



Mungret Residential Development
Appropriate Assessment Screening Report

Proposed Development at Dromdarrig, Mungret, Co. Limerick

January 2021

Application prepared with



Limerick City & County Council
Mungret Residential Development
Report for Screening for Appropriate
Assessment

Issue 1 | 26 January 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 Introduction

Arup has prepared an Appropriate Assessment (AA) Screening Report on behalf of Limerick City & County Council for a proposed housing development at Mungret, County Limerick (hereafter referred to as '*the proposed development*'). This document sets out the results of the AA Screening and provides the competent authority, Limerick City & County Council (LCC) with the information necessary to make a determination on screening for AA for the proposed development.

The proposed development, which will be subject to a Part 8 process by Limerick City & County Council, will provide much needed housing accommodation and establish an enhanced setting for Mungret College and associated buildings. In addition, the construction of a public square will allow for the potential use of this open area for community events and markets.

The proposed development will consist of the following:

- Site area of 7.2 Hectares;
- 253 residential units located in plots A1, A2, A3 and A4;
- Public Open Spaces – POS (A1&A3), and POS (A2);
- Public Square - S1;
- Community Facility;
- Creche;
- Local shop(s); and
- Public Toilet

The aims of this report are to:

- Provide information on, and assess the potential for the proposed development to significantly impact on designated Natura 2000 sites (also known as European sites);
- Determine whether the proposed development is directly connected with, or necessary to the conservation management of any designated Natura 2000 sites; and
- Determine whether the proposed development, alone or in combination with other projects, is likely to have significant effects on designated Natura 2000 sites in view of their conservation objectives.

The screening information presented in this report is as follows:

- Methodology and Legislative Background, refer to **Section 2**;
- Characteristics of the proposed development, refer to **Section 3**;
- Ecological Overview, refer to **Section 4**;

- Identification of relevant Natura 2000 sites (European sites) within the zone of influence and assessment of likely significant effects on Natura 2000 Sites, refer to **Section 5**;
- Assessment of Significance, refer to **Section 6**; and
- Conclusions, refer to **Section 7**.

Figure 1 and **Figure 2** show the location and site layout of the proposed development. The *Findings of No Significant Effects* report is presented in **Appendix A**.

2 Methodology

This section provides details on the adopted methodology and the information gathered to inform the overall assessment process. The ecological baseline of the site and surrounding area is described in **Section 4**. The proposed development is described in **Section 3**. Both sections provide the detail for informing the screening for Appropriate Assessment.

2.1 Guidance and Assessment Methodology

This report has been prepared with regard to the following guidance documents:

- Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC (EC Environment Directorate-General, 2018);
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodical Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001);
- Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC (European Commission, 2007);
- Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (Department of Environment, Heritage and Local Government, 2010 revision);
- Appropriate Assessment under Article 6 of the Habitats Directive; Guidance for Planning Authorities. Circular NPW 1/10 and PSSP 2/10;
- Guidelines for Good Practice Appropriate Assessment of Plans under Article 6(3) Habitats Directive (International Workshop on Assessment of Plans under the Habitats Directive, 2011);
- Communication from the Commission on the precautionary principle. European Commission (2000);
- Limerick County Development Plan (2010-2016).

2.2 Data Sources

This report draws upon information collected as part of a desktop study undertaken in May 2019, bird surveys carried out in the winter season 2019 to 2020, and a modelling and assessment of the hydrogeological regime in the wider context of the site, carried out in 2020. The desktop study reviews the nature of the proposed development (construction and operational aspects) and potential effects of the proposed development on Natura 2000 sites and their qualifying interests. The desktop study also considers the potential for in-combination and cumulative impacts associated with other plans and projects in the area.

The following sources of information (accessed May 2020) were used to collect relevant data on the Natura 2000 network and support the desktop study:

- Google maps aerial photography;
- Ordnance Survey Ireland OSI mapping and aerial photography – www.osi.ie
- Bing aerial photography – www.bing.com/maps
- Online mapping and data on protected sites from the National Parks and Wildlife Service (NPWS);
- Information on environmental quality data available from the EPA;
- Status of EU protected habitats in Ireland provided by the NPWS;
- National Biodiversity Centre database; and
- Environmental Reporting prepared for the Mungret Link Streets Project.

2.3 Legislative Background

According to the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (79/409/EEC), Member States of the European Union are required to establish a Natura 2000 network of sites of highest biodiversity importance for rare and threatened habitats and species across the EU.

In Ireland, the Natura 2000 network of European sites includes Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

SACs are selected for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are selected for the conservation of Annex I birds (including migratory) and their habitats. The Annex habitats and species, for which each site is selected, are the *qualifying interests* (QI) and *special conservation interests* (SCIs) of the site. *Conservation objectives* (CO) for the site are defined for these QIs and SCIs.

A key requirement of the Directives is that the effects of any plan or project, alone, or in combination with, other plans or projects, on the Natura 2000 network, should be assessed before any decision is made to allow that plan or project to proceed. This process is known as Appropriate Assessment (AA). The obligation to undertake an Appropriate Assessment derives from Article 6(3) and 6(4) of the Habitats Directive (92/43/EEC) and both involve a number of steps and tests that need to be applied in sequential order.

Article 6(3) is concerned with the strict protection of sites, while Article 6(4) is the procedure for allowing derogation from this strict protection in certain restricted circumstances.

Article 6(3) of the Habitats Directive states:

“Any plan or project not directly connected with, or necessary to, the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans and projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives.

In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only having ascertained that it will not adversely affect the integrity of the site concerned and if appropriate, after having obtained the opinion of the general public”.

Article 6(4) states:

“If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.

Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.”

The competent authority is required to carry out Appropriate Assessment, as required by Article 6(3) and 6(4) of the Habitats Directive, as follows:

Stage 1 - Screening for Appropriate Assessment – to assess, in view of best scientific knowledge, if the development, individually or in combination with another plan or project is likely to have a significant effect on the Natura 2000 site.

Stage 2 - Appropriate Assessment – This is required if it cannot be excluded, on the basis of objective information, that the development, individually or in combination with other plans or projects, will have a significant effect on a Natura 2000 site. The Appropriate Assessment must include a final determination by the competent authority as to whether or not a proposed development would adversely affect the integrity of a Natura 2000 site. In order to reach a final determination, the competent authority must undertake examination, analysis and evaluation, followed by findings, conclusions and a final determination. The appropriate assessment must contain complete, precise and definitive findings and conclusions, and may not have lacunae or gaps.

Stage 3 – Assessment of alternative solutions- the process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site.

Stage 4 - Assessment where no alternative solutions exist and where adverse impacts remain - an assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed.

3 Characteristics of the Proposed Development

3.1 Introduction

The proposed development which is located on the grounds of the existing Mungret College, is comprised of 253 residential units, associated roads, carparking, open spaces, local services and ancillary utilities infrastructure.

Further details of the proposed development are presented below. Refer also to the drawings provided in the planning package.

The proposed development is not directly connected to or necessary to the management of any European site and is therefore subject to the provisions of Article 6(3) of the Habitats Directive.

3.2 Location

The site is located approximately five kilometres to the west of Limerick City Centre and is identified in the Southern Environs Local Area Plan as the Mungret - Loughmore Opportunity Area. Mungret is a priority area within the Limerick Metropolitan District and is a zoned urban extension of Limerick City under the Southern Environs Local Area Plan.

As shown in **Figure 1** the site is served by several roads:

- to the north by the Quinn's Cross to Mungret regional road (R859) and by the N69;
- to the east by the R510 road which extends from Quinn's Cross to the Raheen roundabout;
- to the south by the R526 Raheen – Patrickswell regional road and by the Caher Road.
- The area has direct access onto the M20 via Ballycummin Avenue to the south.



Figure 1: Site Location | Not to Scale | Source: Google Maps

The land within the site is mostly undeveloped agricultural fields and includes a hardstanding area where the proposed creche and community facility will be located. They are classed by the EPA CORINE (Coordination of Information on the Environment) land cover classification, as ‘pastures’. This includes Mungret College, which is located to the north of plot A4 and the Public Square (S1).

Mungret Village is located towards the north-west and the Courtfield Shopping Centre to the south-east. Raheen Business Park is located towards the south and the Irish Cement facility to the north.

A residential development known as Mungret Woods is located to the north of the subject site. Mungret Park is located north east of the proposed development. The neighbourhoods of Dooradoyle and Raheen are located further east of the proposed development.

3.3 Operation

The site area of the proposed development (refer to **Figure 2**) is 7.2 hectares and will be comprised of plots A1, A2, A3, A4, Public Open Spaces (POS) and a Public Square (S1). In addition, a creche, community facility and local shops will be located to the north of plot A4 and the Public Square (S1).

The proposed development consists of the following:

- 253 residential units located in plots as follows
 - A1 (2.2 ha)
 - A2 (0.96ha)
 - A3 (2.1ha)
 - A4 (0.91ha)

- Public Open Spaces;
 - POS - A1 and A3 (approximately 0.2ha)
 - POS - A2 (approximately 0.2ha)
- Public Square - S1 (approximately 0.2ha);
- Community Facility including a café - (gross area of approximately 341m²);
- Creche - (gross area of approximately 476m²); and
- Local shops which include a beauty salon and corner shop - (gross area of approximately 200m²).



Figure 2: Site Layout | Not to scale | Based on information provided by: EML Architects

3.3.1 Drainage

3.3.1.1 Foul Water Strategy

There is an existing 225mm diameter foul water sewer serving Mungret College to the north west of the site, an existing 225mm diameter foul water sewer serving the Mungret Woods residential development to the north east of the site and a proposed 225mm diameter foul water sewer, which is part of the Mungret Link Streets Project, which will run along the southern boundary of the site.

The proposed development will provide primary carrier sewers below the streets which will drain by gravity to the existing foul sewer network.

3.3.1.2 Storm Water Strategy

There is an existing 225mm diameter surface water drain serving Mungret Community College to the north west of the site, an existing 500mm diameter surface water drain serving Mungret Woods residential development to the north east of the site and a proposed surface water drain, which is part of the Mungret Link Streets Project, which will run along the southern boundary of the site.

The proposed development will provide primary carrier drains below the streets which will serve the impermeable areas within the site.

Runoff from streets and car parking spaces will be collected in linear drainage channels/ or gullies and conveyed by a buried pipe/manhole system. Trapped gullies and sump units will be provided to catch silt/grit. Roof runoff will be collected in downpipes and discharged to the same pipe/manhole system. In keeping with standard drainage design Class 1 by-pass hydrocarbon interceptors and hydrobrake attenuation will be provided as appropriate.

Sustainable Urban Drainage Systems (SuDS) will be implemented for each plot of the proposed development. Attenuation at source will be the over-riding objective.

3.3.2 Landscaping

As part of the design process, there has been an effort, insofar as possible, to retain the mature and viable trees within the site boundary. Nearly all of the existing mature trees within the proposed development site will be retained, including the Austrian Pine (*Pinus nigra*) trees (refer to **Photograph 1**) which are located to the north of plot A3.



Photograph 1: Austrian Pine Trees

To accommodate construction of the proposed development removal of three trees and 7,523m² of unmanaged hedgerow/ shrub will be required. Hedgerows within the proposed development are predominately native and mature and are in good overall condition, however these unmanaged hedgerows have a low species diversity and there was little evidence to suggest these areas are used by protected species.

As part of the proposed development it is estimated that a minimum of 170 new trees will be planted throughout the site. In addition, 1,320m² of structure planting, 330m² of new hedge planting and 220m² of shrub planting will be undertaken. As part of the Landscape Strategy, which is included with the Part 8 documentation, a variety of different tree species have been selected to define different areas of the proposed development e.g. Hornbeam (*Carpinus betulus*) has been chosen to line the main street network, flowering cherry trees (*Plena*) will be specified to the Public Open Spaces and a row of narrowly conical, medium-sized small-leaved limes is proposed in the Public Square.

The planting of thorny plants such as Hawthorn (*Prunus spinosa*), Holly (*Ilex aquifolium*), Blackthorn (*Prunus spinosa*), Dog Rose (*Rosa canina*) and Gorse (*Ulex europaeus*), all of which are present in the wider area, will not only provide security to the rear of residential areas but will also act as wildlife corridors across the site.

Figure 3 illustrates the proposed vegetation removal and retention plan. Structured planting of native trees and hedgerows will be carried out as part of the Landscape Strategy, which is included with the Part 8 documentation.

In addition to this planting, the landscape framework of the proposed development includes a Public Square (S1), Public Open Spaces and areas of informal linear greenspace. Hard and soft landscaping will be incorporated throughout the site, with this contrast of landscaped areas provides alternating functionality

throughout the year. The hard-landscaped spaces will be more functional during the wetter months of the year, whilst the grassed areas will be more attractive spaces to interact with on sunnier days. Each of the public open spaces will provide an outdoor play area for children.

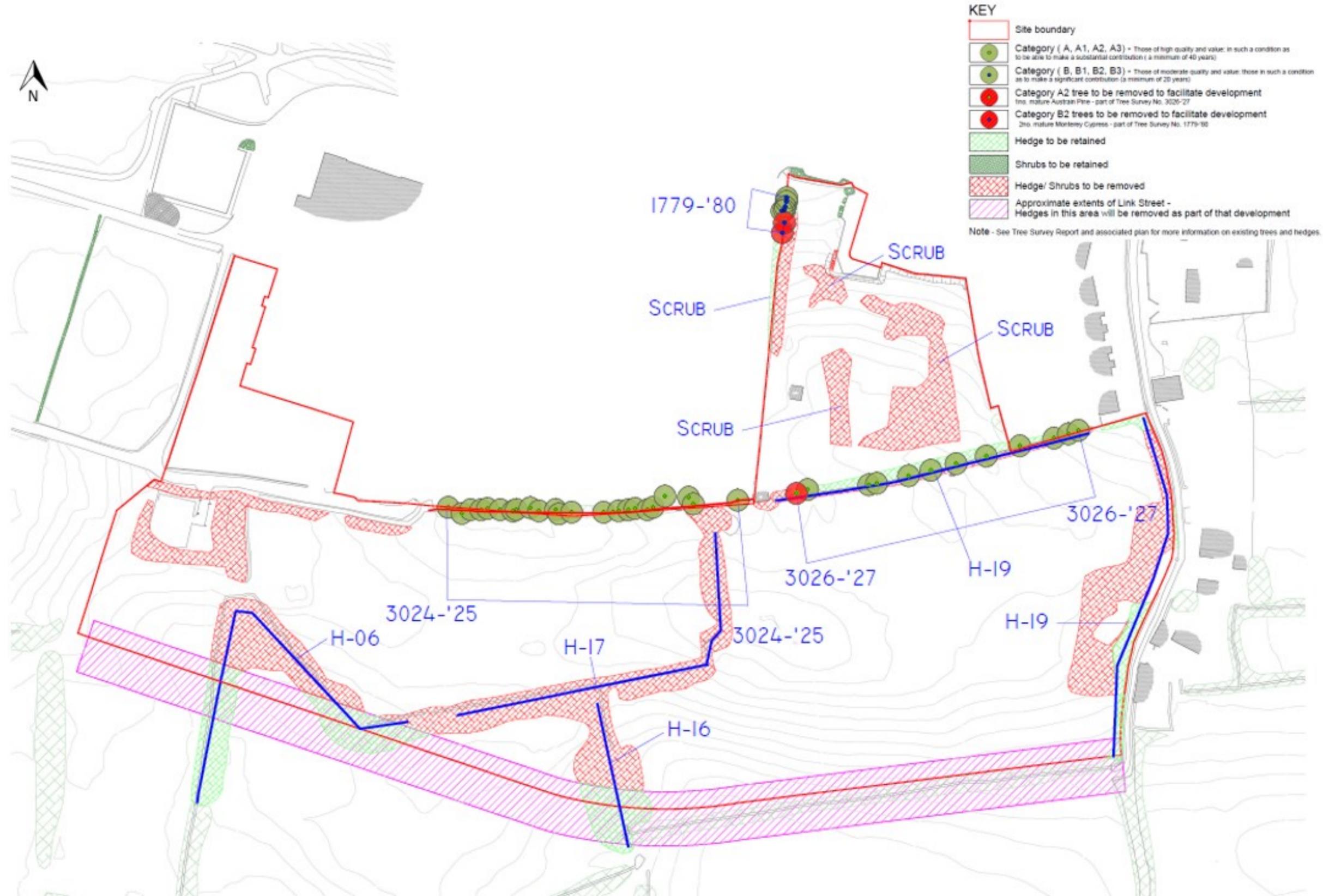


Figure 3: Vegetation Removal Plan | Not to scale | Based on information provided by: Nicholas de Jong Landscape Architects

3.4 Construction

3.4.1 Timeline and Phasing

Construction of the proposed development is likely to be completed over approximately five years and will be carried out in three phases. Activities within or across the phases may be carried out simultaneously depending on how the contractor chooses to construct the scheme. The three construction phases are identified as Phase 1, Phase 2 and Phase 3.

