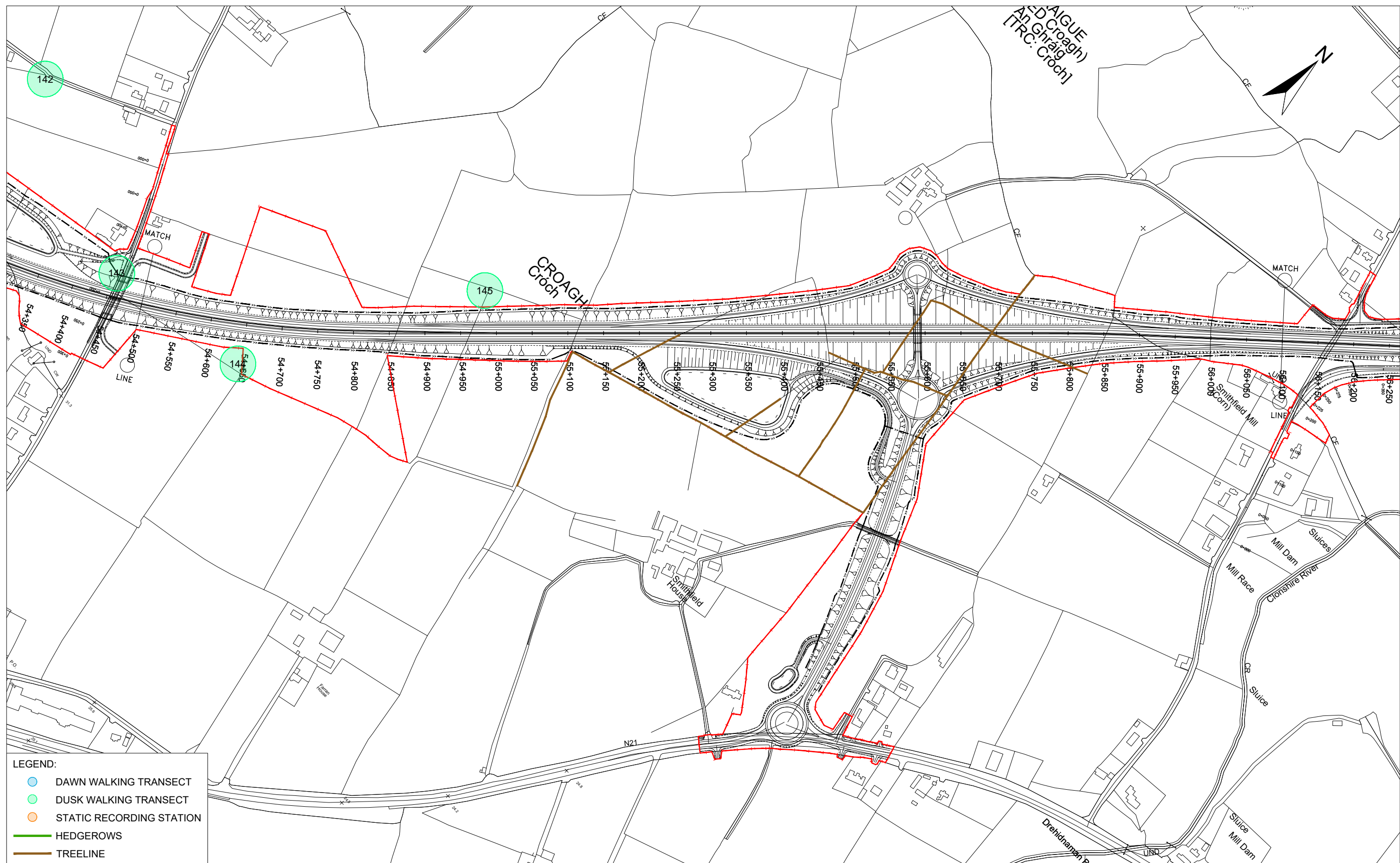
Project
**Foynes to Limerick Road
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**Environmental Impact
Assessment Report**

Drawing Title:
**BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION D
SHEET 3 OF 11**

Designed: Dr TA	File:	Status: E.I.A.R. A7.1
Drawn: LA	Job No: 14.131	
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**Foynes to Limerick Road
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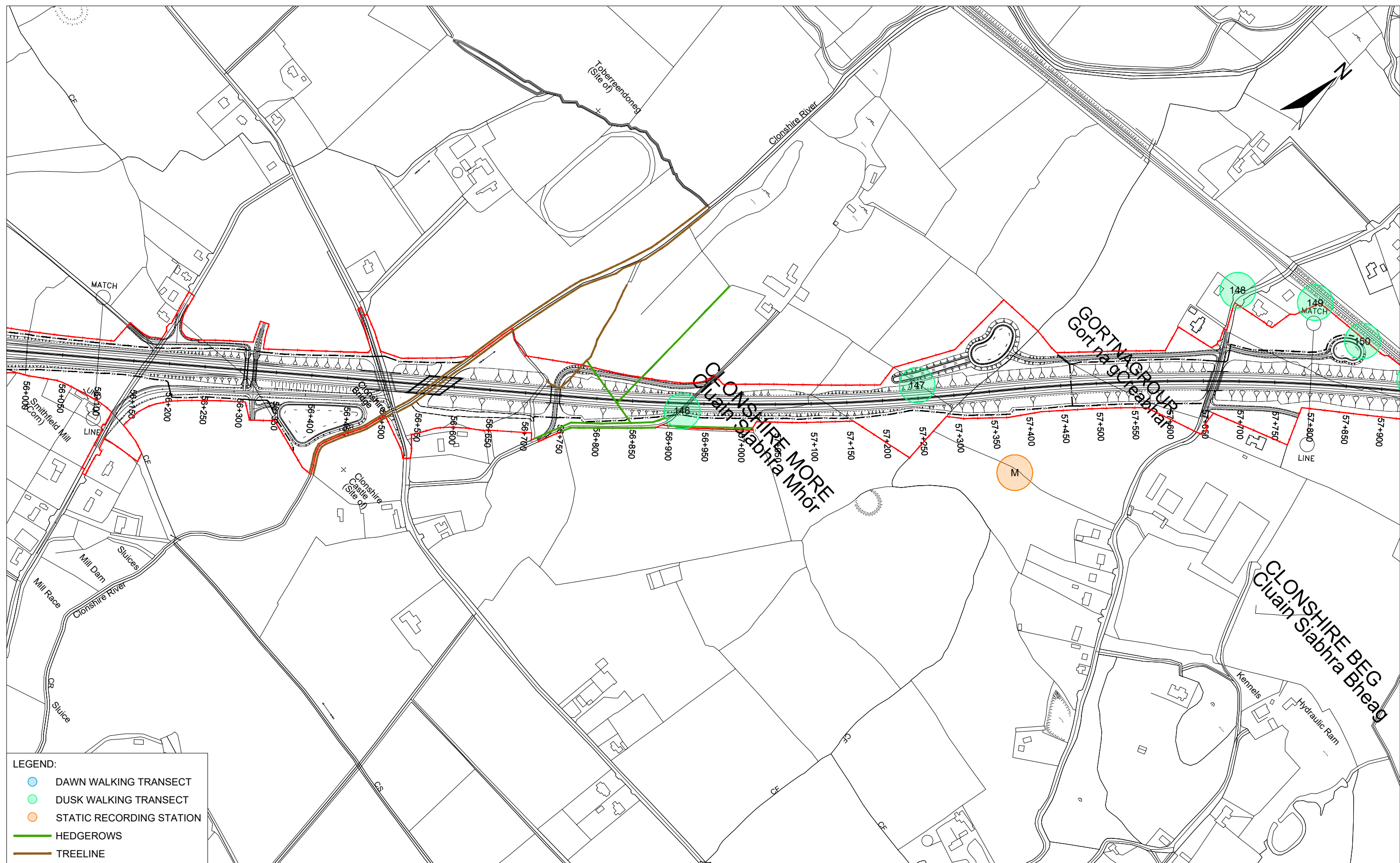
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Drawing Title:

**BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION D
SHEET 4 OF 11**

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Approved: SMG	Date: December 2019	Rev: -

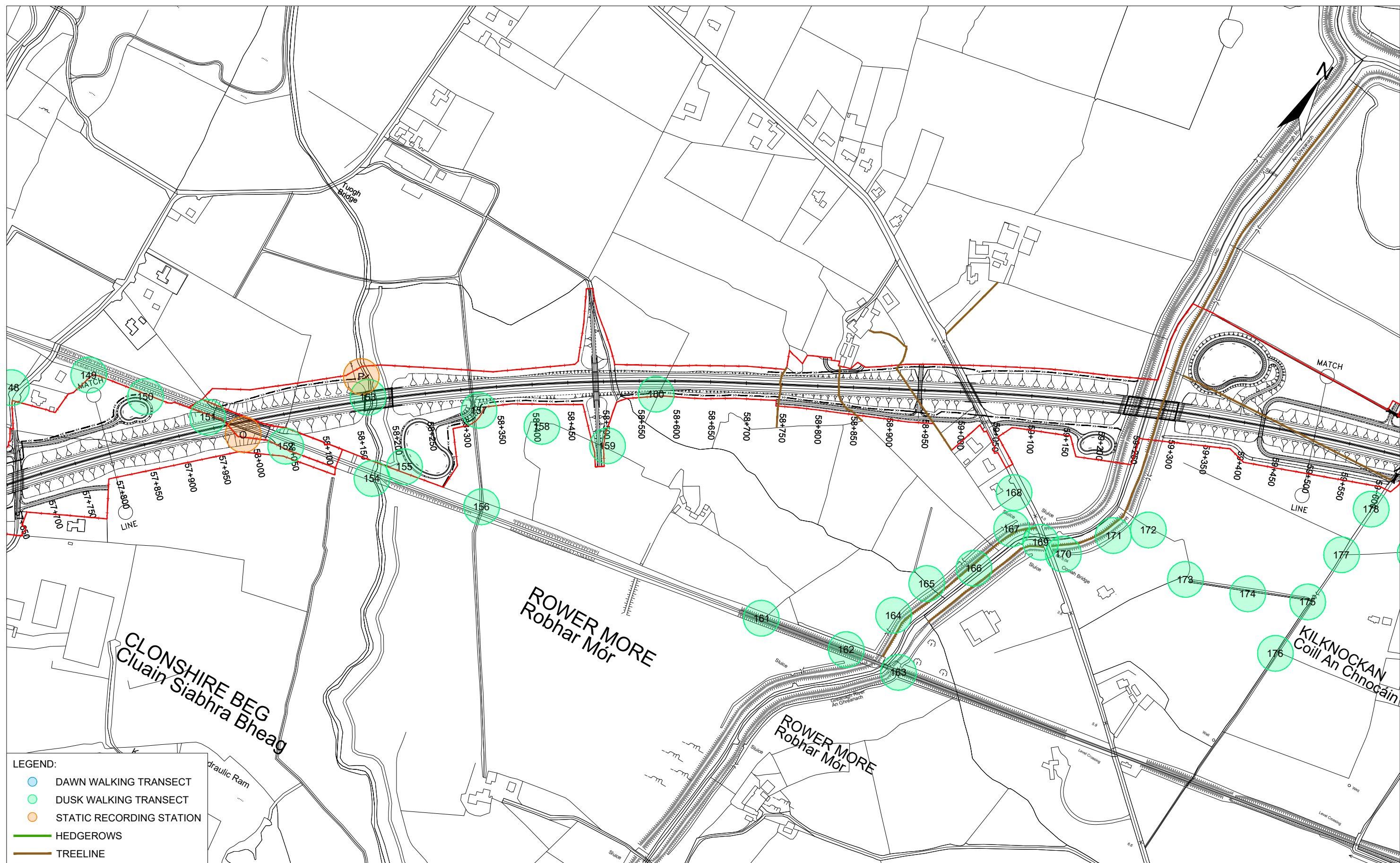
