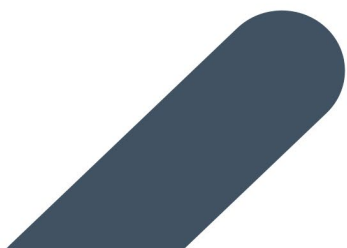


Bat Survey Report

TUS Moylish to City Active
Travel Scheme





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1. INTRODUCTION

MKO was commissioned to undertake a bat survey for a proposed development, a cycleway active travel scheme from TUS Moylish Campus (Grid Ref.: 556131, 658293) to Ennis Road, Limerick City (Grid Ref.: 557207, 657489) on Cratloe Road, Sexton Street North, High Road, Belfield Court and Belfield Gardens, Limerick City.

MKO undertook a daytime walkover to assess the habitats present within the site for their suitability to support roosting and/or commuting bats. This was undertaken by a dusk bat activity survey of the proposed development site. The main objective of the survey was to gather information on roosting, commuting, and foraging bats using the site and to identify any important features for bats. The bat surveys were completed during the main maternity period (May to August) (Collins, 2016) and involved an inspection of the onsite habitats and trees from ground level during the day, followed by a dusk emergence survey carried out on 4th July 2022.

The bat survey and assessment were informed by a desk study and with reference to the following guidelines:

- Bat Surveys for Professional Ecologists – Good Practice Guidelines (3rd edn.) (Collins, 2016)
- Bat Roosts in Trees (Andrews, 2018)
- Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (NRA, 2006a)
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes (NRA, 2006b)
- British Bat Calls: A Guide to Species Identification (Russ, 2012)
- Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. (Kelleher & Marnell, 2006)
- Guidance Note 08/18: Bats and Artificial Lighting in the UK (ILP, 2018)

1.1 Policy and Legislation

All Irish bats are protected under European legislation, namely the Habitats Directive (92/43/EEC). All Irish species are listed under Annex IV of the Directive, requiring strict protection for individuals, their breeding sites and resting places. The lesser horseshoe bat (*Rhinolophus hipposideros*) is further listed under Annex II of the Directive, requiring the designation of conservation areas for the species. Under this Directive, Ireland is obliged to maintain the favourable conservation status of Annex-listed species. This Directive has been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011.

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2021). Under this legislation, it is an offence to intentionally disturb, injure or kill a bat or disturb its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS) and a derogation licence must be granted before works commence.

1.2 Statement of Authority

The bat survey was undertaken by MKO ecologists Claire Stephens (B.Sc. Env, QCIEEM) and Neansaí O' Donovan (B.Sc., QCIEEM). MKO ecologists are professionally trained in bat survey techniques and are experts in undertaking surveys to this level. This report was prepared by Claire Stephens (B.Sc. Env, QCIEEM) and was reviewed by Sarah Mullen (B.Sc., M.Sc., Ph.D., ACIEEM) who has over 6 years' experience in ecological assessment.

2. CHARACTERISTICS OF PROPOSED DEVELOPMENT

The proposed development extends from TUS Moylish Campus, Limerick City (Grid Ref.: 556131, 658293) to the Ennis Road, Limerick City (Grid Ref.: 557207, 657489).

The proposed active travel scheme route will commence at the TUS Moylish campus at Moylish Roundabout and extend east towards the city via R445 Regional Road along Cratloe Road, Sexton Street North and High Road, before heading south along Belfield Court (L-10078) and Belfield Gardens (L-10080) through the largely residential suburbs of Mayorstone, Thomondgate and Belfield on the northern side of Limerick City.

The proposed active travel scheme is located within the existing built road infrastructure. The site is all accessible via the existing built road network. TUS Moylish Campus and the Moylish Roundabout to the north-west of the route are accessed via the Clonmacken Rd./Northern Ring Road from the west and Old Cratloe Road from the north-west. The proposed route terminates at the junction onto the Ennis Rd./R445/R857.

The site location map is shown in Figure 2-1.

2.1.1 Description of the project

The development works will consist of:

- Segregated cycle lanes and footpath upgrades along Cratloe Road, Sexton Street North and High Road with a number of dedicated pedestrian and cycle crossing facilities
- Upgrade of the traffic signals and junction layout at Hassett's Cross, Cross Road and Belfield Court Junctions to provide a protected junction arrangement for cyclists & bus priority measures for public transport.
- An inbound bus lane extending along Cratloe Road from Moylish Roundabout to Hassett's Cross
- Traffic calming measures on Belfield Court and Belfield Gardens such as raised table junctions and build out with cycle by-pass
- Upgrade works to bus stops, side road junctions, and new road surfacing
- Installation of LED public lighting
- Surface water drainage works
- Landscaping works including tree removal & tree planting
- All associated site works

The route is part of the strategic urban and transport planning for Limerick and has been identified to provide safe, more coherent, direct, attractive, and comfortable facilities to encourage cycling as a sustainable transport option. Surface water will discharge to the existing public surface water network.

A total of 25 trees are proposed to be felled as part of the proposed development. No structures will be removed as part of the proposed development.

The Proposed Site Layout Drawings - Drawing No's.: 19-003-LCCC-CR-S2-0000 - 19-003-LCCC-CR-S2-0006 as prepared by the Active Travel Department of Limerick City & County Council accompanies this planning application.

2.1.2 Landscape Proposals

Landscape Plan drawings (1 – 4, July 2022) have been prepared by the Active Travel Department of Limerick City & County Council for the proposed development from TUS Moylish Campus, Limerick City (Grid Ref.: 556131, 658293) to the Ennis Road, Limerick City (Grid Ref.: 557207, 657489). The Landscape Plan drawings are included in **Appendix 1** of this report.

The proposal includes for the planting of native hedgerows along the extent of the roadside boundary to include Guelder rose (*Viburnum opulus*), Hawthorn: *Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Dog Rose (*Rosa canina*), Holly (*Ilex aquifolium*), Spindle: *Euonymus europaeus*) and Chery plum (*Prunus cerasifera*). It is proposed to plant a native wildflower mix along with shade resistant species including Hart's Tongue Fern (*Asplenium scolopendrum*), Hard fern (*Blechnum spicant*), Bloody Cranes-bill (*Geranium sanguineum*), Wild Strawberry (*Fragaria vesca*) and Ivy (*Hedera Hibernica*) in the understory of the native hedge planting. Wildflower meadows will also feature on their own with a restricted cutting regime of the wildflower meadow for the long-term maintenance of this habitat type and floral diversity.