These phases are described below and illustrated in **Figure 4**.

Phase 1 will commence with the construction of 55 Independent Living for Older Persons apartments in the western part of the site and the construction of approximately 54 residential units in the eastern part of the site. Approximately 700m² of the Public Square (S1) will be construction during Phase 1 along with the public open space (POS A1&A3) located to the south east of the site. It is estimated that construction of Phase 1 will take approximately 18 months to complete.

Phase 2 will consist of the construction of 56 residential units (to the west of the 54 units planned as part of Phase 1) and construction works to the proposed Creche, Community Facility and 12 residential units (located to the north of the Independent Living for Older Persons units) respectively. During Phase 2 the remaining area of the Public Square (S1) will be construction in addition to the public open spaces (POS A1& A3 and POS A2). Phase 2 will take approximately 18 months to complete.

Phase 3 will consist of the construction of 76 residential units and will complete the works on the site. It is estimated that Phase 3 will be completed in the 24 months following completion of the previous phases.

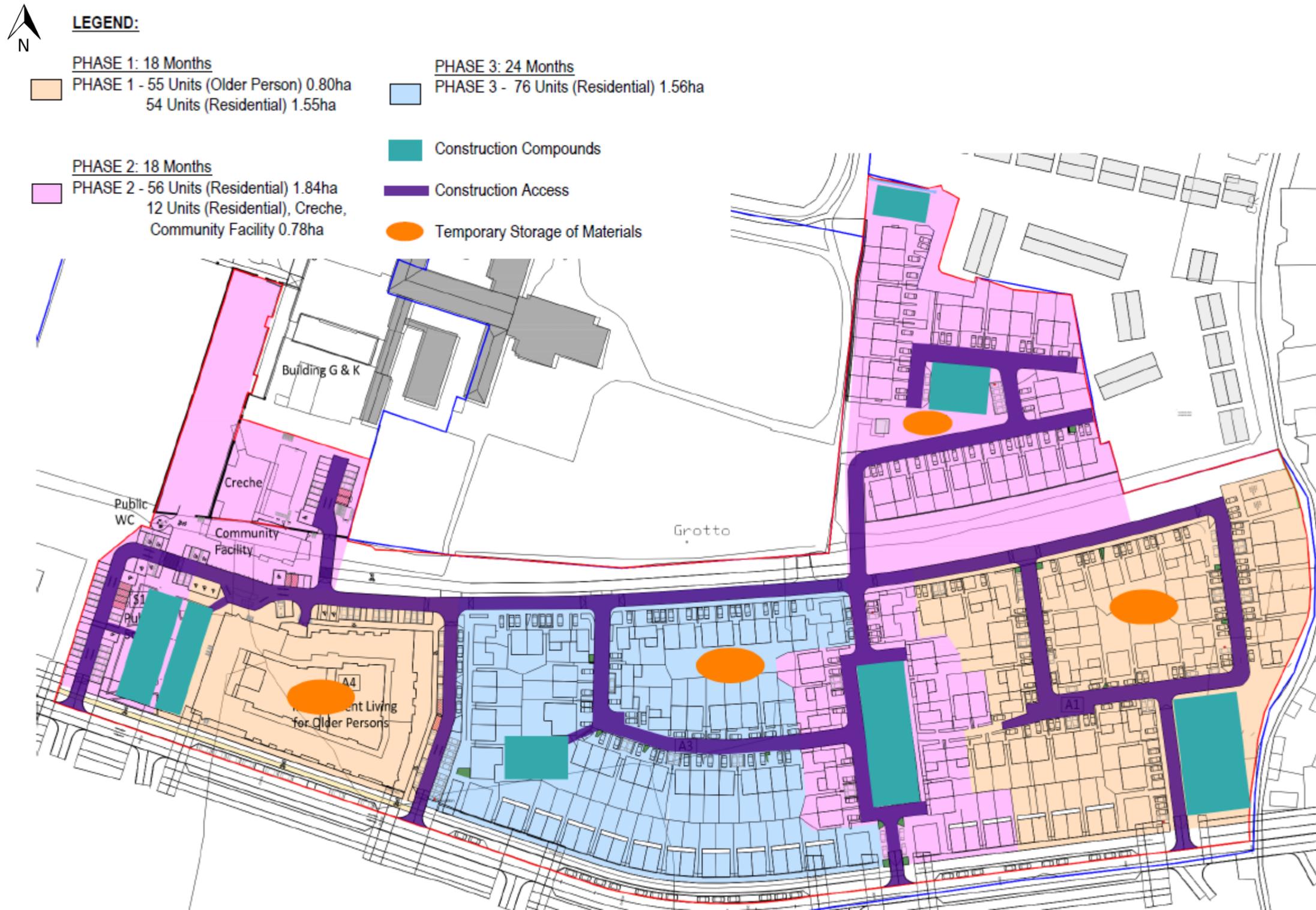


Figure 4: Phasing Plan | Not to scale | Based on information provided by: EML Architects

3.4.2 Construction Compounds

As previously mentioned, the construction programme for the proposed development is planned over a five-year period and will be constructed in three phases, 1, 2 and 3.

Each phase will be served by a local construction compound located in the green /open area of the relevant phase. The construction compound will be opened and closed in line with the construction programme. The locations of the compounds are shown in **Figure 4**.

All construction compounds will provide the following:

- Space for materials lay down;
- Wheel wash;
- Construction waste storage;
- Site Offices;
- Electricity supplied by mains and /or an onsite generator;
- IT/telecommunication connection;
- Water supplied from the public watermain; and
- Mobile welfare facilities – either mobile welfare vans, towed units or self-contained units will be provided for construction personnel and will be fully bunded with foul sewage disposed of by removal off-site.

A designated bunded refuelling area on an impermeable surface will be provided at all construction compounds. Refuelling of vehicles will be restricted to these designated areas.

Site drainage will be provided at each of the construction compounds to collect surface water runoff, which will be directed into the existing local drainage network. Surface water or contaminants within the site compounds will not be released from the site to any waters or the bed and banks of any waters (including ground water).

3.4.3 Construction Methodology

Site Preparation and Groundworks

The initial tasks will include:

- Clearance of the site and any vegetation to be removed phase by phase. To clarify, only vegetation inside Phase 1 will be removed during Phase 1 and so on. Planting and landscaping, as per the Landscape Strategy (included with the Part 8 documentation), will be carried out as each construction phase is completed. Where possible, vegetation will be removed outside of the breeding season and in particular, removal during the peak-breeding season (April-June inclusive) will be avoided.

- Diversion of overhead ESB lines. Following direct discussions between the applicant and the utility provider, the ESB will fully assess upon submission of the planning application;
- Site set up;
- Construction of site compounds and access roads as shown on **Figure 4**. The final road layout will act as access during construction works; and
- Rock breaking using an excavator-mounted breaker will be carried out as required for each phase. Further detail on rock breaking is provided below.

The construction compounds will be located within the boundary of the proposed development as indicated in **Figure 4** and will be accessed by the spurs provided by the Mungret Link Streets Project which will be fully constructed prior to occupation of the residential units.

Phase 1: Construction of Independent Living for Older Persons Apartment Block and Residential Units

Once site preparation works are complete, construction of the apartment block and housing units will commence.

Early construction works will include

- Capping Layer;
- Drainage / Utilities;
- Sub-base;
- Ductwork;
- Lay Kerbs / Gullies;
- Build up to Footpaths / Cycle Ways;
- Blacktop;
- Lighting Columns;
- Finishes to Verges / Road;
- Foundations to Housing Units; and
- Construction of housing units.

Phase 2: Construction of 56 Residential Units, Creche, Community Facility and 12 Residential Units overhead

It is planned that this phase of the proposed development will commence after Phase 1.

The foundations will be laid for the residential units along with retaining structures (at the north east of the site) to allow for pedestrian connection to Mungret Woods via ramps and steps. Five residential units will have direct vehicular connection to Mungret Woods.

Phase 3: Construction of Remaining Residential Units (76 in total)

The final phase will be those identified in Phase 3 and is planned to commence when Phase 2 is complete.

The construction works will be in line with works as described previously for residential units.

Rock Breaking

Based on a review of ground investigation data for the site, it has been identified that there are locations within the site which include some rock close to the surface of the ground. As can be seen in **Figure 5**, most of the rock to be removed is located in the centre/east of the site. It is also noted that no karst features have been identified on this site.

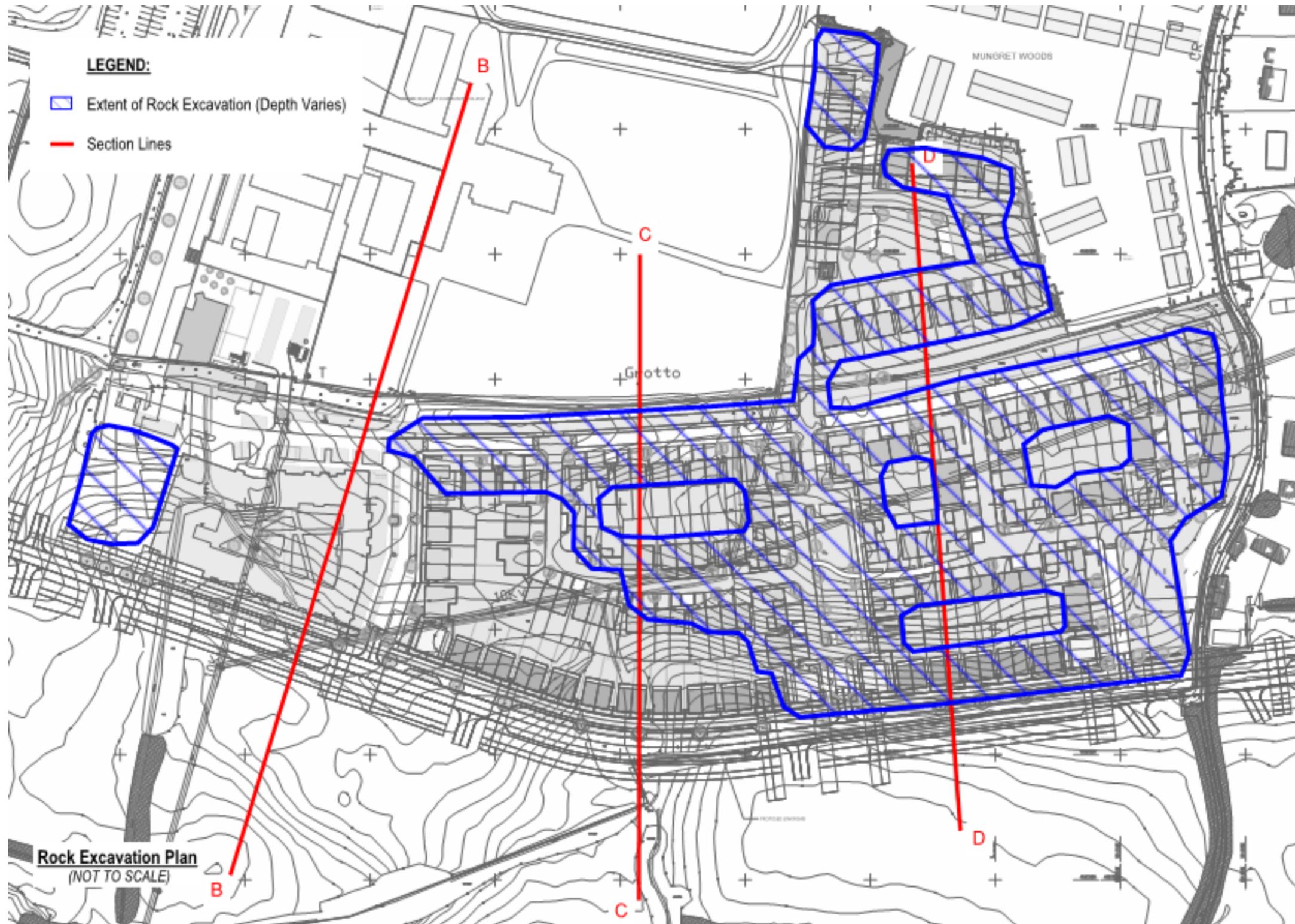


Figure 5: Rock Excavation Plan | not to scale

It is anticipated that the construction contractor will remove the rock using an excavator and an excavator-mounted hydraulic rock breaker. This is likely to be a 13 to 20 tonne hydraulic rock breaker. It is planned that rock will be removed from the site as it is excavated, with the excavated material being taken to its destination in an appropriately licensed quarry. Temporary storage areas have been identified as shown on **Figure 4** when the need to store excess material prior to removal off site. Volumes are expected to be low and only stored for short periods.

Approximately 1m depth of rock will be removed to allow for the foundation of units to be constructed and up to 2m depth of rock where service trenches are required under the roadways. A similar depth of 2m is expected for the storm water attenuation structures required along the southern boundary of the development.

For Phase 1 it is estimated that within the first month of works approximately 2,300m³ of rock will be broken out and removed from site. The transfer of rock from site to a local quarry for final disposal, equates to approximately 400 truck movements over this period. It is not envisaged that this material will have a beneficial re-use on site, however, there is the opportunity for the excavated rock to be properly crushed and graded in the local quarries for re-use on other projects; and the construction contractor will evaluate this opportunity. Local quarries for consideration by the contractor include Lynch's Quarry in Croom, County Limerick, and O'Connell's Quarry in Ardnacrusha, County Clare. Both of these quarries are within 15 kilometres of the site.