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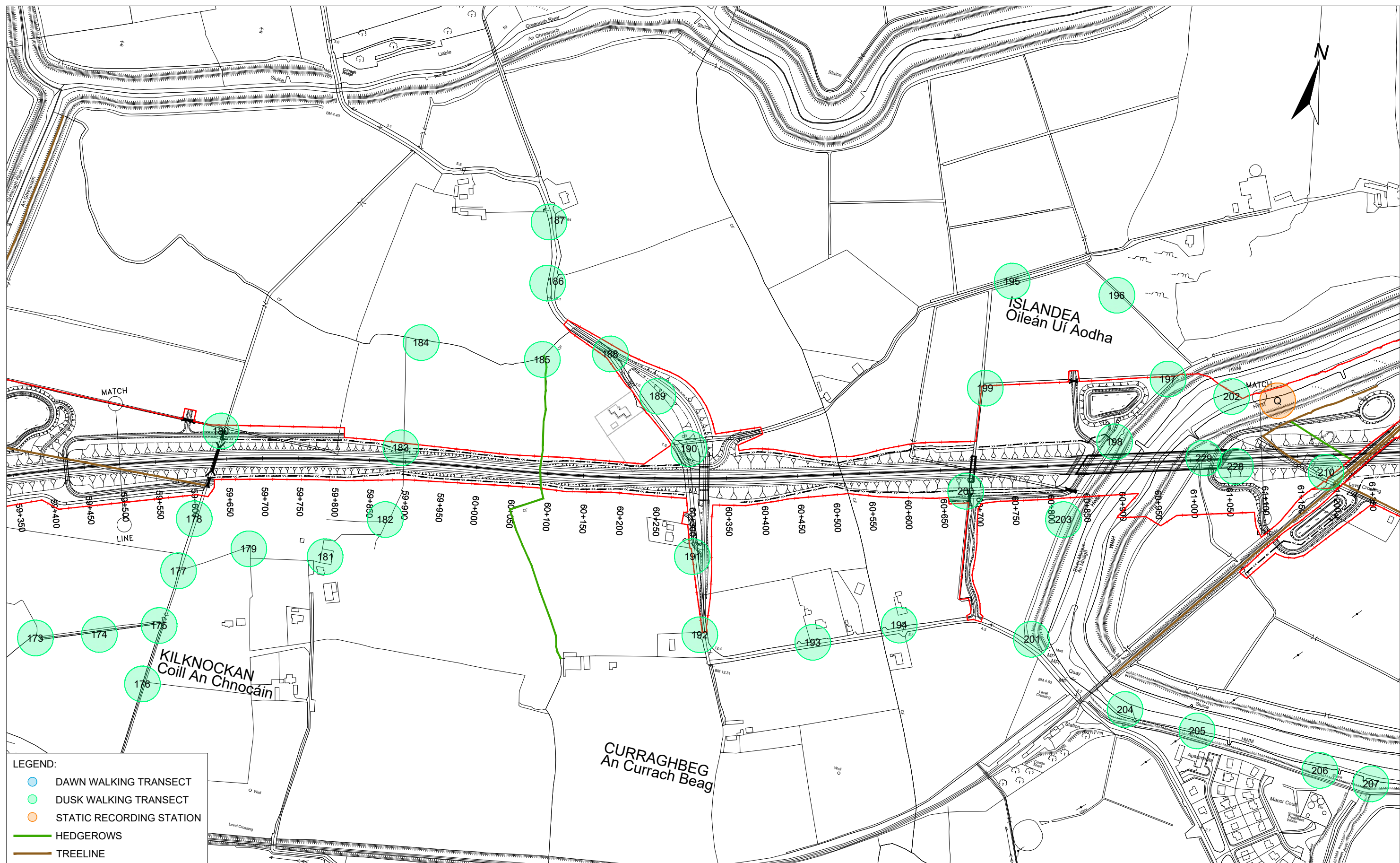


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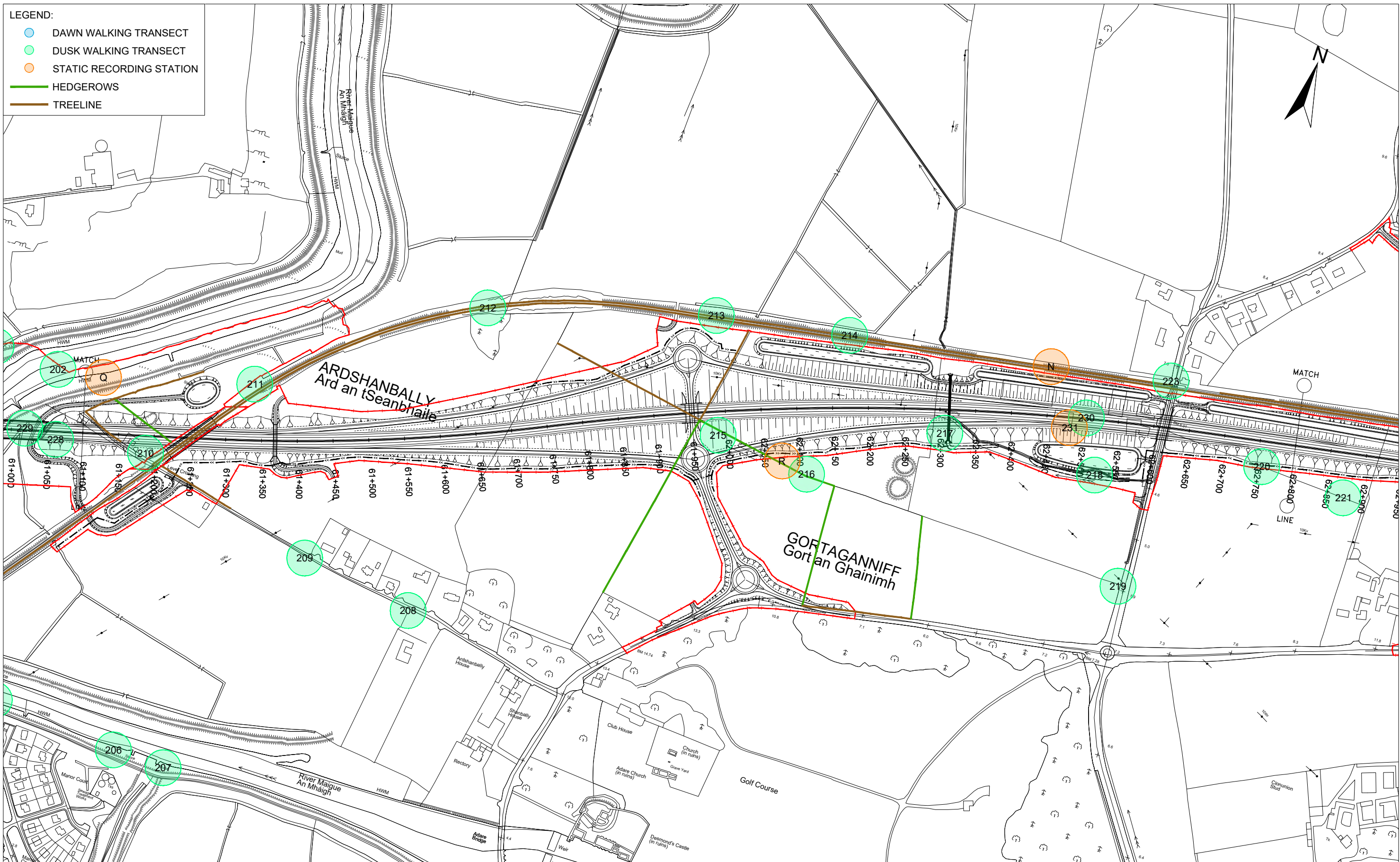