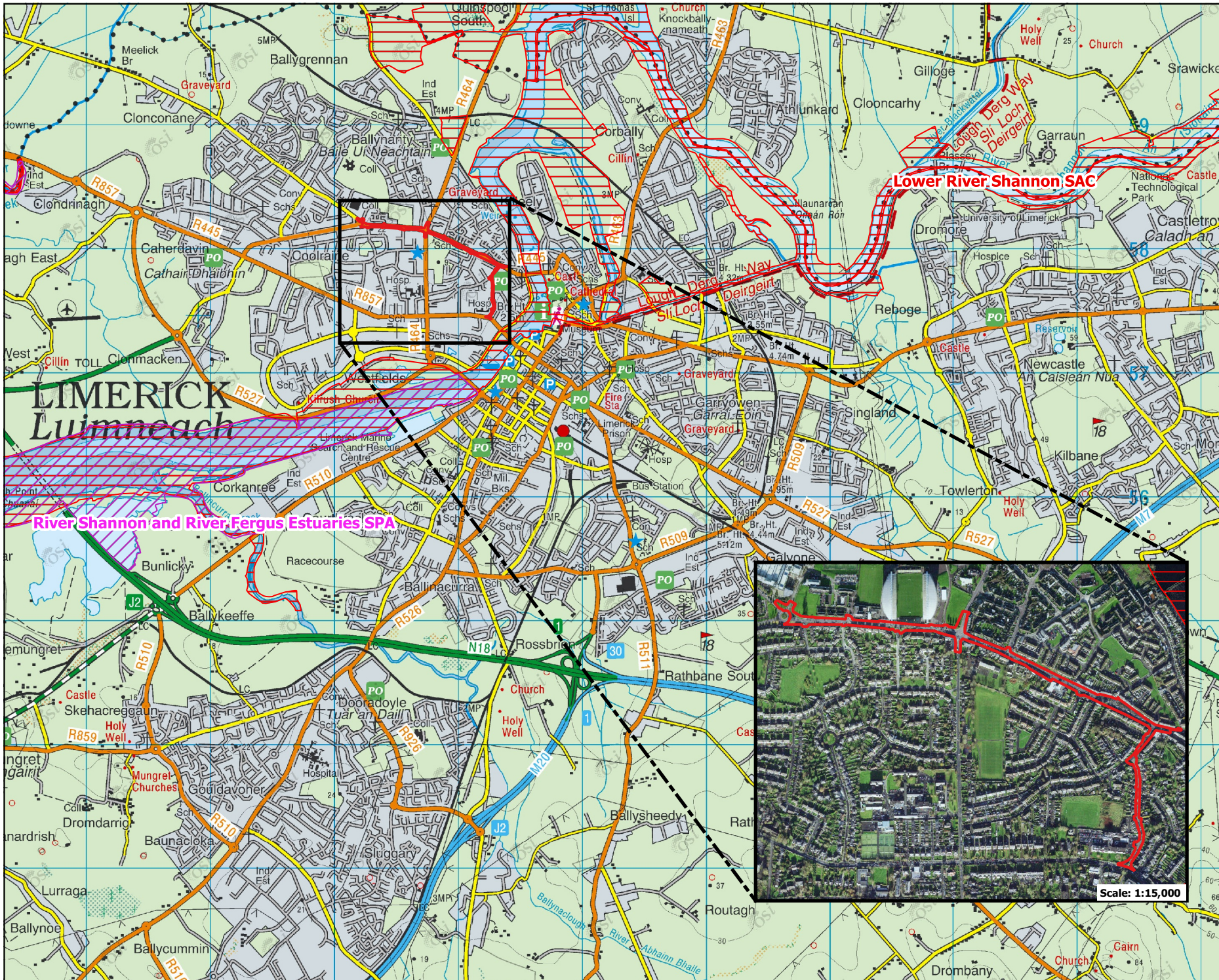
The planting of native hedgerows along the majority of the site boundaries along both sides of the road will increase the connectivity for faunal species, such as bats to the wider environment. There will be no net loss of linear habitats including existing treelines and scattered trees or fragmentation of habitats for bat populations as a result of the proposed development.

Specimen tree planting is proposed to replace the 25 trees proposed to be felled to accommodate the proposed development which includes a mix of native and ornamental species, as well as shrub and herbaceous planting to include pollinator friendly species as well as bulb planting within areas of the scheme. Areas around some existing trees will receive increased area of soft landscaping

The plan also proposes the inclusion of floral lawns with short cut wildflower species which will maximise visual amenity. These areas and others throughout the site incorporate a mix of biodiversity/pollinator friendly tree, shrub species and wildflower meadows.

The landscape strategy also provides for the creation of additional green spaces including rain gardens, swales/bio retention areas, and the provision of bat boxes and the installation of a number of bird boxes within existing trees to be retained along the route.

Additional details for the proposed Landscape Plan as prepared by Limerick City & County Council accompanies this planning application and is included as **Appendix 1** to this report.



Map Legend

-  Site Boundary
-  Special Area of Conservation
-  Special Protection Area



Drawing Title

Site Location

Project Title	
TUS to City Active Travel Scheme	
Drawn By	Checked By
CS	SM
Project No.	Drawing No.
200436	Figure 2-1
Scale	Date
1:40000	21.07.2022



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3. METHODS

3.1 Desktop Study

A desktop review of published material was undertaken to inform all subsequent field studies and assessments. The aim of the desktop review was to identify the presence of species of interest within the proposed site and surrounding region.

3.1.1 National Bat Database of Ireland

The National Bat Database of Ireland holds records of bat observations received and maintained by Bat Conservation Ireland. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. The database was searched for bat presence, and roost records within a 10km radius of the proposed development site.

In addition, information on species' range and distribution, available in the 2019 Article 17 Reports (NPWS, 2019), was reviewed in relation to the location of the proposed development. The NPWS monitors the conservation status of European protected habitats and species and reports their findings to the European Commission every 6 years in the form of an Article 17 Report. The most recent report for the Republic of Ireland was submitted in 2019.

3.1.2 Designated Sites

Special Areas of Conservation (SACs) are designated under EU Habitats Directive. The potential for effects on European Sites is fully considered in the AA Screening Report that accompanies this report. A search of SACs within a 15 km radius of the Study Area found two sites designated for the conservation of bats, Ratty River Cave SAC [002316] and Danes Hole, Poulnalecka SAC [000030].

Natural Heritage Areas (NHAs) are designated under the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. A search of NHA's within a 15 km radius of the Study Area found no sites designated for the conservation of bats.

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. A search of pNHA's within a 15 km radius of the Study Area found two sites designated for the conservation of bats, Cloonlara House pNHA (000028), domestic dwelling house and contains over 100 Leisler's Bats (*Nyctalus leisleri*) during the summer months located 5.7km from the proposed development and Danes Hole, Poulnalecka pNHA/SAC [000030] located 13.6km from the proposed development. There will be no direct effects as the project footprint is located entirely outside the designated sites. No indirect impacts as a result of disturbance, displacement or loss of foraging habitat are anticipated.

3.2 Ecological Appraisal (Bats)

A walkover survey of the Study Area was carried out during daylight hours on the 23rd of July 2020 and on the 4th of July 2022 by Claire Stephens (B.Sc. Env, Qualifying CIEEM) of MKO. The landscape features on the site were visually assessed for potential use as bat roosting habitats and commuting/foraging habitats using a protocol set out in BCT *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn.) (Collins, 2016). Table 4-1 of the 2016 BCT Guidelines identifies a grading protocol for assessing structures, trees and commuting/foraging habitat for bats. The protocol is divided into four Suitability Categories: *High, Moderate, Low and Negligible*.

3.3 Roost Assessment

A search for roosts was undertaken within the boundary of the proposed development by a licenced ecologist. The aim was to determine the presence of roosting bats, potential access points, roosting locations and the need for further survey work or mitigation.

Trees within the site were visually assessed from ground level, for natural features of high value to roosting bats including knot holes, trunk hollows, splits/cracks in branches and areas of flaking bark and also for signs indicating possible bat use including droppings, staining and scratching of bark and any other potential roost features (i.e., PRFs) identified by Andrews (2018).

3.4 Dusk Activity Survey

A dusk activity survey was undertaken on the evening of the 4th of July 2022 by two licensed ecologists. The aim of this survey was to identify if bats were present within the proposed development site, what bat species were present and to gather any information on bat foraging and commuting behaviour. The activity survey covered the extent of the proposed cycleway development site and included an emergence survey from trees to be felled and walked transects along the extent of the proposed site.

Two surveyors were equipped with an active full spectrum bat detector, a Batlogger M (Elekon, Lucerne, Switzerland). Where possible, species identification was made in the field and any other relevant information was also noted, e.g. numbers, behaviour, features used, etc. All bat echolocation was recorded for subsequent analysis to confirm species identifications.

It is proposed to remove 25 street trees along the route to accommodate the proposed development and therefore these trees were subject to a survey. Trees to be removed were subjected to a dedicated dusk emergence bat survey, with one ecologist initially positioned at the western end on Moylish Roundabout and the other positioned opposite Thomond Park to identify if any bats were present and emerging from the trees. The dusk survey commenced 20 minutes before sunset and was completed 2.25 hours after sunset. Conditions were suitable for bat survey; dry, warm (16°C at sunset) with calm conditions (Beaufort Scale Force 3). The moon was not visible for much of the survey and cloud cover was also light throughout (~85 – ~90%)

3.5 Analysis of Manual Detector Results

Echolocation signal characteristics (including signal shape, peak frequency of maximum energy, signal slope, pulse duration, start frequency, end frequency, pulse bandwidth, inter-pulse interval and power spectra) were compared to published signal characteristics for local bat species (Russ, 1999). Myotis species (potentially Daubenton’s bat (*M. daubentonii*), Whiskered bat (*M. mystacinus*), Natterer’s bat (*M. nattereri*)) were considered as a single group, due to the difficulty in distinguishing them based on echolocation parameters alone (Russ, 1999). The echolocation of Soprano pipistrelle (*P. pygmaeus*) and Common pipistrelle (*P. pipistrellus*) are distinguished by having distinct (peak frequency of maximum energy in search flight) of ~55 kHz and ~46 kHz respectively (Jones & van Parijs, 1993).