In summary the rock breaking activity will happen near the start of Phase 1 and will be completed early in the 18-month programme for this phase.

Phase 2 will start shortly after Phase 1 is complete, and to construct Phase 2, it is estimated that approximately 8,200m³ of rock will be removed. Similar to Phase 1, most rock breaking activities will be carried out during the early stages, approximately three months from commencement of Phase 2. It is intended to remove rock identified in the lands of Phase 3 in Phase 2 to complete all these works in a practical manner, the volume above accounts for that. Any rock breaking in the vicinity of Mungret Woods will be completed within the first month of this phase of construction.

The duration of noisy rock-breaking activity will be minimised at each phase, as outlined above. In addition, this activity will be restricted to daytime hours (7am to 7pm), and the off-site effects will be reduced by the use of continuous site hoarding. This typically provides a 10dB reduction in off-site noise levels.

It is estimated that this volume of rock will result in approximately 1500 truck movements in and out of site. The traffic numbers will be low over the anticipated period to complete these works and will be planned and scheduled according to the Construction Traffic Management Plan, which will be prepared by the construction contractor and implemented prior to commencement of works.

3.5 Potential Impacts

3.5.1 Construction Phase

Significant environmental effects are not predicted due to the scale, nature and location of the construction activities. However, there is potential for the following impacts:

- **Noise:** Rock breaking will occur on site as part of the construction of the proposed development, and noisy activities will be completed early in the overall construction programme. Any noise emissions as a result of construction activities will be short term and concentrated in the initial period of each of the three construction phases. Given the substantial distance between the proposed works and the QIs/ SCIs of the designated sites in the wider area and the capacity of species to habituate to regular anthropogenic noise, there is no potential for significant effects.
- **Land:** Excavations will be carried out as part of the construction of the proposed development. Karst features have been recorded to the south of the development site. However, no karst features are evident within the site itself.

3.5.2 Operational Phase

No significant effects on Natura 2000 sites are predicted during the operational phase of the proposed development. There will be a perceptible increase in traffic associated with the operation of the development. The overall transport and movement strategy for the wider area is established on the provision of access by all modes of travel, including the Mungret Link Streets Project to the south of the proposed development, which will act as an additional access road. In the design of the proposed development, a strong emphasis has been placed on the provision of high-quality pedestrian and cycle access throughout, while limiting the impact of traditional vehicular traffic on the local residential road network. It is anticipated that public transport will serve the proposed development, and this will be important in reducing the demand for car journeys, and a reduction in car parking spaces in later development phases.

4 Ecological Overview

This section provides a description of the ecological baseline within the site of the proposed development, and in its immediate vicinity. A more detailed description of the existing environment is provided in **Appendix B – Baseline Ecology Report**.

Impacts from the proposed development generally on biodiversity are described in this section. Although these impacts are not necessarily relevant to impacts on Natura 2000 sites, they are outlined to provide the ecological context for the potential for specific impacts on Natura 2000 sites associated with the proposed development which are addressed in **Section 5**.

4.1 Habitats

The terrestrial habitats within the proposed development site are mostly comprised of undeveloped agricultural fields. **Figure 6** shows the habitats located within the boundary of the proposed development. Refer to **Table 1** for an explanation of the codes and the importance of each habitat.



Figure 6: Habitat Mapping showing Site Boundary in Red | Not to Scale | Based on information from: Mungret Link Streets Project EcIA, 2019¹

¹ Mott MacDonald (November 2018) *Mungret Link Streets Project Ecological Impact Assessment (Appendix B)*

Table 1: Habitat Mapping and Ecological Importance

Code	Habitat	Importance
GA1	Improved Agricultural Grassland	Local Importance (lower value) due to the low species diversity.
WS1	Scrub Habitat	Local ecological value
WL1	Hedgerow	Local Importance (lower value) due to the low species diversity.
WL2	Treelines	Local Importance (lower value) due to the low species diversity.

Approximately 290m south of the site lies Loughmore Common Turlough pNHA. Loughmore Common canal traverses the southern section of the pNHA and forms part of the pNHA. The canal flows to the Barnakyle River, a tributary of the River Maigue (which is part of the Lower River Shannon SAC). Refer to **Section 5.3.1** below for further details.

4.2 Records of Protected Species and Invasive Species

Review of the National Biodiversity Data Centre (NBDC) mapping tool² in December 2020 for the proposed development identified the presence of the following protected species Eurasian Badger (*Meles meles*) and the Common Frog (*Rana temporaria*).

No invasive species were recorded within the proposed development site.

4.3 Natura 2000 and Other Nature Conservation Sites

The closest European sites (Natura 2000 sites) to the proposed development are the River Shannon and River Fergus Estuaries SPA (004077) and the Lower River Shannon SAC (002165), both of which are located approximately 2km from the proposed development (refer to **Section 5** and **Figure 7** for further details of these sites).

Loughmore Common Turlough is a proposed Natural Heritage Area (pNHA) (Site Code 00438) and is located approximately 290m south of the proposed development site. This pNHA is described in more detail in **Section 5** and **Appendix B - Baseline Ecology Report**.

4.4 Birds

In addition to the primary focus on SPA species (Annex I and migratory species of elevated conservation importance), Birds of Conservation Concern in Ireland (BoCCI) provides a conservation status for regularly occurring birds in Ireland.

² www.biodiversity.ie

The conservation status of species is defined using a traffic light system and is based on such criteria as international conservation status, European conservation status, breeding / wintering populations etc. Red-listed species are those of highest conservation priority, being globally threatened, declining rapidly in abundance or range, or having undergone historic declines from which they have not recovered. Amber-listed species have an unfavourable status in Europe, have moderately declined in abundance or range, a very small population size, a localised distribution, or occur in internationally important numbers. Those species which are Green-listed do not meet any of these criteria and therefore require little direct conservation action.

As part of the EcIA which was completed for Mungret Link Streets Project¹ and includes the proposed development area, bird surveys were carried out, with a number of bird species were recorded. Further details on the dates and durations of these surveys are included in the Baseline Ecology Report (**Appendix B**). Species recorded included Magpie (*Pica pica*), Woodpigeon (*Columba palumbus*), Robin (*Erithacus rubecula*), Jackdaw (*Corvus*), Swallow (*Hirundo rustica*) and a Buzzard (*Buteo buteo*). All species at the site during these surveys are Green-listed in Ireland with the exception of Swallow which are Amber-listed in Ireland due to concerns over the entire European population. A winter bird survey was undertaken by Ecofact (as part of the EcIA) in February and March 2018 to assess the bird species using the site. There were two species noted which are on the BoCCI (Colhouns & Cummins 2013) red list: Meadow Pipit (*Anthus pratensis*) and Grey Wagtail (*Motacilla cinerea*)³. No species associated with the River Shannon and River Fergus Estuaries SPA were recorded on site.

As the Loughmore Common Turlough area and the Loughmore Common canal may be of interest from a bird conservation point of view and the site synopsis for Loughmore Common Turlough pNHA notes that “*Loughmore provides suitable winter habitat for Lapwing and Golden Plover*” Dixon Brosnan Environmental Consultants was commissioned to carry out additional winter bird surveys at Loughmore Common Turlough over the winter period 2019/2020. A total of nineteen species were recorded during the site visits between October 2019 and January 2020. One Annex I bird species; Little Egret⁴ (*Egretta garzetta*), one Red Listed Species Meadow Pipit (*Anthus pratensis*) and four Amber Listed Species Jack Snipe (*Lymnocyrtus minimus*), Snipe (*Gallinago gallinago*), Cormorant (*Phalacrocorax carbo*) and Linnet (*Linaria cannabina*) were recorded.

In July 2020 a roost site and probable breeding site for Barn Owl (*Tyto alba*) was discovered under a stone archway within Mungret College. Follow-up visits to the site in early September 2020 confirmed that there was evidence of previous occupancy by Barn Owl under this archway with several areas of ‘whitewash’ signs under suitable perches at this location.

³ The Meadow Pipit (*Anthus pratensis*) and Grey Wagtail (*Motacilla cinerea*) are currently Red-listed due to the decline in numbers. This decline is thought to be attributed to the severely cold winters between 2009/2010 and 2011/2012.

⁴ Even though the Little Egret (*Egretta garzetta*) is on Annex I list it is on the BoCCI green list as its breeding population continues to expand with birds occurring in almost every coastal county, as well as at a number of inland sites.

This archway, which is located outside of the proposed development site boundary, is adjacent to the proposed Creche. Given the proposed development does not include any modifications or interference with this archway, and it is located outside of the site boundary, no significant negative effects are predicted.

4.5 Mammal Species

Data from desktop studies and field surveys, as described in the Baseline Ecology Report (**Appendix B**), were used to determine the mammal species associated with the proposed development site.

Otter

No evidence of Otter (*Lutra lutra*) was recorded within the proposed development area. The canal, which is approximately 400m south of the proposed development site, is considered unsuitable to support otter due to the low volume of water and lack of fishery value. However, there is potential for Otters to use the canal as a commuting route.

Badgers

No evidence of Badger (*Meles meles*) activity was noted within the proposed development area.

Other Non-volant Mammal Species

No other mammal species were noted; however it is likely that Fox (*Vulpes vulpes*), Irish hare (*Lepus timidus*), Pygmy shrew (*Sorex minutus*) and Hedgehog (*Erinaceinae*) occur within the proposed development area. It is unlikely the site is important for any QI/ SCI species.

Bats

In August 2020 a bat survey of two buildings within Mungret College was undertaken, Buildings E and Building F. Even though both buildings are located outside of the site and no works will be carried out as part of this proposed development a bat survey was required given the proximity of the buildings to the site boundary.

The survey determined that bat activity levels near Building E were low indicating that Building E would not be considered to be a significant roost site. As no works will be undertaken to Building E, as part of this proposed development, no significant effect in relation to foraging / commuting habitat loss is expected. No bats were found to be roosting in Building F however the archway was used by some Soprano pipistrelles (*Pipistrellus pygmaeus*) during the survey as a commuting route. Considering no modifications or interference to Buildings E and F are to be undertaken no direct significant effects on bats are expected.

An earlier report, Bat Survey of Mungret College (Dalton 2017), also includes information on the use of structures in Mungret College by bats, which provides useful context for bat activity in the wider area, and no evidence of the Annex II species Lesser Horseshoe Bat (*Rhinolophus hipposideros*) was identified.

As stated in the EcIA¹ all treelines within the site proposed development have negligible suitability for bat roosting due to the lack of suitable roost features. However, it is likely that the treelines are used as foraging and commuting routes by bats and will be retained and integrated into the proposed development. In addition to retaining the existing treelines it is estimated that a minimum of 170 new trees will be planted throughout the site along with 1,320m² of structure planting, 330m² of new hedge planting and 220m² of shrub planting.

4.6 Invertebrates, Herpetofauna and Reptiles

According to the National Biodiversity Data Centre there are records for Holly Blue (*Celastrina argiolus*), Azure Damselfly (*Coenagrion puella*), Blue-tailed Damselfly (*Ischnura elegans*), Large Red Damselfly (*Pyrrhosoma nymphula*) and Ruddy Darter (*Sympetrum sanguineum*) within the site.

A number of butterflies and damselflies were recorded on the site, which included Red admiral (*Vanessa atalanta*), Common blue (*Polyommatus icarus*) and Common blue damselfly (*Enallagma cyathigerum*).

4.7 Potential Effects on Biodiversity

4.7.1 Habitat loss and Habitat Severance

The dominant existing vegetation species, aside from the pastoral fields, are Austrian Pine (*Pinus nigra*), Sycamore (*Acer pseudoplatanus*), Ash (*Fraxinus excelsior*), Blackthorn (*Prunus spinosa*) and Whitethorn (*Crataegus monogyna*). As mentioned in **Section 3.3.2**, to facilitate construction of the proposed development three trees will be removed. As described in the Arborist Report (included in the Baseline Ecology Report- **Appendix B**) the loss of these trees is not considered significant given the abundance of Category A (high quality and value making a substantial contribution) trees along the northern boundary of plot A1 and A3 and a number of trees along the western boundary of plot A2.

Approximately 7,523m² of overgrown hedgerow vegetation will be removed. Considering their low species diversity and the replanting strategy, which will result in the replanting of approximately 500 linear metres of hedgerow within the site, the effect is not significant, and no effects on the QIs/ SCIs of any Natura 2000 site are predicted.

4.7.2 Disturbance to Fauna

As noted in the **Section 4.5**, no evidence of badger or otter were recorded within the proposed development site.

The Wildlife Act 1976, as amended, provides that it is an offence to cut, grub, burn or destroy any vegetation on uncultivated land, or any such growing in any hedge or ditch from the 1st of March to the 31st of August.

Exemptions include the clearance of vegetation in the course of road or other construction works or in the development or preparation of sites on which any

building or other structure is intended to be provided. Nonetheless, vegetation will be removed outside of the bird breeding season.

The site is not an important feeding or roosting site for qualifying interests of the nearby River Shannon and River Fergus Estuaries SPA, and, with the exception of overflying Cormorant, no SCI species were recorded at Loughmore Common Turlough which is located to the south of the subject site. The bird survey concluded that the turlough does not provide high value habitat for SCI species. The birds recorded during site surveys are relatively common and no rare assemblages of bird species were recorded. During the construction phase noise emissions associated with certain construction activities e.g. rock breaking during daytime hours, will cause localised and short-term disturbance, however, it is expected that certain species have the capability to habituate to regular anthropogenic noise and mobile species will move away from the source of noise for the duration of the works, therefore disturbance impacts will not be significant. Further, SCI species do not appear to occur in the area in any great numbers or regularity. The noisiest activity (rock-breaking) will be carried out in the daytime for approximately a month, at the specific locations where rock removal is required, in the early part of each of the three phases of development.

As the treeline north of plot A3 and A1 will be retained, apart from one Austrian Pine tree, the impact of the proposed development on the potential foraging and commuting routes of bats is not significant. The nearest designated site for Lesser Horseshoe Bats (*Rhinolophus hipposideros*) is Curraghchase Woods SAC (00174) which is located over 12km from the proposed development.

During the construction phase site lighting will appropriately positioned and angled downwards which will minimise spillage to surrounding properties and so not to intrude unnecessarily on adjacent buildings and ecological receptors and structures used by protected species.

3000k operational light fittings will be installed in the parts of the proposed development close to Mungret College. This is the range in the light spectrum which minimises potential impacts on bat and bird activity.

Throughout the site operational lighting will consist of 36W LED light fittings which will be mounted on 8m and 6m lighting columns; 8m columns will be positioned along the internal access roads and 6m lighting columns within the residential plots. The LED luminaires will be angled downwards and will be street optic light fittings to minimise spillage to surrounding areas. Lighting bollards, approximately 0.9m, will be installed in pedestrian areas where the wide beam will provide even light distribution whilst also reducing the amount of light spillage to surrounding areas. The design will ensure that the proposed development does not create excessive glare or light spillage, while also meeting minimum requirements for public safety and security.