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BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION D
SHEET 7 OF 11

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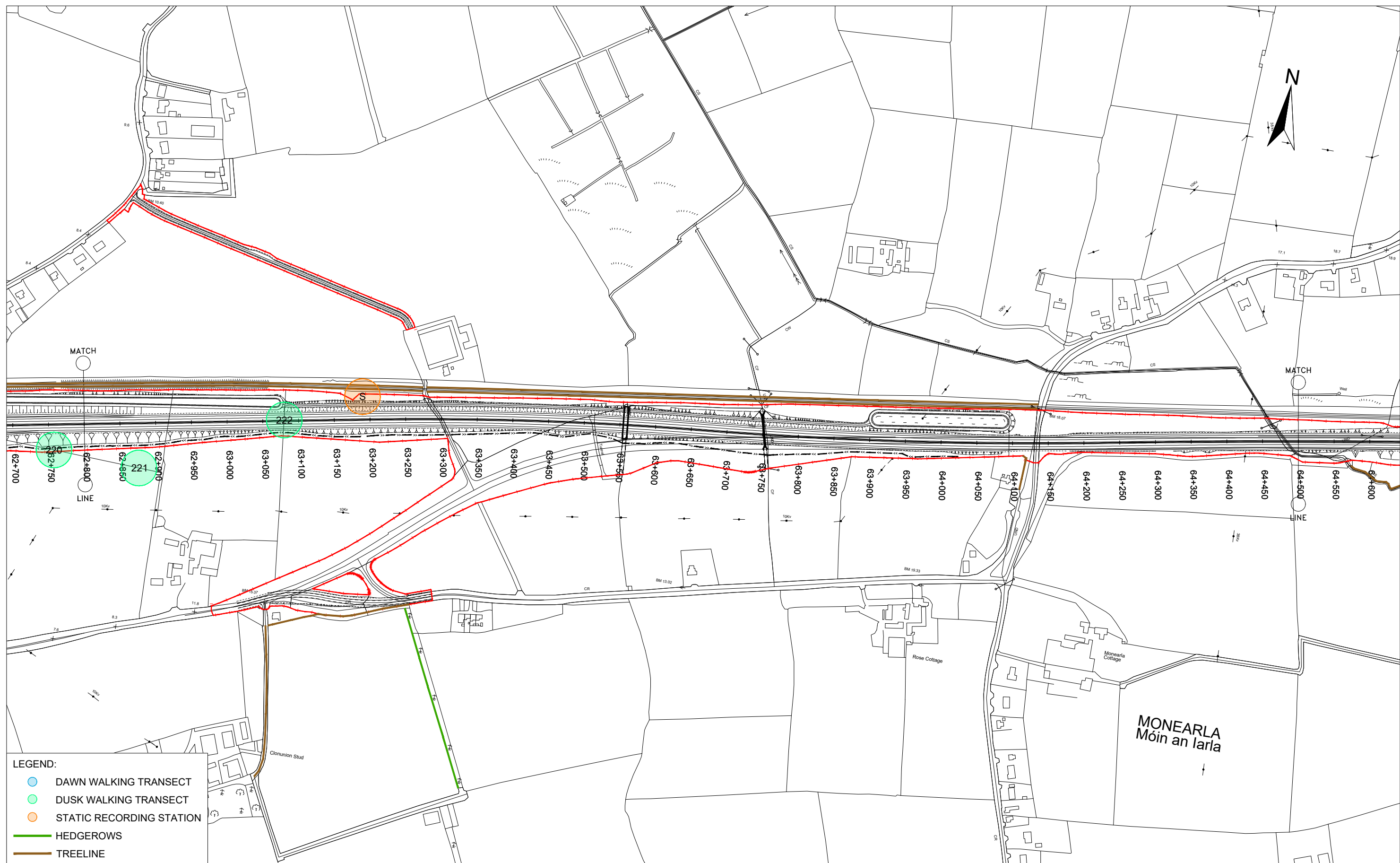