Plate 3-1 below shows a typical sonogram of echolocation pulses for Common Pipistrelle recorded with a SM4BAT bioacoustic static bat recording device. The recorded file is illustrated using Wildlife Acoustics Kaleidoscope software.

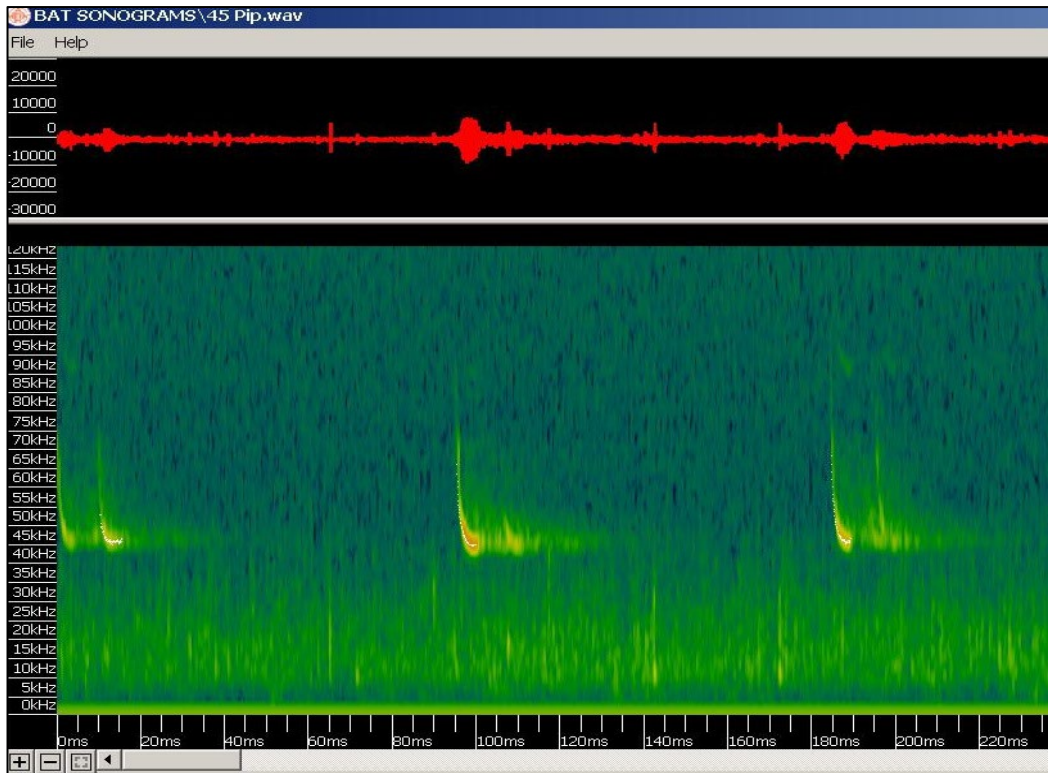


Plate 3-1 Sonogram of echolocation pulses of Common pipistrelle (Peak Frequency 45kHz)

Individual bats of the same species cannot be distinguished by their echolocation alone. Thus, ‘bat passes’ was used as a measure of activity (Collins, 2016). For the purposes of this survey, a bat pass was defined as a recording of an individual species/species group’s echolocation containing at least two echolocation pulses and of maximum 15 seconds length.

3.6 Survey Limitations

Survey design and effort was created in accordance with the most current best practice guidelines for surveying bats (Collins, 2016).

July is within the optimal survey period for bat activity surveys, (Collins, 2016). There were no limitations associated with seasonality, timing, access or weather conditions. Therefore, a full and comprehensive survey was achieved. Therefore, no significant limitations in the scope, scale or context of the assessment have been identified.

4. RESULTS

4.1 Desktop Study

4.1.1 National Bat Database of Ireland

A review of the National Bat Database of Ireland on the 27th July 2022 yielded no results of roosts within a 1km radius of the proposed development. One ad-hoc record for Common pipistrelle (*Pipistrellus pipistrellus*) was recorded within 1km radius of the proposed development in 2007.

The search was extended to include a 10km radius including roosts, transects and ad-hoc observations. Within this search were 23 roosts, 20 transects and 66 ad-hoc observations.

The 20 building roosts within the 10km included Lesser Horseshoe Bat (*Rhinolophus hipposideros*), Brown long-eared bat (*Plecotus auratus*), Leisler's (*Nyctalus leisleri*) and one roost consisted of Natterer's Bat (*Myotis nattereri*).

Twenty transect results returned records predominantly of Daubenton's bat (*Myotis daubentonii*), with one transect each with records of Leisler's (*Nyctalus leisleri*) and Lesser Horseshoe Bat (*Rhinolophus hipposideros*).

Ad-hoc records included Common pipistrelle (*Pipistrellus pipistrellus*), Soprano pipistrelle (*Pipistrellus pygmaeus*), Leisler's bat (*Nyctalus leisleri*), and Daubenton's bat (*Myotis daubentonii*).

The records identify the wider area is widely used by foraging and commuting bat species.

4.1.2 Designated Sites

Within Ireland, the Lesser horseshoe bat is the only bat species requiring the designation of Special Areas of Conservation (SACs) and the site is situated outside the current known range of this species.

A search of all Designated Sites within a 15km radius of the site found two designated for the conservation of bats, Ratty River Cave SAC [002316] and Danes Hole, Poulnalecka SAC [000030]. However, the proposed works are located at least 13km and 13.4km respectively from these designated sites. There will be no direct effects as the project footprint is located entirely outside the designated sites. These sites are outside of the 2.5km core foraging range (NPWS, 2018) for this species according to Map 2 of the detailed Conservation Objectives document. Therefore, no indirect impacts as a result of disturbance, displacement or loss of foraging habitat are anticipated.

4.2 Bat Habitat Appraisal

A walkover survey was carried out during daylight hours on the 23rd of July 2020 and on the 4th July 2022 by a licenced ecologist to assess the site for bat habitat suitability and assess the trees for potential roost habitat.

The works will be confined to the existing road network. The existing road network and footpaths along the entire route as well as concrete walls and hard standing areas along the route are categorised as **buildings and artificial surfaces (BL3)** (Plate 4-1 and 4-3). **Ornamental/non-native shrubs (WS3)** (Plate 4-3) lined the inside of several boundary walls along the route as well as individual ornamental shrubs planted within private gardens including, cherry laurel (*Prunus Laurocerasus*), Leyland cypress (*Cupressocyparis leylandii*), lawson cypress (*Chamaecyparis lawsoniana*), Himalayan birch (*Betula utilis*), laburnum (*Laburnum anagyroides*), hazel (*Corylus avellana*), lime (*Tilia* spp.) and Norway maple (*Acer platanoides*).

Some areas along the route at junctions, roundabout and planted under trees were classified as **flower beds and borders (BC4)** (Plate 4-1).

Grass verges and strips of managed lawns along the route were classified as **amenity grassland (GA2)** (Plate 2-1) with some areas with individual trees planted lined along the roadside categorised as **scattered trees and parkland (WD5)** (Plate 4-2) with some more established linear tree planting classified as **treelines (WL2)** (Plate 4-1).

Tree species recorded planted along the road network included hornbeam (*Carpinus betulus*), lime Norway maple and sycamore (*Acer pseudoplatanus*). Additional trees species recorded included Monterey cypress (*Cupressus macrocarpa*), ash (*Fraxinus excelsior*), rowan (*Sorbus aucuparia*), silver birch (*Betula pendula*), whitebeam (*Sorbus aria*), cherry plum (*Prunus cerasifera*), flowering cherry (*Prunus* spp.), alder (*Alnus* spp.) and Swedish whitebeam (*Sorbus intermedia*).

There are no watercourses within or adjacent to the development site boundary. The River Shannon is located approx. 130m to the south-east of the works and is separated from the works by built up residential area and city roads.