Mammal gates, which will be designed as per the TII⁵ publications, will be incorporated into the site hoarding. These will be located wherever external hedgerows intersect the site hoarding and will facilitate the continued movement

⁵ TII Publications (2009) *Specification for Road Works Series 300 - Fencing and Environmental Barriers*

of mammals across the construction site. No effects on the QIs/ SCIs of any Natura 2000 site are predicted.

4.8 Water Quality

A desktop study and site walkover were carried out by Arup in February 2020 to establish if the proposed development is likely to have a significant effect on the Natura 2000 sites in the wider area. refer to **Appendix B** – Baseline Ecology Report for details.

4.8.1 Hydrological and Hydrogeological Links

A flow path assessment revealed that the proposed development is situated on a water divide with water to the north and south flowing in different directions. Refer to the figures in the Baseline Ecology Report (**Appendix B**) which illustrate surface water and ground water flow directions.

Groundwater to the north of the site flows to the Irish Cement quarry sump which discharges into Bunlicky Clayfield Pond which outfalls to the River Shannon. Surface water to the north of the site percolates through the soil to discharge into the ground, thus following the groundwater flow path to the quarry sump, a distance in excess of 1.7km.

Surface water to the south of the site will flow south into the Loughmore Common canal, which joins the Barnakyle River, and further downstream the River Maigue which ultimately discharges into the Shannon Estuary, a direct distance in excess of 1.9km (and approximately seven kilometres as the river flows). However, the site of the proposed development is effectively bounded to the south by the Mungret Link Streets Project, which in practice will intercept any surface water flowing south from the subject site.

Additionally, groundwater to the south of the site discharges via the springs along Loughmore Common and from there enters the surface water system at the canal. The Loughmore Common Turlough pNHA is approximately 290m south of the proposed development. There is therefore a combination of potential water pathways south of the site to the canal.

To summarise, there are hydrological connections (albeit over a considerable distance) between the proposed development site and the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC.

4.8.2 Potential Effects

Because potential water pathways between the subject site and Natura 2000 sites were identified, the possible sources of water contamination arising on the site were reviewed, and the plausible worst-case pollution event was identified and modelled.

The results of the contaminant modelling indicate, in the case of an accidental diesel spill on site which discharged into the groundwater, that the water would dilute the concentration of the contaminant to below the threshold concentration within the first 200m horizontal distance from the site. The volume of contaminant modelled is based on the worst-case single spill event of fuel on site, and no plausible cumulative scenario of multiple simultaneous spill events has been identified. As the quarry sump (north of the site) and Loughmore Common canal (south of the site) are approximately 1.9km and 290m respectively, the concentration of the contaminant at these groundwater discharge locations will be well below the threshold concentrations. A similar dilution would occur for the other more complex combined surface and ground water pathways identified.

For the southern surface water flow path that discharges to the Loughmore Common canal, the discharge for the canal will receive a large amount of dilution when it flows into the Barnakyle River. The Barnakyle River joins the River Maigue, where it will receive even greater dilution before discharging into the Shannon Estuary. In the spill scenario, the dilution that will have already occurred by the time the contaminant reaches parts of the river network that may support QI species will be such that there will be no impact on those species.

Surface water to the north of the site follows the same pathway as ground water.

Considering the high levels of dilution between the proposed development and Natura 2000 sites, the predicted impact on the designated site from accidental discharge or spill is negligible.

5 Natura 2000 Sites

5.1 Zone of Influence of the Proposed Development

The zone of influence comprises the area within which the proposed project may potentially affect the conservation objectives or qualifying interests (QI) of a Natura 2000 site. There is no recommended zone of influence, and guidance from the National Parks and Wildlife Service (NPWS) recommends that the distance should be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in-combination effects (cumulative).

Natura 2000 sites (European sites) are only at risk from significant effects where a source-pathway-receptor link exists between a proposed development and a Natura 2000 site(s). This can take the form of a direct impact (e.g. where the proposed project and/or associated construction works are located within the boundary of the Natura 2000 site(s)) or an indirect impact where impacts outside of the Natura 2000 site(s) affect ecological receptors within (e.g. impacts to water quality which can affect riparian habitats at a distance from the impact source). Consideration is therefore given to the source-pathway-receptor linkage and associated risks between the proposed project and Natura 2000 sites.

The identification of risk does not automatically mean that an effect will occur, nor that it will be significant. The identification of these risks means that there is a possibility of environmental or ecological damage occurring. The level and significance of the effect depends upon the nature of the consequence, likelihood of the risk and characteristics of the receptor.

The precautionary principle is applied for the purposes of screening to ensure that consideration and pre-emptive action is undertaken where there is a lack of scientific evidence.

Considering the nature and scale of the proposed development, it is considered that source-pathway-receptor linkages only exist to sites in the Shannon Estuary, and upland sites in short bird commuting distance from the site. The habitats within the proposed development site are not significant foraging or breeding or commuting habitat for any mobile QI or SCI species. To comprehensively identify all such sites, a zone of influence has been selected which includes all Natura 2000 sites within 15km of the proposed development.

As noted above, there are hydrological and hydrogeological connections between the proposed development site and the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC. However, even in the event of an accidental spill, there will be no impact on Natura 2000 sites due to the high levels of dilution which will occur within 200m of the spill, as demonstrated by modelling of a plausible worst-case spill scenario.

5.2 European Sites within the Zone of Influence of the Proposed Project and Potential Effects

There are no Natura 2000 sites within the subject site. No habitat loss will occur within any Natura 2000 site as a result of this proposed development. The proposed development site is not of importance for the QI or SCI species of any Natura 2000 site.

Consultation of NPWS online data identified five designated sites within 15km of the proposed development – one Special Protection Area and four Special Areas of Conservation. These sites along with their qualifying interests and conservation objectives are shown in **Figure 7** and outlined in **Table 2** below.

The closest European Sites to the proposed development are the River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC, which are both located approximately 2km north of the proposed development. Tory Hill SAC is located approximately 9.4 km south of the site and Curraghchase Woods SAC and Askeaton Fen Complex SAC are over 11km west of the site.

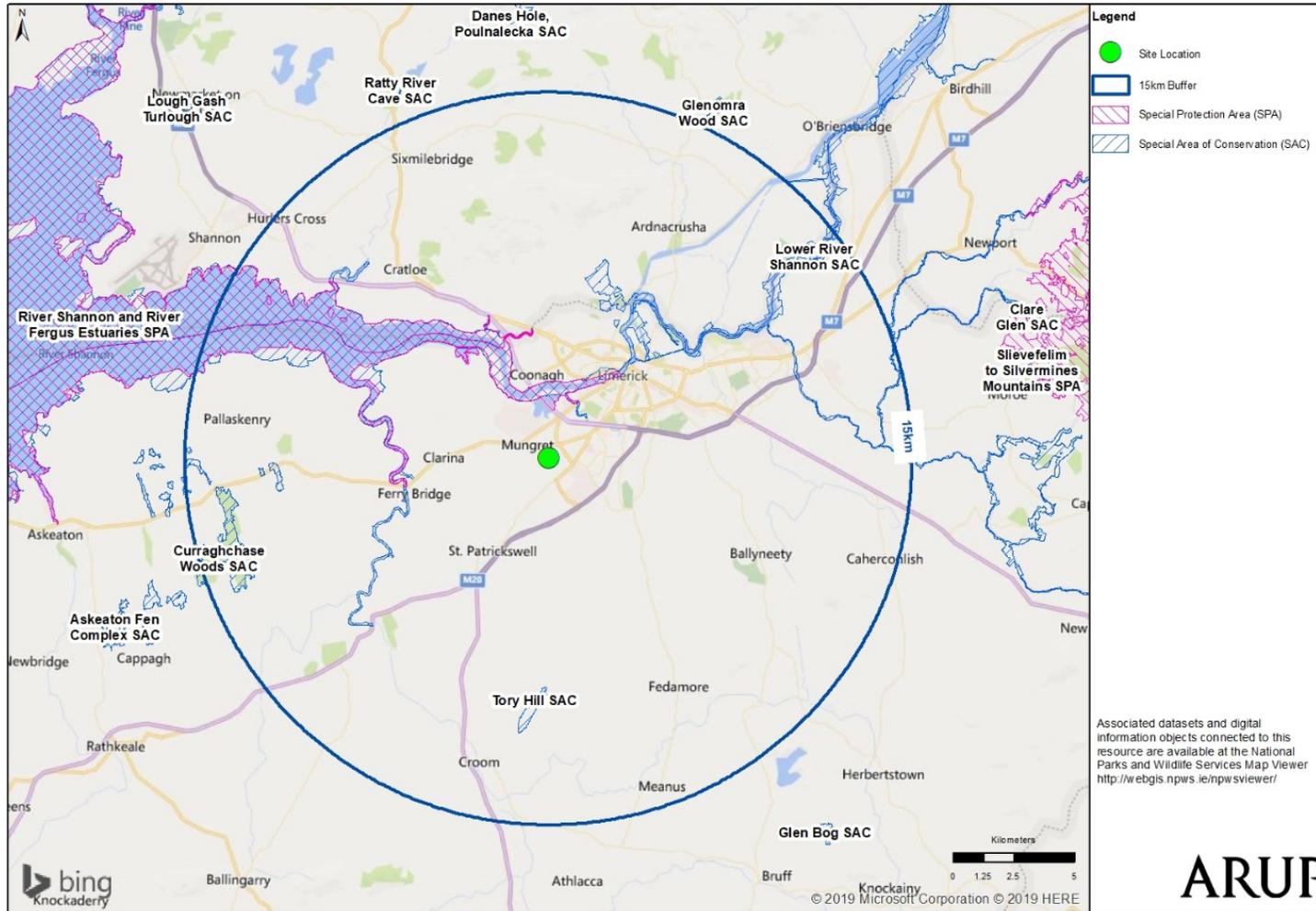


Figure 7: Natura 2000 Sites within 15km of the Proposed Development | not to scale

Table 2: Natura 2000 Sites linked to the proposed project

Special Protection Areas			
Site Name and Code	Qualifying Interests	Conservation Objectives	Distance (km)
River Shannon and River Fergus Estuaries SPA (004077) ⁶	Cormorant (<i>Phalacrocorax carbo</i>) [A017] Whooper Swan (<i>Cygnus cygnus</i>) [A038] Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A046] Shelduck (<i>Tadorna tadorna</i>) [A048] Wigeon (<i>Anas penelope</i>) [A050] Teal (<i>Anas crecca</i>) [A052] Pintail (<i>Anas acuta</i>) [A054] Shoveler (<i>Anas clypeata</i>) [A056] Scaup (<i>Aythya marila</i>) [A062] Ringed Plover (<i>Charadrius hiaticula</i>) [A137] Golden Plover (<i>Pluvialis apricaria</i>) [A140] Grey Plover (<i>Pluvialis squatarola</i>) [A141] Lapwing (<i>Vanellus vanellus</i>) [A142] Knot (<i>Calidris canutus</i>) [A143] Dunlin (<i>Calidris alpina</i>) [A149] Black-tailed Godwit (<i>Limosa limosa</i>) [A156] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A157] Curlew (<i>Numenius arquata</i>) [A160] Redshank (<i>Tringa totanus</i>) [A162] Greenshank (<i>Tringa nebularia</i>) [A164] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179] Wetland and Waterbirds [A999]	To maintain the favourable conservation condition of the Special Conservation Interest species in the River Shannon and River Fergus Estuaries SPA To maintain the favourable conservation condition of the wetland habitat in the River Shannon and River Fergus Estuaries SPA as a resource for the regularly occurring migratory waterbirds that utilise it.	2km straight-line, 7km via hydrological link

⁶ Further details on the Conservation Objective are provided on NPWS website: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004077.pdf

Special Areas of Conservation			
Site Name and Code	Qualifying Interests	Conservation Objectives	Distance (km)
Lower River Shannon SAC (002165) ⁷	<p>Sandbanks which are slightly covered by sea water all the time [1110]</p> <p>Estuaries [1130]</p> <p>Mudflats and sandflats not covered by seawater at low tide [1140]</p> <p>Coastal lagoons [1150]</p> <p>Large shallow inlets and bays [1160]</p> <p>Reefs [1170]</p> <p>Perennial vegetation of stony banks [1220]</p> <p>Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]</p> <p>Salicornia and other annuals colonising mud and sand [1310]</p> <p>Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>) [1330]</p> <p>Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [1410]</p> <p>Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]</p> <p>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]</p> <p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p> <p><i>Margaritifera margaritifera</i> (Freshwater Pearl Mussel) [1029]</p> <p><i>Petromyzon marinus</i> (Sea Lamprey) [1095]</p> <p><i>Lampetra planeri</i> (Brook Lamprey) [1096]</p> <p><i>Lampetra fluviatilis</i> (River Lamprey) [1099]</p> <p><i>Salmo salar</i> (Salmon) [1106]</p> <p><i>Tursiops truncatus</i> (Common Bottlenose Dolphin) [1349]</p> <p><i>Lutra lutra</i> (Otter) [1355]</p>	<p>To restore the favourable conservation condition of Freshwater Pearl Mussel in the Lower River Shannon SAC</p> <p>To restore the favourable conservation condition of Sea Lamprey in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Brook Lamprey in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of River Lamprey in the Lower River Shannon SAC</p> <p>To restore the favourable conservation condition of Salmon in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Sandbanks which are slightly covered by sea water all the time in the Lower River Shannon SAC</p>	2km straight-line, 7km via hydrological link

⁷ Further details on the Conservation Objective are provided on NPWS website: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002165.pdf

		<p>To maintain the favourable conservation condition of Estuaries in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in the Lower River Shannon SAC</p> <p>To restore the favourable conservation condition of Coastal lagoons in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Large shallow inlets and bays in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Reefs in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Perennial vegetation of stony banks in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Vegetated sea cliffs in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of</p>	
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		<p>Salicornia and other annuals colonizing mud and sand in the Lower River Shannon SAC</p> <p>To restore the favourable conservation condition of Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Bottlenose Dolphin in the Lower River Shannon SAC</p> <p>To restore the favourable conservation condition of Otter in the Lower River Shannon SAC,</p> <p>To restore the favourable conservation condition of Mediterranean salt meadows (<i>Juncetalia maritimi</i>) in the Lower River Shannon SAC,</p> <p>To maintain the favourable conservation condition of Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation in the Lower River Shannon SAC</p> <p>To maintain the favourable conservation condition of Molinia meadows on calcareous, peaty or clayey-silt laden soils (<i>Molinion</i></p>	
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		<p><i>caeruleae</i>) in the Lower River Shannon SAC</p> <p>To restore the favourable conservation condition of Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) in the Lower River Shannon SAC</p>	
<p>Curraghchase Woods SAC (000174)⁸</p>	<p>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</p> <p>Taxus baccata woods of the British Isles [91J0]</p> <p><i>Vertigo moulinsiana</i> (Desmoulin's Whorl Snail) [1016]</p> <p><i>Rhinolophus hipposideros</i> (Lesser Horseshoe Bat) [1303]</p>	<p>To restore the favourable conservation condition of Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>)* in Curraghchase Woods SAC</p> <p>To restore the favourable conservation condition of Taxus baccata woods of the British Isles* in Curraghchase Woods SAC</p> <p>To restore the favourable conservation condition of Lesser Horseshoe Bat in Curraghchase Woods SAC</p>	12.8km
<p>Tory Hill SAC (000439)⁹</p>	<p>Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) [6210]</p> <p>Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davalliana</i> [7210]</p> <p>Alkaline fens [7230]</p>	<p>To restore the favourable conservation condition of Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites) in Tory Hill SAC</p>	9.4km

⁸ Further details on the Conservation Objective are provided on NPWS website: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000174.pdf

⁹ Further details on the Conservation Objective are provided on NPWS website: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000439.pdf

		<p>To maintain the favourable conservation condition of Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davalliana</i>* in Tory Hill SAC</p> <p>To restore the favourable conservation condition of Alkaline fens in Tory Hill SAC</p>	
Askeaton Fen Complex SAC (002279) ¹⁰	<p>Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davalliana</i> [7210]</p> <p>Alkaline fens [7230]</p>	<p>To maintain the favourable conservation condition of Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davalliana</i>* in Askeaton Fen Complex SAC</p> <p>To maintain the favourable conservation condition of Alkaline fens in Askeaton Fen Complex SAC</p>	11km

¹⁰ Further details on the Conservation Objectives are provided on NPWS website

5.3 Other Designated Sites

Natural Heritage Areas (NHAs) and Proposed Natural Heritage Areas (pNHAs) are nationally designated sites of conservation importance. NHAs and pNHAs within 15km of the proposed development are listed in **Table 3** below and shown on **Figure 8**.