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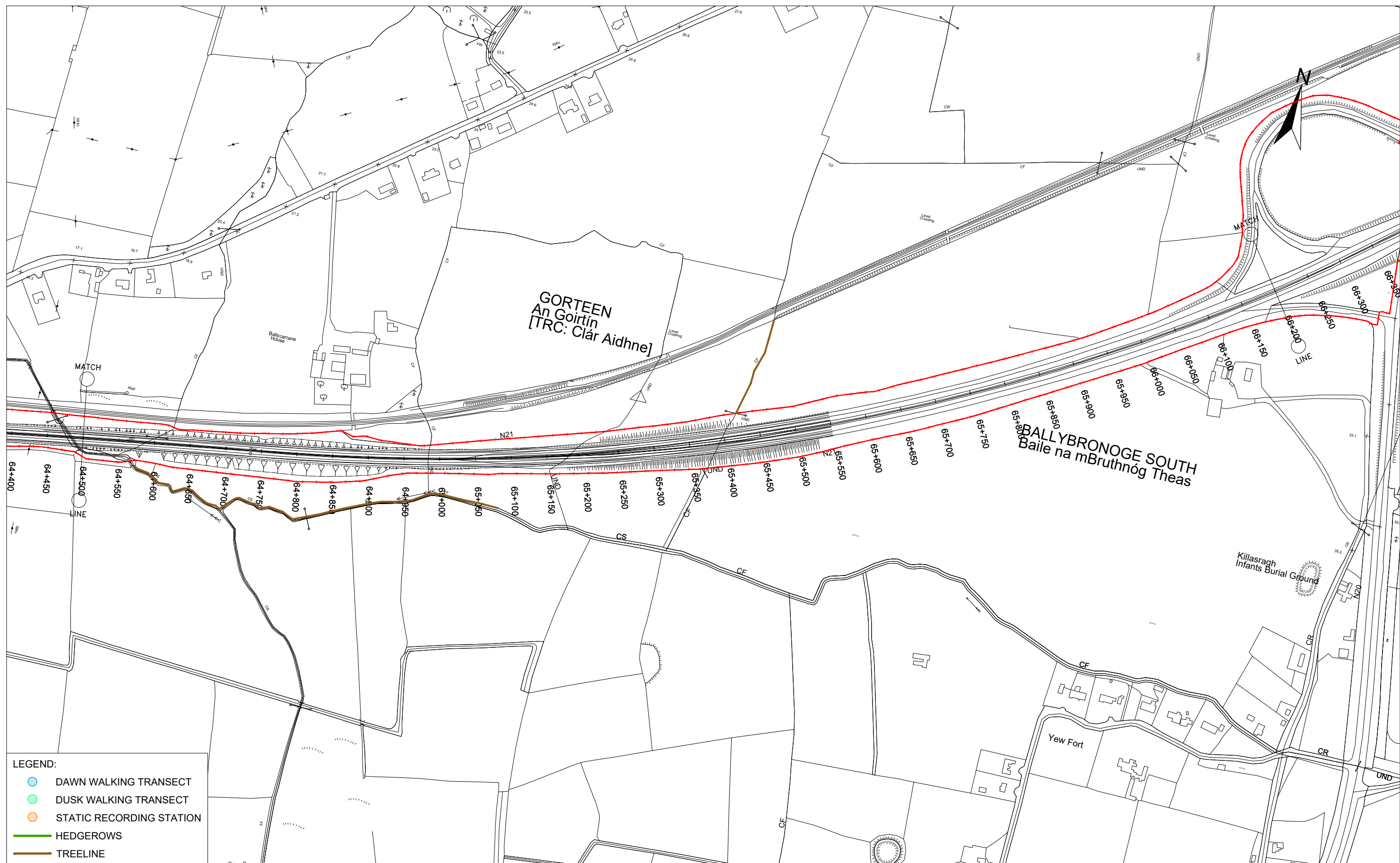
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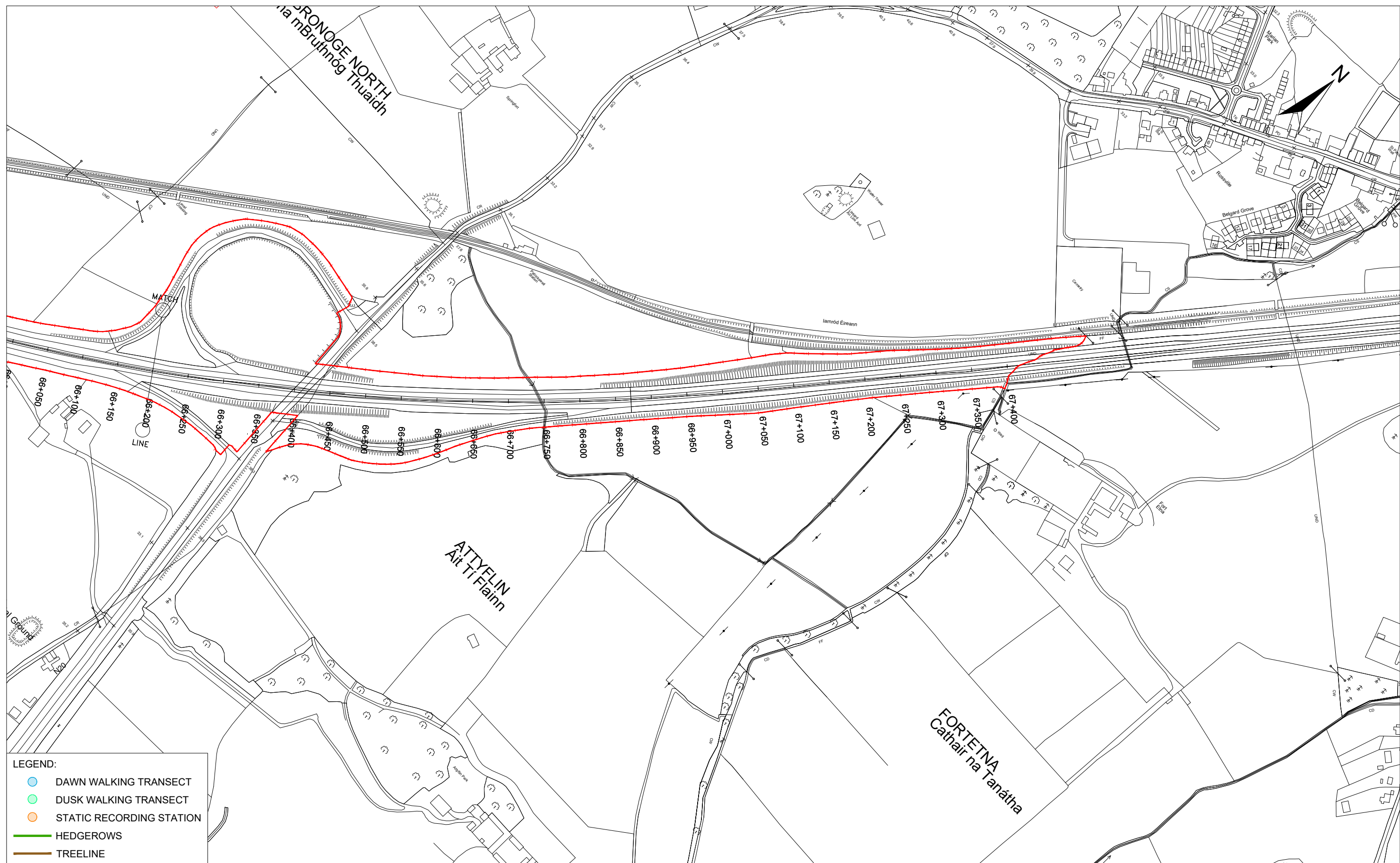
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Drawing Title:

**BAT SURVEY - WINTER / SPRING RESULTS 2018
SECTION D
SHEET 10 OF 11**

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