Plate 4-1 Moylish Roundabout with flower beds (BC4) planted and TUS Moylish Campus to the north (right), amenity grassland (GA2), footpaths and existing road network classified as buildings and artificial surfaces (BL3). Maple (*Acer* spp.) treeline



Plate 4-2 Scattered trees habitat along Bellfield Gardens



Plate 4-3 Point where route terminates at the junction onto the Ennis Rd, R445/R857 categorised as buildings and artificial surfaces (BL3). Ornamental/non-native shrubs (WS3) growing along private boundary walls

With regard to foraging and commuting bats, scattered trees, individual semi-mature trees forming treelines which exist along the existing road infrastructure landscaped boundary and footpaths as well as ornamental hedgerows along private dwelling boundaries are likely to be utilized by commuting and foraging bats and are considered to be of *(moderate suitability)* i.e. Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees or linked back gardens (Collins, 2016).

The individual street trees and flower beds and borders were assessed as having *(low suitability)* for commuting and foraging bats i.e., habitat that could be used by small numbers of commuting bats such as planting under individual trees attracting some insects, but isolated (Collins, 2016).

The remaining habitats including artificial surfaces including existing footpaths and road network and amenity grassland strips have been assessed as *(negligible suitability)* as they do not provide suitable habitat for local bat populations.

4.3

Roost Assessment

Trees

Searches of all trees on site for Potential Roosting Features (PRFs) and/or tree roosts were conducted during daylight hours within the site on the 4th July 2022.

Trees may have increased or decreased probability of hosting roosting bats in certain circumstances i.e. Having large broadleaf trees with cavities or other damage such as rot or loose bark increased probability whereas, Conifer plantations and young trees with little – no damage have a decreased probability of hosting bats (Kelleher and Marnell, 2006). The majority of trees within the site were assigned a *Negligible – Low* roosting potential due to their size and lack of PRFs such as cavities, rot, etc. The 25 trees to be felled were assigned *Negligible* roosting potential due to their size and lack of PRFs.

Assessment of Trees to be Felled

During the daytime inspection, trees were examined and assessed for roosting potential. A Tree Survey Report (June 2022) was prepared by Independent Tree Surveys Ltd. accompanies this planning application. A total of 25 trees are proposed to be felled as part of the proposed development. This includes x5 category B trees, x18 category C, and x2 category U. Table 4-1 provides a description of tree categorised as outlined within the Tree Survey Report (June 2022). No bats observed emerging from the trees to be felled at dusk and no PRFs were identified within the all immature to semi-mature trees to be felled.

Table 4-1 Tree Category Description

Category	Description
A	Indicates a tree of high quality and value. These are trees that are particularly good examples of their species, which also provide landscape value. These trees are in such a condition as to be able to make a substantial contribution. (A minimum of 40 years is suggested)
B	Indicates a tree of moderate quality and value. Trees that might be included in the high category but are downgraded because of impaired condition. These trees are in such a condition as to make a significant contribution. (A minimum of 20 years is suggested)
C	Indicates a tree of low quality and value - trees with an estimated remaining life expectancy of at least 10 years, or younger trees with a stem diameter of below 150mm and/or <10m in height.
U	Trees that are in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.

4.4

Dusk Activity Survey

An emergence survey was carried out on two areas of trees proposed to be removed on 4th July 2022 by two surveyors. Surveyors were positioned at different locations with one ecologist initially positioned at the western end on Moylish Roundabout and the other positioned opposite Thomond Park for approximately 1.3 hours. The aim of the survey was to observe, listen and record any bats exiting or entering potential roost sites in 25 trees identified for removal. No bats were observed exiting any trees or nearby building during the emergence survey.

Following the emergence survey, a walked transect was carried out. This covered the full extent of the proposed cycleway route traveling along the existing footpaths north and south of the existing road network. A small number of foraging and commuting bats were recorded during the dusk bat activity survey. Activity was dominated by Common pipistrelle (*Pipistrellus pipistrellus*) (n=17), followed by Soprano pipistrelle (*Pipistrellus pygmaeus*) (n=1). This species is common and widespread across Ireland. Activity levels were concentrated along the more established treeline habitats along the route of the proposed development as shown in Figure 4-1. Bat activity was low with a total of 18 bat passes recorded at dusk. Plate 4-4 below shows species composition across the site.

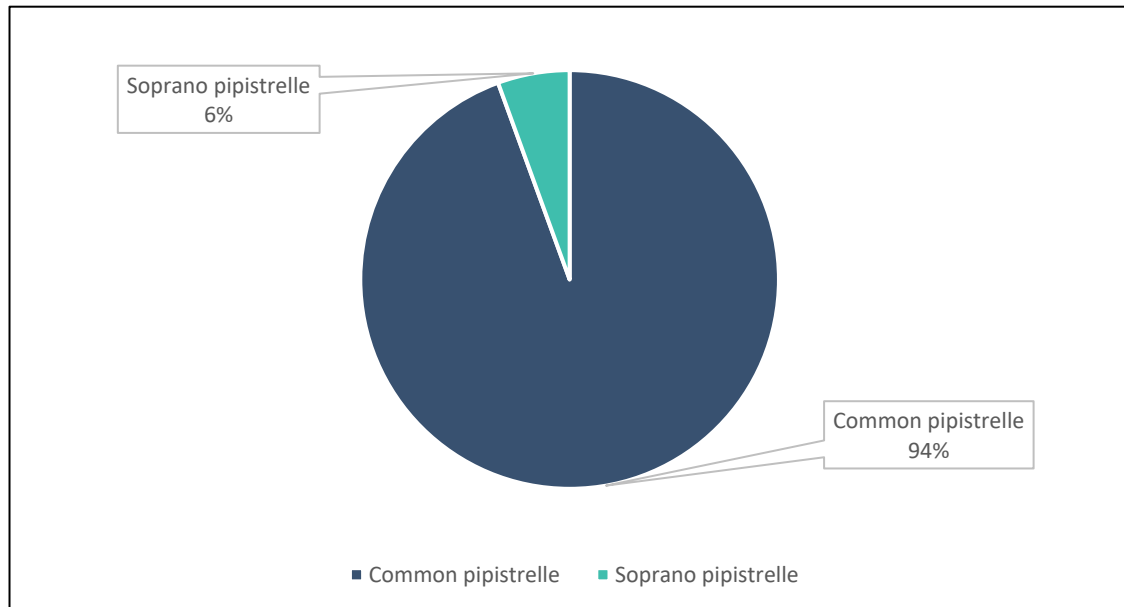


Plate 4-4 Species Composition –Dusk survey 4th July 2022

4.5 Importance of Bat Population Recorded at the Site

Ecological evaluation within this section follows a methodology that is set out in Chapter three of the ‘*Guidelines for Assessment of Ecological Impacts of National Roads Schemes*’ (NRA, 2009).

All bat species in Ireland are protected under the Bonn Convention (1992), Bern Convention (1982) and the EU Habitats Directive (92/43/EEC). Additionally, in Ireland bat species are afforded further protection under the Birds and Natural Habitats Regulations (2011) and the Wildlife Acts 1976-2021.

Bats as an Ecological Receptor have been assigned *Local Importance (Higher value)* on the basis that the habitats within the proposed development site are utilized by a regularly occurring bat population of *Local Importance*.

No bat roosts were identified within the boundary of the proposed development and no roosting site of National Importance (i.e., site greater than 100 individuals) was recorded.



Map Legend

- Site Boundary
- Bat Survey Walked Transect Route
04.07.2022
- Common pipistrelle
- Soprano pipistrelle

Bat Survey results 2022

- Common pipistrelle
- Soprano pipistrelle



Microsoft product screen shots reprinted with permission from Microsoft Corporation

Drawing Title
**Bat Activity survey results
04.07.2022**

Project Title
TUS to City Active Travel Scheme

Drawn By CS	Checked By SM
Project No. 200436	Drawing No. Figure 4-1
Scale 1:5000	Date 21.07.2022

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5. ASSESSMENT OF LIKELY EFFECTS

5.1 Loss of Roosting Habitat

5.1.1 Semi-Mature Trees

Medium-term Slight Effect

Stands of planted predominantly ornamental treelines occur regularly throughout the route of proposed cycleway scheme. No high potential roost features were identified during the daytime inspection. None of the 25 trees to be removed were identified to provide greater than negligible suitability for roosting bats. Overall, the site, is not considered to provide significant suitable roosting habitat for bat species. While it is proposed to retain the majority of trees and ornamental hedgerows where possible, there will be some loss of individual 25 street trees including partial treelines habitats to facilitate the proposed development during the construction phase.