Table 3: NHAs and pNHAs within 15km of the project area

Name	Site Code	Distance from site (as the crow flies)
Woodcock Hill Bog NHA	2402	9.2 km
Proposed NHAs		
Cloonlara House	28	11.2 km
Curraghchase Woods	174	12.8 km
Adare Woodlands	429	9.3 km
Castleconnell (Domestic Dwelling, Occupied)	433	12.6 km
Inner Shannon Estuary - South Shore	435	1.5 km
Loughmore Common Turlough	438	288 metres
Tory Hill	439	9.4 km
Garrannon Wood	1012	8.3 km
Dromore & Bleach Loughs	1030	8.7 km
Skoolhill	1996	11.5km
Knockalisheen Marsh	2001	6 km
Fergus Estuary and Inner Shannon, North Shore	2048	2.7 km

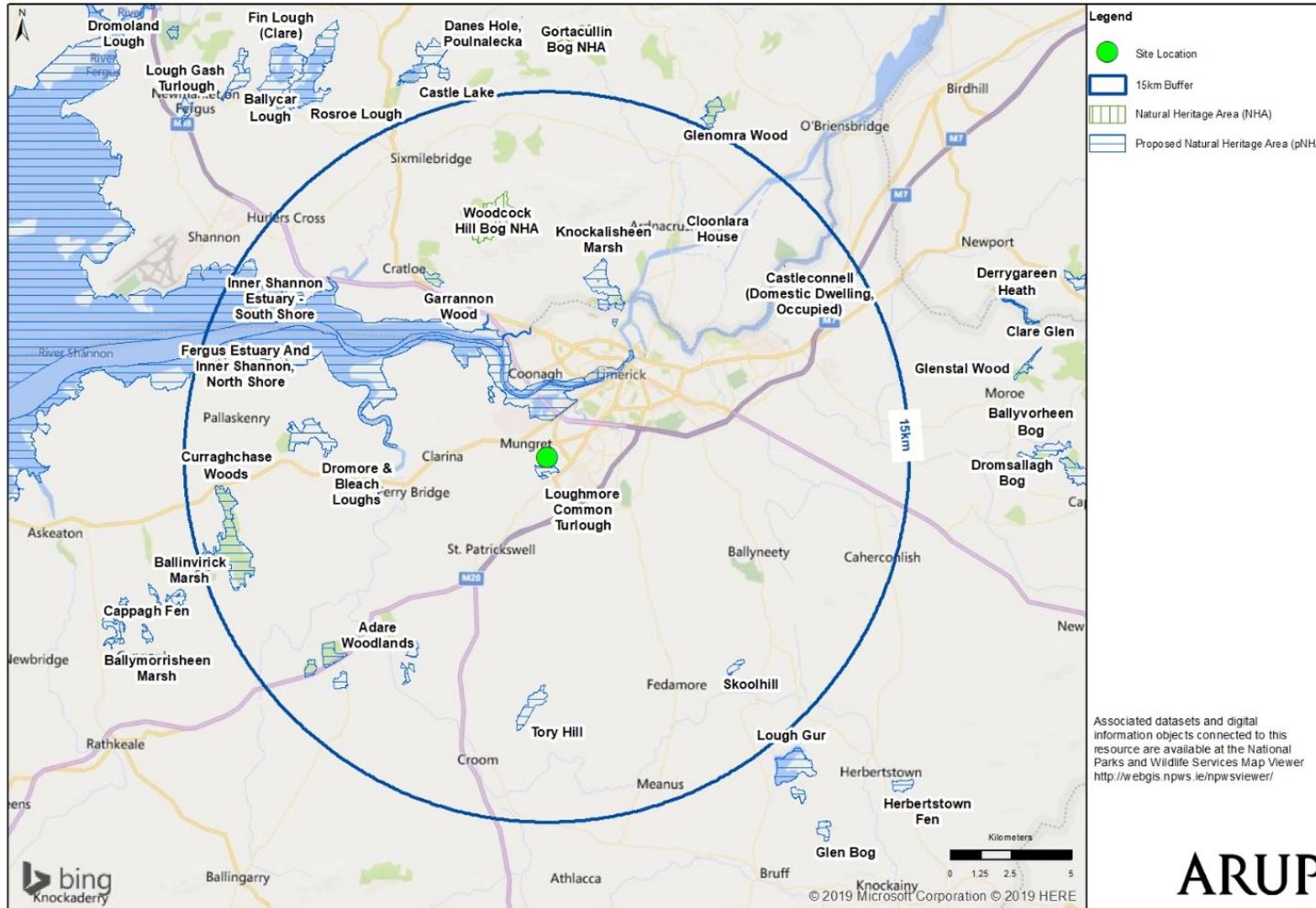


Figure 8: NHAs and pNHAs within 15km of the Proposed Development | not to scale

5.3.1 Loughmore Common Turlough

Loughmore Common Turlough is a proposed Natural Heritage Area (pNHA) (Site Code 00438) approximately 290m south of the proposed development site. It is a turlough / seasonal lake that supports plant and bird species dependent on the shallow flooding patterns. A detailed description of the Loughmore Common Turlough pNHA is outlined in **Appendix B** - Baseline Ecology Report.

Groundwater-dependent habitats may be impacted by the proposed development by accidental contamination, localised flooding or the alteration of base-flow supplies to wetlands causing the area to dry out. The Loughmore Common Turlough pNHA, is potentially a groundwater-dependent habitat. No karst features are evident within the proposed development site however there is potential for karst-related features in the bedrock, and there is therefore a potential hydrological/hydrogeological connection between the proposed development and Loughmore Common Turlough.

The 2018 winter bird survey, which was carried out in Feb-March 2018 as part of the EcIA¹, noted that no Annex I bird species were identified during that survey, however, the site synopsis above notes that it provides suitable winter habitat for Lapwing (*Vanellus vanellus*) and Golden Plover (*Pluvialis apricaria*) both of which are noted as SCI species of the River Shannon and River Fergus Estuaries SPA.

The additional bird surveys carried out in the winter of 2019/2020 by Dixon Brosnan Environmental Consultants did not record any SCI species of the nearby River Shannon and River Fergus Estuaries SPA with the exception of overflying Cormorant.

Overall, it is concluded the turlough has been affected by drainage in the past and does not provide high value habitat for important bird species. The birds recorded during site surveys are relatively common and no rare or rare assemblages of bird species were recorded. Any impact on the Loughmore Common Turlough pNHA will not have an adverse impact on any SCI of the River Shannon and River Fergus Estuaries SPA.

5.4 Cumulative Effects

5.4.1 Introduction

Cumulative impacts or effects are changes in the environment that may result from numerous human induced, small-scale alterations. Cumulative impacts can be thought of as occurring through two main pathways: first, through persistent additions or losses of the same materials or resource, and second, through the compounding effects as a result of the coming together of two or more effects.

In addition to the proposed development, other nearby relevant projects and plans have been considered. The purpose of this is to identify any possible significant in-combination or cumulative effects/impacts of the proposed development with other such plans and projects.

Four other projects have been identified which have the potential for cumulative or in-combination effects, when considered together with the proposed development. In considering potential cumulative effects, it has been assumed that these projects may be constructed in parallel with the proposed development. Refer to **Figure 9**. These are:

- Mungret Link Streets Project
- Mungret Gate Residential Development
- Post-Primary School at Caheranardish
- Irish Cement Alternative Fuels Project.



Figure 9: Location of potential Cumulative Projects | Not to Scale | Source: Bing Maps

5.4.2 Mungret Link Streets Project

Located directly south of the proposed development is the Mungret Link Streets Project. This approved project consists of the construction of approximately 1.7km of new public road within the Mungret /Loughmore Common area. In addition, the project includes the provision of cycleways, footpaths, roadside parking, surface water drainage / sustainable urban drainage, and street lighting. Construction of the Mungret Link Streets Project will be completed prior to occupation of the proposed residential units.

The Mungret Link Streets Project was approved by Limerick City & County Council under a Part 8 process, which included the consideration of the potential for effects on Natura 2000 sites, the potential for the requirement for EIA, the potential for ecological impacts, and an assessment of the risk of flooding. This consideration included the potential for combined environmental effects with the construction of the proposed Mungret Residential Development project (referred to as ‘Limerick 2030 housing project’), and the competent authority Limerick City & County Council concluded that it is not likely that there will be significant adverse effects on Natura 2000 sites, having regard to the potential for in-combination effects.

5.4.3 Mungret Gates Residential Development

Recent development in the area includes residential development at The Grange (west of the Courtfield Shopping Centre), at Mungret Woods (east of Mungret College) and north of the R859 at Sli Na Manach. Planning permission has also been granted to Homeland MLS Ltd for the construction of 201 homes at Mungret Gate, Baunacloka, Mungret. This residential development, which is located approximately 500m north-east of the proposed development area, will also include the construction of the eastern end of the Mungret Link Streets Project. The only potential in-combination environmental effects that have been identified relate to construction-phase traffic, which will have no effect on Natura 2000 sites.

5.4.4 Post Primary School at Caheranardrish

Two new primary schools have also been constructed within the area accessed off the R859 to the west of Mungret College, and Mungret Neighbourhood Park (north of Mungret College). In addition, an application for the construction of a secondary school in Caheranardrish, which is approximately 250m south-west of the proposed development site, was submitted and subsequently granted permission. The proposed development is described as follows:

“Construction of a new 1000 pupil post-primary school circa 11,379sqm over 3 storey levels with rooftop plantroom and 450sqm photovoltaic panels. Incorporating Teaching spaces, Social spaces, Multi-purpose hall, Special Education Needs unit & ESB substation. A new site entrance & internal road with set-down area, car parking for 90no. spaces, covered bicycle stand, 6no. ballcourts, playing field, landscaping, new boundary treatments. Main access will be via new roadway with cycle lane and footpath which will be formed off the planned new distributor road with spur connection as granted permission 19/8011 and all associated site works on a 10acres site.”

As for the nearby residential development, the key potential for in-combination environmental effects will arise during construction, particularly with regard to the traffic generated by the delivery of construction materials, the removal of construction waste, and the commuting of construction staff. No potential for cumulative or in-combination effects on Natura 2000 sites arises in this case.

5.4.5 Irish Cement Development

The Irish Cement manufacturing facility and quarry is located approximately 1km to the north of the site. The quarry is a limestone quarry that is actively dewatering the bedrock, a locally important aquifer. Irish Cement are regulated by the EPA through an Industrial Emissions licence (P0029-05). The Industrial Emissions licence addresses the water discharging from the site into Bunlicky Pond as two emissions: SW1 which comprises of cooling water, storm water and quarry water and SW2 which comprises of the discharge from a pump sump in the limestone quarry.

All surface water from the site passes through settling tanks and oil interceptors prior to discharge into Bunlicky Clayfield Pond. Discharge emission points are monitored quarterly and the outflow from Bunlicky Pond is monitored annually. Bunlicky Clayfield Ponds' discharge to the River Shannon is controlled via adjustable weir and flap valves. Although it has already been established that there is no potential for contamination from the proposed development being perceptible at this location, it is also noted that Irish Cement also implement significant pollution controls and monitoring for their licensed emission points.

Irish Cement was granted planning permission on appeal to An Bord Pleanála for the following development on 12 April 2018:

“Application for 10 year permission for development to allow for the replacement of fossil fuels through the introduction of lower carbon alternative fuels and to allow for the use of alternative raw materials in their Limerick Cement Factory. To facilitate the on-site handling, storage, and introduction of the alternative fuels and alternative raw materials it is proposed to construct: a tyre storage area with tyre handling/separation area, and associated conveyor kiln 6 with fire water retention tank; a proposed pumpable fluids storage tank which is located within a concrete bund area with associated uploading station all within a 2.4m high security fencing; a proposed fine solids handling building with 2 no. associated truck unloading areas & associated feed conveyors; associated switch room building & associated conveyor from screening building to dosing building at front end of kiln 6, as well as a fine solids transfer building, associated conveyor connecting to a proposed fine solids dosing building to back end of kiln 6 and associated fore-water retention tank; a proposed alternative raw materials storage building with concrete path surround; 3 no. proposed silos for the introduction of free-flowing solids; a proposed by-pass filter comprising a bag filter and a cooling tower with concrete path surround and 1 no. fire-water retention tank. The works include for the demolition of 4 no. steel and metal clad covered car park bay structures. The works also include for associated mechanical equipment and ancillary works, including provision of short sections of internal roadway, pavement, fencing and landscape works. In reducing the quantity of fossil fuel use, the proposed development seeks to introduce a range of alternative fuels up to a maximum of 90,000 tonnes per annum. The use of alternative raw materials is contained within this proposed overall quantity.”

The application area extends to 10.52 hectares within Limerick Cement Factory (this application relates to an activity for which an Industrial Emissions Licence applies under the Environmental Protected Act 1992, as amended (Industrial Emission Licence Register Number P0029-03. An Environmental Impact Statement accompanies this planning application).”

In granting permission for the proposed development, An Bord Pleanála reduced the duration of the permission from 10 years to 7 years. This site is sufficiently distant from the subject development to rule out the potential for any cumulative or in-combination effects on Natura 2000 sites.

6 Assessment of Significance

The proposed development will not result in any significant direct, indirect or in-combination effects on Natura 2000 sites. **Table 4** has been used to determine whether significant effects are likely. The Construction Environmental Management Plan (CEMP), which is attached as **Appendix C**, summarises the general measures that will be taken to minimise potential effects on local biodiversity. These measures have not been developed to address any likely significant effects on Natura 2000 sites.

Table 4: Significant Effects Checklist

Does the project have the potential to	Yes or No
Reduce the area of key habitats?	No
Reduce the population of key species?	No
Change the balance between key species?	No
Reduce diversity of the site?	No
Result in disturbance that could affect population size or density or the balance between key species?	No
Result in fragmentation?	No
Result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding, etc.)?	No
Cause delays in progress towards achieving the conservation objectives of the site?	No
Interrupt progress towards achieving the conservation objectives of the site?	No
Disrupt those factors that help to maintain the favourable conditions of the site?	No
Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	No
Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem?	No
Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site?	No
Interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)?	No

This judgement has been arrived at on the following basis:

- All development activity will take place within the site works boundary. No works will take place within any Natura 2000 site. No material or spoil from the works will be deposited in any Natura 2000 site. There will be no encroachment on the habitats or species of any Natura 2000 site.
- There will be no loss of Natura 2000 site habitat area, no fragmentation of the habitats of Natura 2000 sites, no disturbance to the qualifying species of the Natura 2000 sites, no impacts on population density of these species, no impacts on water resources and no impacts on water quality of the Natura 2000 sites.

- There will be no significant emissions to air or soil during construction or operation. There will also be no significant noise emissions affecting Natura 200 sites during the construction or operational phase
- As potential groundwater and surface water impacts have been considered there will be no significant effects on the Natura 2000 sites and their conservation objectives.

7 Screening Statement and Conclusions

The aims of this report were as follows:

- Provide information on and assess the potential for the proposed project to significantly affect Natura 2000 Sites (also known as European sites).
- Determine whether the proposed project is directly connected with, or necessary to the conservation management of any Natura 2000 sites.
- Determine whether the proposed project, alone or in combination with other projects, is likely to have significant effects on Natura 2000 sites in view of their conservation objectives.

It has been objectively concluded by Arup that:

- There is no potential for the proposed project to significantly affect Natura 2000 Sites.
- The proposed project is not necessary to the conservation management of any Natura 2000 sites.
- The proposed project, alone or in combination with other projects, is unlikely to have significant effects on Natura 2000 sites in view of their conservation objectives.

It has been determined by Arup that it is possible to rule out likely significant effects on any Natura 2000 sites. It is the view of Arup that it is not necessary to undertake any further stage of the Appropriate Assessment process.

8 References

- Arup (April 2019) *Mungret Geotechnical Desk Study*
- Circular NPW 1/10 and PSSP 2/10; *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities*
- Colhoun & Cummins (2013) *Birds of Conservation Concern in Ireland 2014–2019*
- Department of Environment, Heritage and Local Government, (2010); *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities*
- European Commission Environment Directorate-General, (2000); *Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC*
- European Commission Environment Directorate-General, (2001); *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodical Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*
- European Commission, (2007) *Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC.*
- Institute of Ecology and Environmental Assessment, (September 2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland, Terrestrial, Freshwater, Coastal and Marine*
- International Workshop on Assessment of Plans under the Habitats Directive, (2011); *Guidelines for Good Practice Appropriate Assessment of Plans under Article 6(3) Habitats Directive*
- Limerick City and County Council (2011) *Southern Environs Local Area Plan 2011-2017 Extended until May 2021*
- Limerick Twenty Thirty (2018) *Strategic Masterplan and Urban Design Strategy for Mungret (3rd draft Report).*
- Mott MacDonald (November 2018) *Mungret Link Streets Project Ecological Impact Assessment*
- Mott MacDonald (May 2019) *Mungret Link Streets Project Environmental Impact Assessment Screening*
- Rory Dalton Ecology Services (2017) *Bat Survey of Mungret College*

Appendix A

Findings of No Significant Effects Report

Appendix A Findings of No Significant Effects Report

Name of Project:

Mungret Residential Development

Names of Natura 2000 Sites of relevance to the proposed development:

There will be no direct nor indirect significant negative effects on any Natura 2000 sites as a result of the proposed development. However, there is one Natura 2000 site, within 15km of the proposed development, with which there is an indirect hydrological connection, River Shannon and River Fergus Estuaries SPA (Site Code 004077). The Lower River Shannon SAC (Site Code 002165) is also a site of relevance.

Is the project or plan directly connected with or necessary to the management of the site?

No

Are there other projects or plans that together with the project or plan being assessed could affect the site?

No

THE ASSESSMENT OF SIGNIFICANCE OF EFFECTS**Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 site.**

It has been determined by Arup that it is possible to rule out likely significant impacts on any Natura 2000 sites.

Explain why these effects are not considered significant.

- All development activity will take place within the site works boundary. No works will take place within any Natura 2000 site. No material or spoil from the works will be deposited in any Natura 2000 site. There will be no encroachment on the habitats or species of any Natura 2000 site.
- There will be no loss of Natura 2000 site habitat area, no fragmentation of the habitats of Natura 2000 sites, no disturbance to the qualifying species of the Natura 2000 sites, no impacts on population density of these species, no impacts on water resources and no impacts on water quality of the Natura 2000 sites.
- There will be no significant emissions to air or soil during construction or operation. There will also be no significant noise emissions affecting Natura 2000 sites during the construction or operational phase.

Sources of Data:

This report has been prepared with regard to the following guidance documents, where relevant:

- Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC (EC Environment Directorate-General, 2018);
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodical Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001);
- Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC (European Commission, 2007);
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (Department of Environment, Heritage and Local Government, 2010 revision);
- Appropriate Assessment under Article 6 of the Habitats Directive; Guidance for Planning Authorities. Circular NPW 1/10 and PSSP 2/10;
- Guidelines for Good Practice Appropriate Assessment of Plans under Article 6(3) Habitats Directive (International Workshop on Assessment of Plans under the Habitats Directive, 2011);
- Communication from the Commission on the precautionary principle. European Commission (2000).
- Limerick County Development Plan (2010-2016)
- Limerick City and County Council (2011) *Southern Environs Local Area Plan 2011-2017 Extended until May 2021*
- Limerick Twenty Thirty (2018) *Strategic Masterplan and Urban Design Strategy for Mungret (3rd draft Report)*.
- Mott MacDonald (November 2018) *Mungret Link Streets Project Ecological Impact Assessment*
- Mott MacDonald (May 2019) *Mungret Link Streets Project Environmental Impact Assessment Screening*
- Rory Dalton Ecology Services (2017) *Bat Survey of Mungret College*

Sources of information that were used to collect data on the Natura 2000 network of sites and on the existing ecological environment are listed below:

- Google maps aerial photography;
- Ordnance Survey Ireland OSI mapping and aerial photography – www.osi.ie
- Bing aerial photography – www.bing.com/maps
- Online mapping and data on protected sites from the National Parks and Wildlife Service (NPWS);
- Information on environmental quality data available from the EPA;

- Status of EU protected habitats in Ireland provided by the NPWS;
- National Biodiversity Centre database; and

OVERALL CONCLUSIONS

Based on the information provided above, and by applying the precautionary principle, it has been determined by Arup that it is possible to rule out likely significant effects on any Natura 2000 sites and therefore it is the view of Arup that it is not necessary to undertake any further stage of the Appropriate Assessment process.

Appendix B

Baseline Ecology Report

Limerick City & County Council
Baseline Ecology Report
Mungret Residential Development

Issue 1 | 22 January 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 261585

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Appendices

Appendix 1

Mungret Link Streets Project Ecological Impact Assessment (Mott MacDonald)

Appendix 2

Figures from Water Quality Assessment Report

Appendix 3

Photographs from Site Walkover

Appendix 4

Calculations from Contaminant Concentration Assessment

Appendix 5

Graphs from Contaminant Concentration Assessment

1 Introduction

Limerick City & County Council propose to construct a develop a housing development at Mungret, County Limerick. The purpose of this report is to describe the existing ecology with the proposed development area.

1.1 Description of Proposed Development

The proposed development is approximately five kilometres to the west of Limerick City Centre. Mungret Village is located north-west of the subject site and a residential development- Mungret Woods is located to the north east.

Figure 1 shows the location of the proposed development.

The proposed development, which is located adjacent to Mungret College, is comprised of 253 residential units, associated roads, carparking, open spaces, local services and ancillary utilities infrastructure. **Figure 2** shows the proposed site layout.

The proposed development will consist of the following:

- Site area of 7.2 hectares;
- 253 residential units located in plots A1, A2, A3 and A4;
- Public Open Spaces – POS (A1&A3), and POS (A2);
- Public Square - S1;
- Community Facility;
- Creche;
- Local shop(s); and
- Public Toilet.



Figure 1: Site Location | Not to Scale | Source: Google Maps



Figure 2: Site Layout | Not to scale | Based on information provided by: EML Architects

2 Ecological Baseline

2.1 Introduction

This section provides a description of the ecological baseline within the site of the proposed development, and in its immediate vicinity.

The baseline information for this section was gathered by desktop research, site walkovers and surveys. In addition, baseline data from an Ecological Impact Assessment (EcIA), which was prepared on behalf of Limerick City & County Council for the proposed Mungret Link Streets Project¹ was also used. Refer to **Appendix 1**. The study area of the EcIA included the proposed development site, refer to **Figure 3**.



Figure 3: EcIA Study Area (yellow) and proposed development (red site boundary) | Not to Scale | Based on information from: Mungret Link Streets Project EcIA, 2019

The habitats and species identified during the desktop study, site walkovers and surveys and EcIA are described below.

¹ Mott MacDonald (May 2019) *Mungret Link Streets Project Ecological Impact Assessment*

As there are no watercourses within and/or directly adjacent to the site of the proposed development there was no requirement to undertake an aquatic survey.

2.2 Habitats

As detailed in the EcIA¹ the terrestrial habitats within the proposed development site was classified using the scheme outlined in the Heritage Council publication *A Guide to Habitats in Ireland* (Fossitt, 2000). The value of a habitat is site specific and will be partially related to the amount of that habitat in the surrounding landscape. Habitats that are considered to be good examples of Annex I and Priority habitats are classed as being of International or National Importance. Semi-natural habitats with high biodiversity in a county context and that are vulnerable, are considered to be of County Importance. Habitats that are semi-natural, or locally important for wildlife, are considered to be of Local Importance (higher value) and sites containing small areas of semi-natural habitat or which maintain connectivity between habitats are considered to be of Local Importance (lower value).

Figure 4 shows the habitats located within the boundary of the proposed development. The associated codes are explained below.



Figure 4: Habitat Mapping showing Site Boundary in Red | Not to Scale | Based on information from: Mungret Link Streets Project EcIA, 2019

GA1 – Improved Agricultural Grassland

The majority of the proposed development site is comprised of Improved Agricultural Grassland (GA1) and is dominated by rye-grass (*Lolium spp*). The fields, which are used as grazing for cattle and sheep are of Local Importance (lower value) due to the low species diversity.

WS1 – Scrub Habitat

Scrub habitat (WS1) is located at the south and eastern fringes of the subject site. This area is predominantly comprised of Blackthorn (*Prunus spinosa*) and Hawthorn (*Crataegus monogyna*) scrub which are of local ecological value.

WL1 - Hedgerow

The hedgerow (WL1), which is located around the Public Square (S1) area of the proposed development site predominantly comprises Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*), with intermittent Ash (*Fraxinus excelsior*) and Elder (*Sambucus nigra*), with an undergrowth of Bramble (*Rubus fruticosus* agg.). Considering the low species diversity, the hedgerow is of Local Importance (lower value). Beehives were also identified in this area.

WL2- Treelines

A treeline (WL2) form the boundary of agricultural fields running east-west in the northern part of the subject site. The treeline predominantly comprises Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus*), Horse Chestnut (*Aesculus hippocastanum*) and Elder (*Sambucus nigra*). The treeline was assessed as having Local Importance (lower value) due to the low species diversity.

A tree and hedgerow survey² was carried out in May 2018, which identified the location and quality of significant trees and hedgerows within the area. This survey is appended to the Landscape Strategy which is included with the Part 8 documentation. There is a line of Category A (high quality and value making a substantial contribution) trees along the northern boundary of plot A1 and A3 and a number of trees along the western boundary of plot A2, refer to **Photograph 1**. None of the trees are protected by a Tree Preservation Order.

To accommodate construction of the proposed development removal of three trees and 7,523m² of unmanaged hedgerow/ shrub will be required. Hedgerows within the proposed development are predominately native and mature and are in good overall condition, however these unmanaged hedgerows have a low species diversity and there is little evidence to suggest these areas are used by protected species.

² Arbor Care (2018) *Arboricultural Impact Assessment Report*



Photograph 1: Austrian Pine Trees

2.3 Records of Protected Species and Invasive Species

The National Biodiversity Data Centre (NBDC) website (www.biodiversity.ie) contains a mapping tool that indicates known records of legally protected species within a selected OS 1km Grid Square. The proposed development is located within two 1km grid squares R5453 and R5353. Data on these squares was downloaded from the website in December 2020. It is noted that this list is not exhaustive, and an absence of records does not imply that particular species are not present within the given area. The following protected species have been recorded in these two 1km grid squares - Eurasian Badger (*Meles meles*) and the Common Frog (*Rana temporaria*).

No invasive species were recorded within the proposed development site.

2.4 Natura 2000 and Other Nature Conservation Sites

The closest European sites (Natura 2000 sites) to the proposed development are the River Shannon and River Fergus Estuaries SPA (004077) and the Lower River Shannon SAC (002165), both of which are located approximately 2km from the proposed development. Refer to **Figure 5**.