In the absence of mitigation, the loss of potential bat roosting habitat is considered to be classified as *Medium-term Slight Effect*

Mitigation

- Where removal of trees or ornamental hedgerows is unavoidable, additional hedgerow or tree planting will be carried out using a mix of native species and some pollinator friendly ornamental species (i.e., there will be no net loss of linear hedgerow or treeline) as outlined within the Landscape Plan which is included as **Appendix 1**.
- A pre-commencement tree roost inspection will be undertaken by a qualified ecologist at the appropriate time of year. The function of this survey will be to assess any changes in baseline environment since the time of undertaking the survey in July 2022. If high potential roost features are identified within any of the trees to be removed, follow up surveys including endoscope surveys and/or emergence/re-entry surveys will be undertaken. If a bat roost is identified, a bat derogation licence will be obtained from NPWS prior to felling and the felling activity will be supervised by a qualified ecologist.
- The landscape strategy also provides for the creation of additional green spaces including herbaceous lawns, rain gardens, swales/bio retention areas, and the provision of bat boxes. A number of bat boxes are proposed to be installed within existing trees to be retained along the route.
- Bat boxes will be erected on new/existing trees within the proposed development site following best practice guidelines (Kelleher & Marnell 2006, NRA 2006). A minimum of three bat boxes are recommended for installation prior to any works commencing. Schwegler 1FF woodcrete bat boxes are recommended. Bat boxes will have a southerly orientation and be positioned at least 2m from the ground, away from artificial lighting. They will be placed adjacent to vegetation features such as treelines to ensure they are close to existing flight paths and can avoid wide open spaces (Collins, 2016).

Residual effect

With the implementation of the prescribed mitigation measures, no significant effects are predicted.

5.2 Loss of Foraging & Commuting Habitat

Medium-term Moderate Effect

Scattered trees, individual semi-mature trees forming treelines which exist along the existing road infrastructure landscaped boundary and footpaths, as well as ornamental hedgerows along private dwelling boundaries, were identified as being of *'moderate'* importance for commuting bats as they provide connectivity to the surrounding landscape. These habitats provide the most suitable

foraging/commuting habitat for bat species within the development boundary. The majority of foraging and commuting bat activity was recorded along linear sections of planted trees to the western extent of the site during the manual transect survey.

While it is proposed to retain the ornamental hedgerows, majority of the individual trees and scattered trees and treeline where possible, there will be some loss of this habitat to facilitate the proposed development during the construction phase. The Tree Protection Plan prepared by Independent Tree Surveys Ltd. which accompanies this planning application will be adhered to. The plan outlines where the Tree Protection Fence is to be installed to ensure no unnecessary loss of trees occurs. However, the proposal will not result in a net loss of suitable foraging or commuting bat habitat and additional planting, associated with the landscape design, will provide additional supporting habitat.

In the absence of mitigation, the loss of potential bat commuting habitat is assessed as ***Medium-term Slight Effect***.

Mitigation

- The removal of vegetation within the proposed development site will comply with the requirements of the Wildlife Act 1976-2021.
- Where removal of trees or hedgerows is unavoidable, additional tree and hedgerow planting will be carried out using native species. (i.e., there will be no net loss of linear hedgerow or treeline).

Residual effect

With the implementation of the prescribed mitigation measures, no significant effects are predicted.

5.3

Disturbance

Long-term Moderate Effect

Construction and operation of the proposed cycleway development in an already busy urban setting will result in increased human activity, noise and lighting within the proposed site. Therefore, the potential for effects on bats requires consideration.

The proposed development is located along busy local roads bordered by existing residential developments. TUS Moylish Campus is located just off Moylish Roundabout to the western extent, Thomond Park Sports Stadium to the north as well as University Maternity Hospital which is also located off Belfield Gardens to the southern extent of the proposed scheme. The existing route is already subject to street lighting along its extent. It is likely that bat species in the area have become accustomed to some levels of disturbance and the increased short term small-scale construction activity within the built road infrastructure will not result in a significant increase in disturbance during the construction or operation phase. Although no significant effects on bats due to disturbance are anticipated the following best practice measures will be implemented during the construction and operational phases of the development.

Mitigation

- All construction plant and equipment to be used on-site will be modern equipment and will comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations 1998, and any subsequent amendments.
- Plant machinery will be turned off when not in use. Machines, which are used intermittently, will be shut down during those periods when they are not in use.
- Operating machinery will be restricted to the proposed development site boundary.
- It is expected that works will occur during normal working hours (08:00am – 18:00 pm) which will be agreed with the local authority in consultation with the appointed contractor prior to works commencing.

- Light spills during construction works will be minimised where possible thus reducing the effect on areas outside the proposed development, and consequently on fauna of conservation value including bats.
- Exterior lighting shall be designed to minimize light spillage thus reducing the effect on areas outside the proposed development, and consequently on bats. The luminaries will be of the type that prevent upward spillage of light and minimize horizontal spillage away from the intended lands.
- The lighting plan for the operational phase of the proposed development, must be designed with consideration of the following guidelines: Bat Conservation Ireland guidelines; Bat Conservation Ireland (Bats and Lighting: Guidance Notes for Planners, Engineers, Architects and Developers, BCI, 2010) and the Bat Conservation Trust (Guidance Note 08/18 Bats and Artificial Lighting in the UK (BCT, 2018), to minimise light spillage, thus reducing any potential disturbance to bats.
- The light fitting/scheme must be designed to help mitigate the effect of the artificial lighting on the local bat populations by incorporating:
 - Warm White LED (2700 - 3000K) light source throughout – less attractive to insects, and a good light source to enable directional luminaires.
 - Rear shields will be fitted to Luminaire Type C along the residential/open amenity area to the west – to reduce light spill and eliminate upward light.
 - Lamps have also been specified with 0 Degree tilt (where possible) to ensure limited unwanted light spill.
 - Intelligent PIR lighting system will be used along pathways so that the lights on a section of path will only be energised when that section of path is in use.

Residual effect

With the implementation of the prescribed mitigation measures, no significant effects are predicted.

6. CONCLUSION

This report provides a full and comprehensive assessment of the potential for impact on bat populations within the site boundary. The surveys and assessment provided in this report are in accordance with the relevant industry guidance.

All trees proposed to be felled within the proposed development site are of negligible to low suitability for roosting bats. There are no structures to be demolished as part of the proposed development. During the manual transect survey bat activity by foraging and commuting bats was concentrated along the treelines throughout the site. A landscaping plan prepared for the proposed development allows for the planting of native hedgerows, specimen tree planting proposed to replace the 25 trees to be felled and shrub and herbaceous planting to ensure there will be no net loss of linear landscape features within the proposed development site. The lighting for the proposed development will be designed to minimise impacts on bats.

Bat activity within the site was dominated by Common pipistrelle. This species is widespread across Ireland.

Following consideration of the residual effects (post mitigation) it is noted that the proposed small-scale development in an existing busy urban environment will not result in any significant effects on bats. Provided that the proposed development is constructed and operated in accordance with the design, best practice and mitigation that is described within this report, significant effects on bats are not anticipated at any geographic scale.

7.