Loughmore Common Turlough is a proposed Natural Heritage Area (pNHA) (Site Code 00438) and is located approximately 290m south of the proposed development site. Loughmore Common canal traverses the southern section of the pNHA and forms part of the pNHA. The canal flows to the Barnakyle River, a tributary of the River Maigue (which is part of the Lower River Shannon SAC). **Refer to Figure 6**

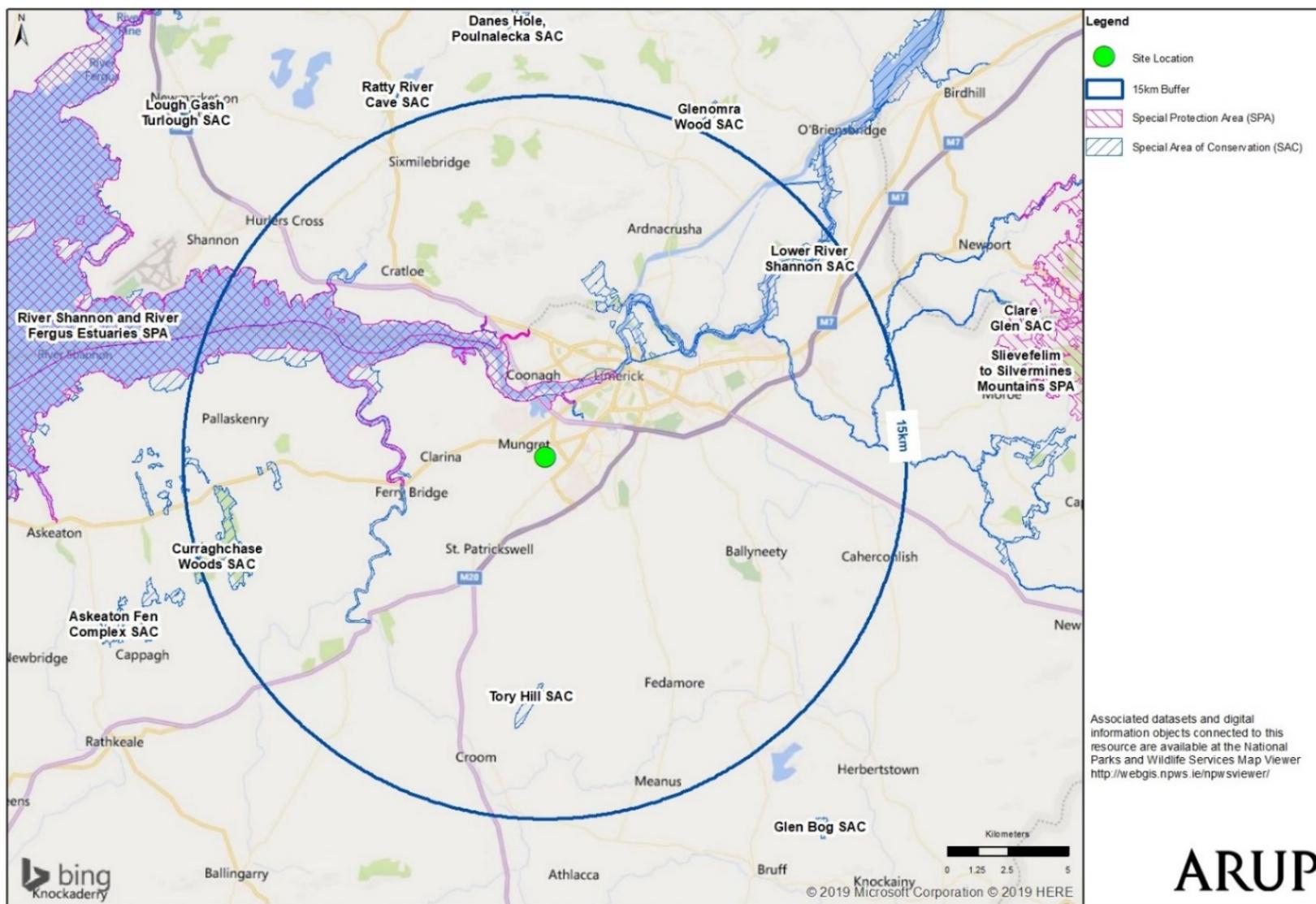


Figure 5: NHAs and pNHAs within 15km of the project area | not to scale

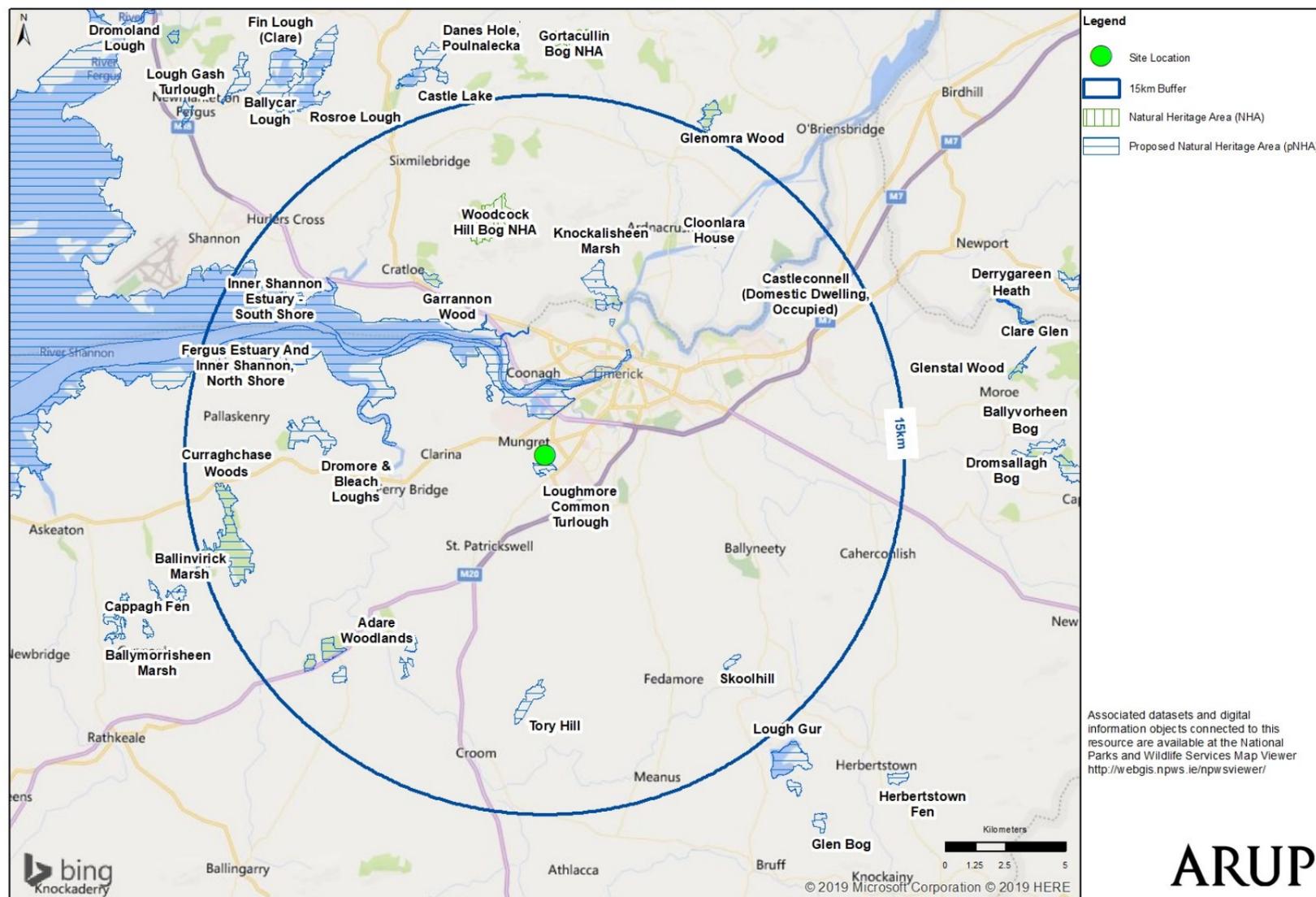


Figure 6: Natural Heritage Areas within 15km of the Proposed Development | not to scale

2.4.1 Loughmore Common Turlough

Loughmore Common (pNHA) is a turlough / seasonal lake that supports plant and bird species dependent on the shallow flooding patterns.

A habitat survey which was carried out as part of the Mungret Link Streets Project¹ noted that the pNHA comprises areas of heavily grazed calcareous grassland comprising Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Silverweed (*Potentilla anserine*), Red Clovers (*Trifolium pratense*), White Clover (*Trifolium repens*), Creeping Buttercup (*Ranunculus repens*), Meadowsweet (*Filipendula ulmaria*), Common Sedge (*Carex nigra*), and Tawny Sedge (*Carex hostiana*). Two Early Marsh Orchids (*Dactylorhiza incarnata*) and three Common Spotted-Orchids (*Dactylorhiza fuchsia*) were also identified within the calcareous grassland habitat. This habitat does not equate to semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) in accordance with the Interpretation Manual of European Union Habitats.

Further west, species typical of wetter conditions were present which included a high frequency of Hard Rush (*Juncus inflexus*), Compact Rush (*Juncus conglomeratus*) Common Sedge (*Carex nigra*), Glaucous Sedge (*Carex flacca*), Hairy Sedge (*Carex hirta*) with occasional Devil's-bit Scabious (*Succisa pratensis*), Quaking Grass (*Briza media*), Crested Dog Tail (*Cynosurus cristatus*) and Black Bog Rush (*Schoenus nigricans*).

Further, an area of large sedge swamp (approx. 0.5ha) occurs immediately south of the Loughmore Common canal, within the pNHA boundary. This habitat is wet under foot and is dominated by Reed Canary-Ggrass (*Phalaris arundinacea*). Other frequently occurring species include Bulrush (*Typha latifolia*), Yellow-Flag Iris (*Iris pseudacorus*), Long-Stalked Yellow-Sedge (*Carex viridula* ssp. *Brachyrrhyncha*), Water Horsetail (*Equisetum fluviatile*), Timothy (*Phleum pratense*), Meadowsweet, Silverweed, Marsh Cinquefoil (*Potentilla palustris*), Glaucous Sedge, Common Vetch (*Vicia sativa*), Water Mint (*Mentha aquatica*), and Short-Fruited Willowherb (*Epilobium obscurum*). This habitat has a high degree of biodiversity and is of national importance given it occurs within the pNHA boundary.

A second smaller patch of large sedge swamp was identified immediately north of the canal and was dominated with Pendulous Sedge (*Carex pendula*). A patch of tall-herb swamp occurs immediately east of the sedge swamp habitat. Species identified within the habitats were dominated with hard rush, compact rush, water horsetail, water mint and occasional Lesser Water-Plantain (*Baldellia ranunculoides*), Water Forget-me-not (*Myosotis scorpioides*). Two adult Common Frogs (*Rana temporaria*) were recorded within the habitat.

An area of rich fen habitat occurs towards the centre of the pNHA site. The habitat is dominated with Black Bog Rush (*Schoenus nigricans*) sedge species (*Carex* spp.) and *Campylium stellatum* in the ground layer. Tussocks of rush, devil's bit scabious and marsh cinquefoil.

Loughmore Common canal traverses the southern section of the pNHA and forms part of Loughmore Common Turlough pNHA.

The canal flows to the Barnakyle River, a tributary of the River Maigue (which is part of the Lower River Shannon SAC about 7.7 river kilometres downstream).

The rare plant species Opposite-Leaved Pondweed (*Groenlandia densa*) has been recorded in the canal in the past³. Vegetation within the canal was dominated with Water-Cress (*Nasturtium officinale*) with frequent Pendulous Sedge (*Carex pendula*), Bulrush (*Typha latifolia*), Yellow Iris (*Iris pseudacorus*), Soft Rush (*Juncus effusus*), Water-Plantain. Some individual willow trees are also present on the banks of the canal.

The EcIA Screening Report for the Mungret Link Streets Project¹ provides the following site synopsis of Loughmore Common Turlough pNHA.

“Loughmore Turlough is located about 5km south-west of Limerick City, adjacent to the main Limerick/Cork road (N20) and north of it. It lies in a shallow basin, elongated in an east-west direction, and floods shallowly (30-40cm) in winter”.

*“A variety of plant communities occur, depending on substrate type and degree of wetness. In the western half of the site, and along the eastern shore, the substrate is peaty, and the vegetation is dominated by sedges (*Carex* spp.), with Tufted Hair-grass (*Deschampsia cespitosa*), Marsh Horsetail (*Equisetum palustre*), Tall Fescue (*Festuca arundinacea*), Early Marsh-orchid (*Dactylorhiza incarnata*), Hard Rush (*Juncus inflexus*) and Yellow Loosestrife (*Lysimachia vulgaris*). Some of these species are more commonly associated with marshes than with turloughs. Also unusual is the occurrence of Greater Bird's-foot-trefoil (*Lotus uliginosus*) and Common Fleabane (*Pulicaria dysenterica*), two species which, although relatively more common here than in other regions, have not been recorded at other Irish turloughs. A calcium-rich environment is evident in places, with the occurrence of the moss species, *Campylium stellatum*, in the ground layer.*

*“The flooding area is largely dominated by Common Sedge (*Carex nigra*), with accompanying grasses and herbs such as Silverweed (*Potentilla anserina*), Creeping Bent (*Agrostis stolonifera*), and creeping Buttercup (*Ranunculus repens*). Wetter areas within the site, e.g. hollows and ditches, support a slightly different vegetation, with Water Horsetail (*Equisetum fluviatile*) and Amphibious Bistort (*Persicaria amphibia*). The vegetation shows a maritime influence with the occurrence of Parsley Water-dropwort (*Oenanthe lachenalii*) and Slender Spike-rush (*Eleocharis uniglumis*). These species are more typically found in upper saltmarsh habitats, and their presence suggests that there may be a slight salt influence in the floodwater, or may be a reflection of the site's location close to the Shannon Estuary.*

*“Standing water on the site is colonised by Water Horsetail, Branched Bur-reed (*Sparganium erectum*), Water-cress (*Nasturtium officinale*) and Broad-leaved Pondweed (*Potamogeton natans*). Small areas of limestone grassland and wet grassland are also present. The rare plant species, opposite-leaved Pondweed (*Groenlandia densa*), occurs on the site, as does Meadow Barley (*Hordeum secalinum*).*

³ Roger Goodwillie undertook a vegetation survey and evaluation of Loughmore Common Turlough in 1992.

Both of these species are protected under the Flora (Protection) Order, 1999. Loughmore provides suitable winter habitat for Lapwing and Golden Plover, and Snipe breed here.

“The main threats to the site are drainage, agricultural reclamation, pollution and afforestation. Loughmore is apparently drier today than it has been in the past, and it seems that drainage of the surrounding land rather than of the site itself may be the reason. There is evidence that bird numbers at the site may have reduced as a result of the dessication.

“Turloughs are a rare habitat in Europe, and in Ireland are under threat from agricultural intensification. Although affected by drainage, Loughmore is an unusual example of this habitat type. Due to the site's southerly location, its shallowness, its proximity to the sea and some calcium enrichment, the flora of Loughmore includes some unique elements, which enhance the conservation value of this turlough.”

2.5 Birds

As part of the EcIA which was completed for Mungret Link Streets Project¹ and includes the proposed development area, bird surveys were carried out, with a number of bird species were recorded. Species recorded included Magpie (*Pica pica*), Woodpigeon (*Columba palumbus*), Robin (*Erithacus rubecula*), Jackdaw (*Corvus*), Swallow (*Hirundo rustica*) and a Buzzard (*Buteo buteo*). All species are Green-listed in Ireland with the exception of Swallow which are Amber-listed in Ireland due to concerns over the entire European population. A winter bird survey was undertaken by Ecofact (as part of the EcIA) in February and March 2018 to assess the bird species using the site. There were two species noted which are on the Bird of Conservation Concern in Ireland (BoCCI) (Colhouns & Cummins 2013) red list: Meadow Pipit (*Anthus pratensis*) and Grey Wagtail (*Motacilla cinerea*)⁴. The 2018 winter bird survey noted that “a number of species found at this site and the species composition are in line with what would be expected in farmland in Co. Limerick. There were no species on Annex 1 of the EU Birds Directive. There were also no species associated with the River Shannon and River Fergus estuaries SPA recorded on the site. It is considered unlikely that they would use the site”.