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APPENDIX 1

LANDSCAPE PLAN DRAWINGS



NORTH

TUS MOYLISH

OLD CRATLOE ROAD

BROOKVILLE AVENUE

Specimen Tree
Short Floral Lawn
Existing Trees
Bat Box
Bird Box
Tree to be Removed

Crossing

Shrub Planting
Bulb Planting

Native Hedge
Specimen Tree
Wildflower Meadow
Cycletrack

Rain Garden

Raised Table

Bus Stop
Crossing

Specimen Tree

Bus Stop & Shelter

Cycletrack
Footpath

THOMOND PARK

Increased Soft Landscape
Zone around Existing
Tree

Crossing

Trees to be Removed

MAYORSTONE UPPER

Soft Landscape Legend:

- Red line boundary
- Existing trees to be retained & protected
Refer to Independent Tree Surveys drawings for details
- Existing trees to be removed
Refer to Independent Tree Surveys drawings for details
- Native Short Cut Floral Lawn of Irish Provenance:
'Short Cut Wildflower Mixture' (DW01 by 'Design by Nature') or equal and approved
- Native Hedge planting:
Planted on low mound in a double staggered row, 4no. /lin.m. (60-100cm tall with post and wire fence at centre):
10% Guelder rose: *Viburnum opulus*, b/fr, 80-100cm
20% Hawthorn: *Crataegus monogyna*, b/fr, 80-100cm
10% Blackthorn: *Prunus spinosa*, b/fr, 100-120cm
10% Dog Rose: *Rosa canina*, b/fr, 60-80cm
30% Holly: *Ilex aquifolium*, t/b, 60-80cm
10% Spindle: *Euonymus europaeus*/r, 60-80cm
10% Cherry Plum: *Prunus cerasifera*, b/fr, 100-120cm
Under-planted with 20% Hart's Tongue Fern:
Asplenium scolopendrum, 20% Hard Fern: *Blechnum spicant*, 30% Bloody Cranes-bill: *Geranium sanguineum*, 20% Wild Strawberry: *Fragaria vesca* and 10% Ivy: *Hedera hibernica* all 1L planted at 3no./m² and seeded with native wildflower mix of Irish Provenance:
'Hedgerow Wildflower Mixture' (suitable for light shade - EC04 by 'Design by Nature') or equal and approved.
- Specimen tree planting to include the following species:
(all min. 2.0m clear stem)
Columbar Oak: *Quercus robur* 'Fastigiata Koster', r/b, 18-20cm girth
Hornbeam: *Carpinus betulus* 'Frans Fontain', r/b, 18-20cm girth
Ornamental Pear: *Pyrus calleryana* 'Chanticleer', r/b, 18-20cm girth
Wild Cherry: *Prunus avium* 'Plena', r/b, 18-20cm girth
Beech: *Fagus sylvatica*, r/b, 20-25cm girth
Oak: *Quercus robur*, r/b, 20-25cm girth
Scots Pine: *Pinus sylvestris*, r/b, 18-20cm girth
Walnut: *Juglans regia*, r/b, 18-20cm girth
Sweet Chestnut: *Castanea sativa*, r/b, 18-20cm girth
Cherry Plum: *Prunus cerasifera*, r/b, 16-18cm girth

- Shrub & Herbaceous planting:
To include the following pollinator mix species (but not limited to):
(typical plant sizes and planting density shown)
Sarcococca confusa, c/g, 3L, 3/sq.m
Berberis darwinii, c/g, 3L, 3/sq.m
Mahonia x media 'Charity', c/g, 5L, 3/sq.m
Ribes nigrum, c/g, 3L, 3/sq.m
Geranium 'Sweet Heidi', c/g, 2L, 4/sq.m
Buddleia davidii, c/g, 3L, 3/sq.m
Fuchsia 'Gem', c/g, 2L, 3/sq.m
Ribes rubrum, c/g, 3L, 3/sq.m
Erica carnea 'Nathalie', c/g, 2L, 3/sq.m
Bergenia 'Summertime', c/g, 2L, 3/sq.m
Lavandula angustifolia 'Imperial Gem', c/g, 2L, 3/sq.m
Laurus nobilis f. *angustifolia*, c/g, 10L, 3/sq.m
Rosmarinus officinalis 'Sissinghurst Blue', c/g, 2L, 3/sq.m
- Bulb planting:
Daffodil: *Narcissus* 'Golden Echo', bulb, 18/sq.m
Daffodil: *Narcissus* 'Tete-a-Tete', 18/sq.m
Wood Anemone: *Anemone nemorosa*, 18/sq.m
Snake's head fritillary: *Fritillaria meleagris*, 12/sq.m
Bluebell: *Hyacinthoides non-scripta*, 18/sq.m

- Native wildflower meadow of Irish Provenance:
'Biodiversity Wildflower Meadow Mixture' (suitable for light shade - WF02 by 'Design by Nature') or equal and approved
- Swale / Bio-retention Area
- Bird box locations
- Bat box locations

Note: Refer to Engineer's drawings for details.



- Footpath / Cycletrack - Refer to Engineer's drawings for details
- Road / Road Markings - Refer to Engineer's drawings for details
- Coloured Road Surfaces / Tactile Pavings and Crossings - Refer to Engineer's drawings for details



Typical native hedgerow



Bird box



Typical wildflower meadow

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Transport & Mobility
Merchants Quay
Limerick

DATE: 2022-07-29
SCALE: 1:500
DRAWN: MS
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JOB NO: LCC190003

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Active Travel Scheme
STAGE:
Part 8 Planning

DRAWING TITLE:
Landscape Plan 1/4

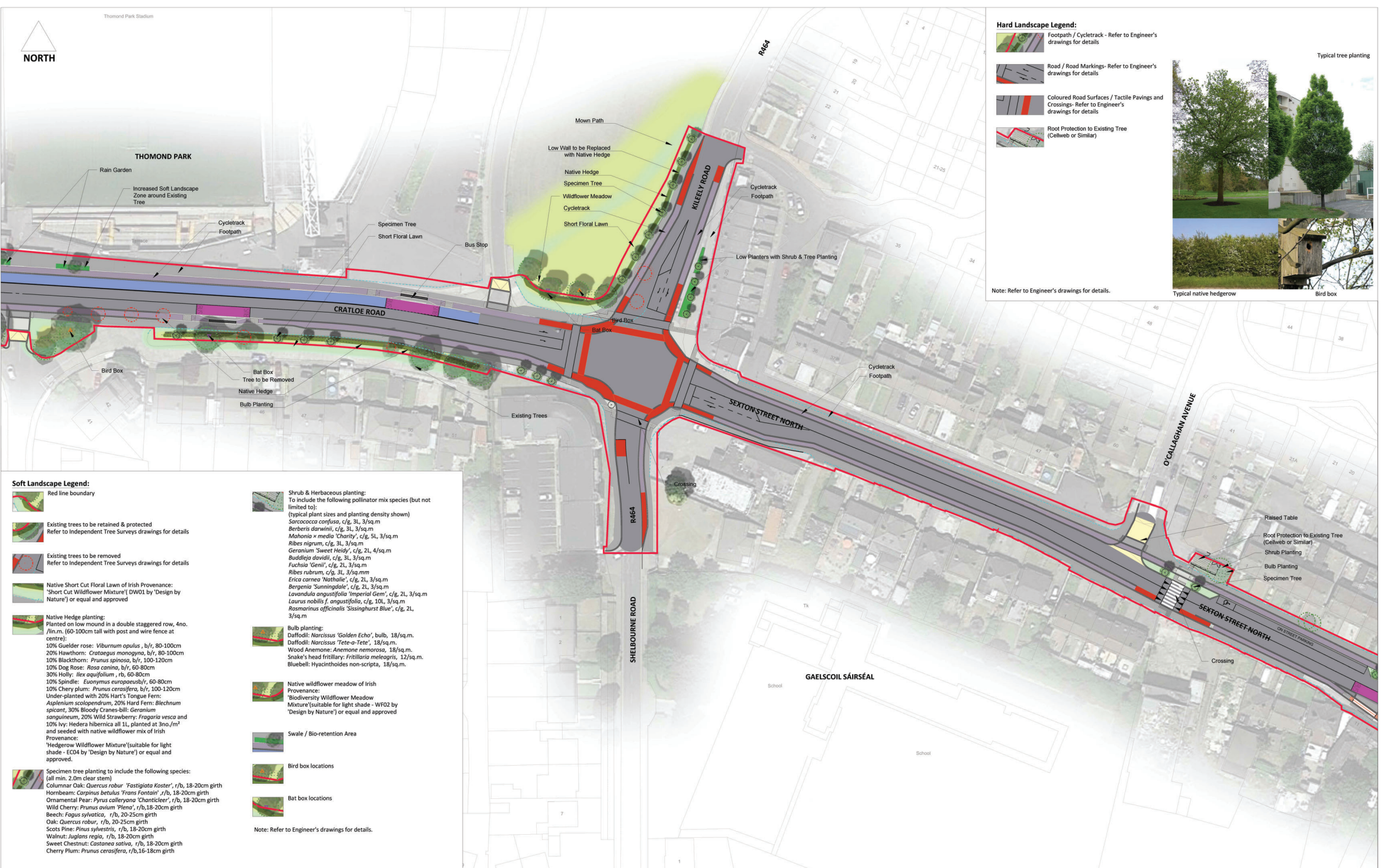
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LP01

SHEET SIZE:
A1

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00



Thomond Park Stadium



Hard Landscape Legend:

- Footpath / Cycletrack - Refer to Engineer's drawings for details
- Road / Road Markings- Refer to Engineer's drawings for details
- Coloured Road Surfaces / Tactile Pavings and Crossings- Refer to Engineer's drawings for details
- Root Protection to Existing Tree (Cellweb or Similar)

Note: Refer to Engineer's drawings for details.



Soft Landscape Legend:

- Red line boundary
- Existing trees to be retained & protected
Refer to Independent Tree Surveys drawings for details
- Existing trees to be removed
Refer to Independent Tree Surveys drawings for details
- Native Short Cut Floral Lawn of Irish Provenance:
"Short Cut Wildflower Mixture" DW01 by "Design by Nature" or equal and approved
- Native Hedge planting:
Planted on low mound in a double staggered row, 4no./lin.m. (60-100cm tall with post and wire fence at centre):
10% Guelder rose: *Viburnum opulus*, b/r, 80-100cm
20% Hawthorn: *Crataegus monogyna*, b/r, 80-100cm
10% Blackthorn: *Prunus spinosa*, b/r, 100-120cm
10% Dog Rose: *Rosa canina*, b/r, 60-80cm
30% Holly: *Ilex aquifolium*, rb, 60-80cm
10% Spindle: *Euonymus europaeus*, b/r, 60-80cm
10% Cherry plum: *Prunus cerasifera*, b/r, 100-120cm
Under-planted with 20% Hart's Tongue Fern: *Asplenium scolopendrum*, 20% Hard Fern: *Blechnum spicant*, 30% Bloody Cranes-bill: *Geranium sanguineum*, 20% Wild Strawberry: *Fragaria vesca* and 10% Ivy: *Hedera hibernica* all 1L, planted at 3no./m² and seeded with native wildflower mix of Irish Provenance:
"Hedgerow Wildflower Mixture"(suitable for light shade - EC04 by "Design by Nature" or equal and approved.
- Specimen tree planting to include the following species: (all min. 2.0m clear stem)
Columnar Oak: *Quercus robur* 'Fastigiata Koster', r/b, 18-20cm girth
Hornbeam: *Carpinus betulus* 'Frans Fontain', r/b, 18-20cm girth
Ornamental Pear: *Pyrus calleryana* 'Chanticleer', r/b, 18-20cm girth
Wild Cherry: *Prunus avium* 'Pleni', r/b, 18-20cm girth
Beech: *Fagus sylvatica*, r/b, 20-25cm girth
Oak: *Quercus robur*, r/b, 20-25cm girth
Scots Pine: *Pinus sylvestris*, r/b, 18-20cm girth
Walnut: *Juglans regia*, r/b, 18-20cm girth
Sweet Chestnut: *Castanea sativa*, r/b, 18-20cm girth
Cherry Plum: *Prunus cerasifera*, r/b, 16-18cm girth
- Shrub & Herbaceous planting:
To include the following pollinator mix species (but not limited to):
(typical plant sizes and planting density shown)
Sarcococca confusa, c/g, 3L, 3/sq.m
Berberis darwinii, c/g, 2L, 3/sq.m
Mahonia x media 'Charity', c/g, 5L, 3/sq.m
Ribes nigrum, c/g, 3L, 3/sq.m
Geranium 'Sweet Heidi', c/g, 2L, 4/sq.m
Bueltia davidii, c/g, 3L, 3/sq.m
Fuchsia 'Genii', c/g, 2L, 3/sq.m
Ribes rubrum, c/g, 3L, 3/sq.m
Erica carnea 'Nathalie', c/g, 2L, 3/sq.m
Bergenia 'Sunningdale', c/g, 2L, 3/sq.m
Lavandula angustifolia 'Imperial Gem', c/g, 2L, 3/sq.m
Laurus nobilis f. *angustifolia*, c/g, 10L, 3/sq.m
Rosmarinus officinalis 'Sissinghurst Blue', c/g, 2L, 3/sq.m
- Bulb planting:
Daffodil: *Narcissus 'Golden Echo'*, bulb, 18/sq.m.
Daffodil: *Narcissus 'Tete-a-Tete'*, 18/sq.m.
Wood Anemone: *Anemone nemorosa*, 18/sq.m.
Snake's head fritillary: *Fritillaria meleagris*, 12/sq.m.
Bluebell: *Hyacinthoides non-scripta*, 18/sq.m.
- Native wildflower meadow of Irish Provenance:
Biodiversity Wildflower Meadow Mixture (suitable for light shade - WF02 by "Design by Nature" or equal and approved)
- Swale / Bio-retention Area
- Bird box locations
- Bat box locations

Note: Refer to Engineer's drawings for details.

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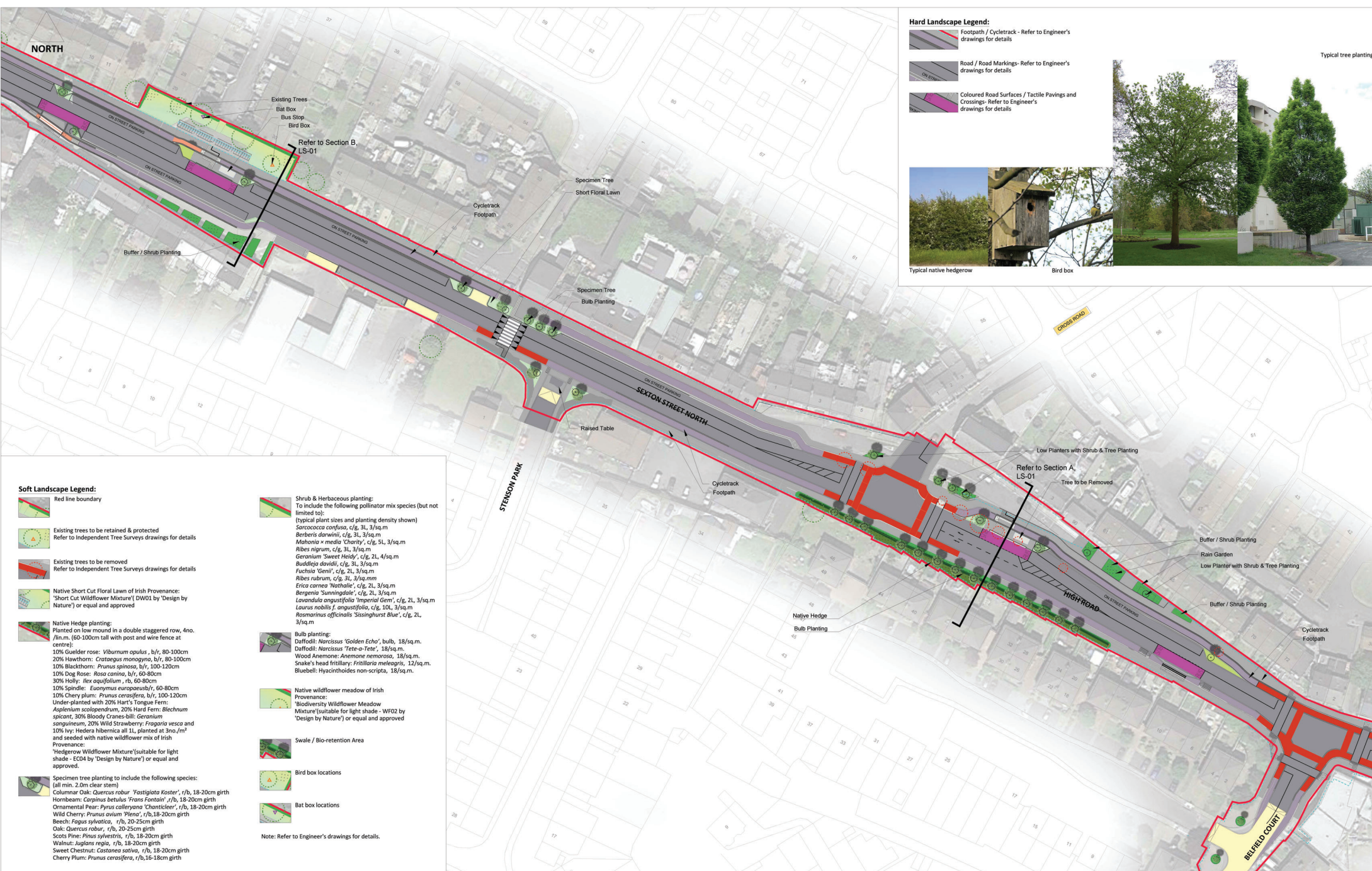
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TUS Moylish to City
Active Travel Scheme
STAGE:
Part 8 Planning

DRAWING TITLE:
Landscape Plan 2/4

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Hard Landscape Legend:

- Footpath / Cycletrack - Refer to Engineer's drawings for details
- Road / Road Markings- Refer to Engineer's drawings for details
- Coloured Road Surfaces / Tactile Pavings and Crossings- Refer to Engineer's drawings for details



Soft Landscape Legend:

- Red line boundary
- Existing trees to be retained & protected
Refer to Independent Tree Surveys drawings for details
- Existing trees to be removed
Refer to Independent Tree Surveys drawings for details
- Native Short Cut Floral Lawn of Irish Provenance:
'Short Cut Wildflower Mixture' (DW01 by 'Design by Nature') or equal and approved
- Native Hedge planting:
Planted on low mound in a double staggered row, 4no./lin.m. (60-100cm tall with post and wire fence at centre):
10% Gaelder rose: *Viburnum opulus*, b/r, 80-100cm
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Beech: *Fagus sylvatica*, r/b, 20-25cm girth
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Walnut: *Juglans regia*, r/b, 18-20cm girth
Sweet Chestnut: *Castanea sativa*, r/b, 18-20cm girth
Cherry Plum: *Prunus cerasifera*, r/b, 16-18cm girth

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(typical plant sizes and planting density shown)
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Ribes nigrum, c/g, 3L, 3/sq.m
Geranium 'Sweet Heidi', c/g, 2L, 4/sq.m
Buddleja davidii, c/g, 3L, 3/sq.m
Fuchsia 'Genii', c/g, 2L, 3/sq.m
Ribes rubrum, c/g, 3L, 3/sq.m
Erica carnea 'Nathalie', c/g, 2L, 3/sq.m
Bergenia 'Sunningdale', c/g, 2L, 3/sq.m
Lavandula angustifolia 'Imperial Gem', c/g, 2L, 3/sq.m
Laurus nobilis f. *angustifolia*, c/g, 10L, 3/sq.m
Rosmarinus officinalis 'Sissinghurst Blue', c/g, 2L, 3/sq.m
- Bulb planting:
Daffodil: *Narcissus* 'Golden Echo', bulb, 18/sq.m
Daffodil: *Narcissus* 'Tete-a-Tete', 18/sq.m
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Snake's head fritillary: *Fritillaria meleagris*, 12/sq.m
Bluebell: *Hyacinthoides non-scripta*, 18/sq.m
- Native wildflower meadow of Irish Provenance:
'Biodiversity Wildflower Meadow Mixture' (suitable for light shade - WF02 by 'Design by Nature') or equal and approved
- Swale / Bio-retention Area
- Bird box locations
- Bat box locations

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 Active Travel Scheme
STAGE:
 Part 8 Planning
DRAWING TITLE:
 Landscape Plan 3/4

DRAWING NO:
 LP01
SHEET SIZE:
 A1
REVISION:
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Soft Landscape Legend:

- Red line boundary
- Existing trees to be retained & protected
Refer to Independent Tree Surveys drawings for details
- Existing trees to be removed
Refer to Independent Tree Surveys drawings for details
- Native Short Cut Floral Lawn of Irish Provenance: 'Short Cut Wildflower Mixture' DW01 by 'Design by Nature' or equal and approved
- Native Hedge planting:
Planted on low mound in a double staggered row, 4no./lin.m. (60-100cm tall with post and wire fence at centre):
10% Guelder rose: *Viburnum opulus*, b/r, 80-100cm
20% Hawthorn: *Crataegus monogyna*, b/r, 80-100cm
10% Blackthorn: *Prunus spinosa*, b/r, 100-120cm
10% Dog Rose: *Rosa canina*, b/r, 60-80cm
30% Holly: *Ilex aquifolium*, r/b, 60-80cm
10% Spindle: *Eunymus europaeus*, b/r, 60-80cm
10% Chery plum: *Prunus cerasifera*, b/r, 100-120cm
Under-planted with 20% Hart's Tongue Fern: *Asplenium scolopendrium*, 20% Hard Fern: *Blechnum spicatum*, 20% Bloody Crane-bill: *Geranium sanguineum*, 20% Wild Strawberry: *Fragaria vesca* and 10% Ivy: *Hedera hibernica* all 1L, planted at 3no./m² and seeded with native wildflower mix of Irish Provenance: 'Hedgerow Wildflower Mixture' (suitable for light shade - WF02 by 'Design by Nature' or equal and approved.
- Specimen tree planting to include the following species: (all min. 2.0m clear stem)
Columnar Oak: *Quercus robur* 'Fastigiata Koster', r/b, 18-20cm girth
Hornbeam: *Carpinus betulus* 'Frans Fontain' r/b, 18-20cm girth
Ornamental Pear: *Pyrus calleryana* 'Chanticleer', r/b, 18-20cm girth
Wild Cherry: *Prunus avium* 'Plena', r/b, 18-20cm girth
Beech: *Fagus sylvatica*, r/b, 20-25cm girth
Oak: *Quercus robur*, r/b, 20-25cm girth
Scots Pine: *Pinus sylvestris*, r/b, 18-20cm girth
Walnut: *Juglans regia*, r/b, 18-20cm girth
Sweet Chestnut: *Castanea sativa*, r/b, 18-20cm girth
Cherry Plum: *Prunus cerasifera*, r/b, 18-20cm girth
- Shrub & Herbaceous planting:
To include the following pollinator mix species (but not limited to):
(typical plant sizes and planting density shown)
Sarcococca confusa, c/g, 3L, 3/sq.m
Berberis darwinii, c/g, 3L, 3/sq.m
Mahonia x media 'Charity', c/g, 5L, 3/sq.m
Ribes nigrum, c/g, 3L, 3/sq.m
Geranium 'Sweet Heidi', c/g, 2L, 4/sq.m
Buddleja davidii, c/g, 3L, 3/sq.m
Fuchsia 'Genii', c/g, 2L, 3/sq.m
Ribes rubrum, c/g, 3L, 3/sq.m
Erica carnea 'Nathalia', c/g, 2L, 3/sq.m
Bergenia 'Sunningdale', c/g, 2L, 3/sq.m
Lavandula angustifolia 'Imperial Gem', c/g, 2L, 3/sq.m
Laurus nobilis f. *angustifolia*, c/g, 10L, 3/sq.m
Rosmarinus officinalis 'Sissinghurst Blue', c/g, 2L, 3/sq.m
- Bulb planting:
Daffodil: *Narcissus* 'Golden Echo', bulb, 18/sq.m
Daffodil: *Narcissus* 'Tete-a-Tete', 18/sq.m
Wood Anemone: *Anemone nemorosa*, 18/sq.m
Snake's head fritillary: *Fritillaria meleagris*, 12/sq.m
Bluebell: *Hyacinthoides non-scripta*, 18/sq.m
- Native wildflower meadow of Irish Provenance: 'Biodiversity Wildflower Meadow Mixture' (suitable for light shade - WF02 by 'Design by Nature' or equal and approved)
- Swale / Bio-retention Area
- Bird box locations
- Bat box locations

Hard Landscape Legend:

- Footpath / Cycletrack - Refer to Engineer's drawings for details
- Road / Road Markings - Refer to Engineer's drawings for details
- Coloured Road Surfaces / Tactile Pavings and Crossings - Refer to Engineer's drawings for details

Note: Refer to Engineer's drawings for details.



Typical wildflower meadow



Typical native hedgerow

Bird box

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REVISIONS

DATE	REV	BY	CH	DESCRIPTION

Transport & Mobility
 Merchants Quay
 Limerick
 DATE: 2022-07-29
 SCALE: 1:500
 DRAWN: MS
 CHECKED: MS
 JOB NO: LC190003

PROJECT:
 TUS Moylish to City
 Active Travel Scheme
 STAGE:
 Part 8 Planning
DRAWING TITLE:
 Landscape Plan 4/4

 DRAWING NO:
 LP05
 SHEET SIZE: REVISION
 A1 00