However, as the Loughmore Common Turlough and the Loughmore Common canal may be of interest from a bird conservation point of view and the site synopsis for Loughmore Common Turlough pNHA notes that “Loughmore provides suitable winter habitat for Lapwing and Golden Plover” Dixon Brosnan Environmental Consultants were commissioned to carry out additional winter bird surveys at Loughmore Common Turlough pNHA over the winter period 2019/2020. A combination of walkover and transect surveys were utilised to ensure that all bird species utilising the site were recorded. An initial walkover survey along the northern site periphery was carried out on 18th October 2019.

⁴ The Meadow Pipit (*Anthus pratensis*) and Grey Wagtail (*Motacilla cinerea*) are currently Red-listed due to the decline in numbers. This decline is thought to be attributed to the severely cold winters between 2009/2010 and 2011/2012.

Line transect surveys were carried out in November and December 2019 and January 2020.

A total of nineteen species were recorded during the site visits between October 2019 and January 2020. One Annex I bird species; Little Egret (*Egretta garzetta*⁵), one Red Listed Species Meadow Pipit (*Anthus Pratensis*) and four Amber Listed Species (Jack Snipe (*Lymnocyptes minimus*), Snipe (*Gallinago gallinago*), Cormorant (*Phalacrocorax carbo*) and Linnet (*Linaria cannabina*)) were recorded.

The birds recorded were typical of the grassland mosaic and hedgerow habitat within the study site. The site does not appear to be an important feeding or roosting site for qualifying interests of the nearby River Shannon and River Fergus Estuaries SPA, and, with the exception of overflying Cormorant, no Special Conservation Interest (SCI) species were recorded at Loughmore Common Turlough during site visits.

The bird survey concluded that the turlough does not provide high value habitat for important bird species. The birds recorded during site surveys are relatively common and no rare or rare assemblages of bird species were recorded.

⁵ Even though the Little Egret (*Egretta garzetta*) is on Annex I list it is on the BoCCI green list as its breeding population continues to expand with birds occurring in almost every coastal county, as well as at a number of inland sites.



Photograph 2: Archway entrance to courtyard. Barn Owl roost/ nest site located underneath the entrance along the sidewalls and ledges

Barn Owl, (*Tyto alba*) is one of three regularly occurring owl species in Ireland. The species is considered scarce nationally and is largely absent from parts of the west and northwest of the country. Barn Owls are Red-listed on the latest Birds of Conservation Concern in Ireland list (Colhoun & Cummins 2013). Barn Owls experienced significant decline in population in Ireland in recent decades with the losses attributed to loss of habitat, changes in farming practices and the use of rodenticides (Lusby & O’Clery 2014). Recent research has confirmed that Barn Owls may be benefitting from the introduction of Greater White-toothed Shrew, *Crocidura russula*, a non-native mammal species which has spread rapidly since its discovery in Ireland in 2008 (e.g. Smiddy, 2018). Barn Owl numbers and breeding range both seem to have improved somewhat in the past decade (J. Lusby pers comm.).

Barn Owls are largely nocturnal and resident in Ireland. Barn Owls breed in a variety of sites, but typical nest sites include lofted sheds and barns and ruined buildings. They also breed in natural sites including in deep ivy cover and hollow trees. Radio-tracking has revealed that Irish Barn Owls may travel several kilometres to forage when provisioning chicks (Lusby & O’Clery, 2014).

Barn Owls may use a site to breed and to roost and can return to a breeding site for many years. The availability of suitable prey in the hinterland of the chosen site is believed to be a key determinant in the sustained use of a particular site. Some sites are used intermittently and are preferred at certain times of year. For instance, some sites where nesting has not been recorded are frequent roost sites outside of the breeding season.

A roost site and probable breeding site for Barn Owl was discovered under a stone archway within Mungret College. (**Photograph 2**). This archway, which is located outside of the proposed development site boundary, is located north of the proposed creche.

Follow-up visits to the site in early September 2020 confirmed that there was evidence of previous occupancy by Barn Owl under this archway with several areas of ‘whitewash’ signs under suitable perches at this location (**Photograph 3**).



Photograph 3: Whitewash and rotten timbers under the stone archway.

There was also signs of usage of a ledge where holes in a wooden ledge revealed the presence of a build-up of pellets (regurgitate) and compressed droppings (**Photograph 4**).



Photograph 4: Whitewash under suitable roosting perches.

These are taken as signs of the historic occupancy of the site by breeding Barn Owl. By early September any young that were present had fledged and there was no indication of continued use of the site. It is possible that Barn Owls will chose to roost at this location, as it remains accessible. However, the continued or sporadic use of this site as a roost site, or as a future nest site is not something that can be predetermined.

2.6 Mammal Species

Otter

Otters, along with their breeding and resting places are protected under the provisions of the Wildlife Act 1976, as amended by the Wildlife (Amendment) Act, 2000. No evidence of otter (*Lutra lutra*) was recorded within the proposed development area. Further, the canal which is approximately 400m south of the proposed development site is considered unsuitable to support otter due to the low volume of water and lack of fishery value. However, there is potential for Otters to use the canal as a commuting route.

Badgers

No evidence of badger (*Meles meles*) activity was noted within the proposed development area. One disused badger sett was recorded approximately 500m south-west of the proposed development. Badger paths, snuffle holes and prints were also observed within the scrub habitat located approximately 350m south of the proposed development.

No other non-volant mammal species were noted, however it is likely that fox (*Vulpes vulpes*), Irish hare, pygmy shrew and hedgehog occur within the proposed development area.

Bats

The National Biodiversity Data Centre (NBDC) provide a “habitat suitability” index for bats, whereby the index ranges from 0 to 100, with 0 being least favourable and 100 most favourable for bats. **Table 1** below gives the suitability of the study area for the bat species found in Ireland. The overall assessment of bat habitats for the current study area is given as 37.11.

Table 1: Habitat Suitability for Bats as obtained from the NBDC maps

Common name	Scientific name	Suitability index	Irish red list status
All bats	-	37.11	
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	50	Least Concern
Brown long-eared bat	<i>Plecotus auritus</i>	58	Least Concern
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	52	Least Concern
Lesser horseshoe bat	<i>Rhinolophus hipposideros</i>	21	Least Concern
Leisler's bat	<i>Nyctalus leisleri</i>	53	Near Threatened
Whiskered bat	<i>Myotis mystacinus</i>	16	Least Concern
Daubenton's bat	<i>Myotis daubentonii</i>	37	Least Concern
Nathusius's pipistrelle	<i>Pipistrellus nathusii</i>	10	Least Concern
Natterer's bat	<i>Myotis nattereri</i>	37	Least Concern

In August 2020 a bat survey of two buildings within Mungret College was undertaken, Buildings E and Building F. Even though both buildings are located outside of the site and no works will be carried out as part of this proposed development, a bat survey was required given the proximity of the buildings to the site boundary.

The buildings were assessed for potential usage by bats and was inspected both externally and internally where access allowed. The survey determined that bat activity levels near Building E were low indicating that Building E would not be considered to be a significant roost site. Additionally, works to Building E would not have a significant effect in relation to foraging / commuting habitat loss. No bats were found to be roosting in Building F however the archway was used by some pipistrelles during the survey as a commuting route.

All treelines within the site proposed development have negligible suitability as a potential roosting site due to the lack of suitable roost features. The only other features in the wider area (but outside the subject site) which either have the potential for bat roosting or are known to support bats are areas within the existing Mungret College buildings, and a mature treeline approximately 200m west of the proposed development. The proposed development will not directly impact on either of these features. However, it is likely that the treelines within the proposed development area are used as foraging and commuting routes by bats and will be retained and integrated into the proposed development.

2.7 Invertebrates, Herpetofauna and Reptiles

According to the National Biodiversity Data Centre there are records for Holly Blue (*Celastrina argiolus*), Azure Damselfly (*Coenagrion puella*), Blue-tailed Damselfly (*Ischnura elegans*), Large Red Damselfly (*Pyrrosoma nymphula*) and Ruddy Darter (*Sympetrum sanguineum*) within the site.

A number of butterflies and damselflies were recorded on the site, which included Red Admiral (*Vanessa atalanta*), Common Blue (*Polyommatus icarus*) and Common Blue Damselfly (*Enallagma cyathigerum*).

2.8 Water Quality, Hydrological and Hydrogeological Pathways

A desktop study and site walkover were completed to establish if the proposed development is likely to have a significant effect on the Special Areas of Conservation (SAC) and Special Protection Areas (SPA) in the wider area. The following information was examined during the assessment to understand the surface water and groundwater flow paths for the area:

- Historic maps and aerial photographs;
- Topographical data;
- Groundwater monitoring information;
- Flow estimations in a nearby river;
- Surface water outflow locations; and
- Nearby dewatering.

2.8.1 Desk Study

A desk study was carried out to identify the location of surface water and groundwater features for the proposed development and the surrounding area.

The proposed development is located southwest of the village of Mungret and consists primarily of agricultural land (**Figure 1 of Appendix 2- Water Quality Assessment**). The site is bounded to the north by Mungret College, Mungret Park and Mungret Woods Housing complex and to the south by agricultural lands and Loughmore Common, a low-lying bog which is also noted as a turlough. As previously mentioned, Loughmore Common Turlough is a pNHA located approximately 290m south of the site. The River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC are both approximately 2km north of the proposed development. Bunlicky Clayfield Pond located approximately 1.8km north of the northern boundary of the site, is partially included in the River Shannon and River Fergus Estuaries SPA.

The Ordnance Survey Irelands' (OSI) Historic 25-inch and 6-inch maps were examined on the Geological Survey Irelands' (GSI) Groundwater Data Viewer⁶. No water features were identified in the proposed development site boundary from the OSI Historic maps. The following features were noted in the wider local area:

⁶ GSI, 2020. Groundwater Data Viewer. Ordnance Survey Ireland | Contains Irish Public Sector Data (Geological Survey).

- Two spring locations were noted to the north and northwest of the site on the Historic 25-inch map, see **Figure 2 - Appendix 2 (Water Quality Assessment)**, both approximately 0.7km from the northern boundary of the proposed development site. The spring water from both locations was noted to be flowing in a north-northwest direction.
- Areas of rock outcrop were also noted to the west of the site approximately 0.9km from the western boundary of the site.
- The Loughmore Common Turlough, which is located to the south of the site, is marked as *Liable to Flood*.
- A *hydraulic ram* and *filter beds* were recorded in Mungret Park, approximately 0.3km to the north of the site on the Historic 6-inch map, see **Figure 3 - Appendix 2 (Water Quality Assessment)**. However, from examining the aerial photography and the site walkover, there appears to be no evidence of these structures in recent history or present day.
- The aerial photography from 2010 shows a north to west running surface water feature, **Figure 4 - Appendix 2 (Water Quality Assessment)**. This feature appears to be groundwater fed as there is no stream discharging from this location. The ground elevation contours show this area to be semi-enclosed by higher topographic areas. This feature was identified during the site walkover as a fenced in area of wetted land.
- The OSI Cartography map delineates the manmade canal in Loughmore Common as discharging to the west-southwest and Barnakyle River (**Figure 5 - Appendix 2 (Water Quality Assessment)**).
- The Barnakyle River outfalls into the Shannon Estuary approximately 10km to the northwest of the proposed development.

2.8.2 Site Walkover

The surface water and groundwater features identified from the desk study were located during the site walkover in February 2020 to establish flow direction, and to ascertain the likelihood of the features being impacted upon by the proposed development. It is considered unlikely that the surface water and groundwater flow directions would have changed since the site walkover. This section describes the walkover survey with **Figure 6 - Appendix 2 (Water Quality Assessment)** highlighting the features noted during the visit.

A walkover survey was undertaken at Mungret by Arup and Limerick City and County Council on Thursday 27th February 2020. The purpose of the site visit was to examine the site and surrounding area for surface water and groundwater features to ascertain the flow path and direction of water in the area. **Figure 6 – Appendix 2 (Water Quality Assessment)** shows the locations examined during the site walk over with **Table 2** stating the feature examined at that location. **Appendix 3** presents the photographs taken during the site visit.

Table 2: Summary of features examined during the site walkover.

Location No.	Feature to examine
1	Proposed development site and borehole to the east, BH205
2	Canal and turlough
3	Canal discharge location
4	Irish Cement quarry
5	Spring sites to the north
6	Two springs by the church
7	Borehole to the west, BH211
8	Mungret Park
9	N69 for surface water drains

Arup hydrogeologists M. Kabza (P.Geo) and L. Connolly (Design Engineer) completed the walkover. The weather during the site visit was noted to be cold and dry with some passing showers of rain.

The field hedgerows were examined for the presence of culverts or drains. No surface water features were observed on site. A. Malone (Limerick County Council) noted that there had been a lot of rainfall prior to the site visit, with the soil at full saturation. This was observed during the site visit as puddles of water were on the fields as well as water being released from the ground as the soil was walked on.

A borehole (identified as BH205, which is located to the east of the proposed development site) was visited, with the wellhead found to be in good condition with the wooden barriers still erect. The borehole was locked and therefore, a water level reading could not be taken.

The Loughmore Common manmade canal was accessed through the local landowners' property. The landowner informed that the spring to the south of the canal (see **Figure 6 - Appendix 2 Water Quality Assessment**) discharges into the toe drain, which further discharges into the manmade canal once it passes through a sluice gate. He noted that the sluice gate has historically overflowed, and he believes the canal is not able to take all the water that it receives.

The landowner further noted that there was dye tracing carried out in the area on a spring in Loughmore Common in the 1970s.

He stated that the dye was found to discharge to the northeast of the site at the location marked at **Figure 6 - Appendix 2** *Water Quality Assessment*.

The landowner noted that the water level in the turlough during the time of the visit was high. It was noted that the canal was not lined and, thus, there is a potential connection with the turlough in the adjacent field. The canal is manmade, with the water discharging into it from a nearby industrial estate. The berm between the canal and the toe drain had recently been cleared to prevent it from overflowing into the adjacent fields. A small groundwater inflow was observed in the toe drain bank. The landowner noted that there were six springs in the field north of the canal. He stated that it would not be possible to visit the six springs as they would be submerged in water from the turlough. These spring locations were crosschecked against the karst features mapped by Tynan Environmental, and their locations are presented on **Figure 3 – Appendix 2** *Water Quality Assessment*. The canal stream was followed during the site visit, with the stream observed to be flowing to the south-southwest.

Prior to the site visit, three springs were identified from the Ordnance Survey Irelands' Historic 25-inch map. These spring sites were examined during the site visit for any evidence of their presence. It was not possible to confirm the presence of these springs. The spring site to the west of the site of the proposed development, (see **Figure 6 - Appendix 2** (*Water Quality Assessment*)), was not able to be walked over as there was heras fencing surrounding the likely location of the spring. It was seen through the fencing, that the ground at this location was marshy with the shrubbery indicating a high water- table.

It was not possible to access the location of the two springs site. The potential location of the springs' discharge stream was examined, and it was not possible to identify any flowing water on the surface for this location, however, some ponding was observed. If these springs were still active, it would be possible to see a stream from the discharging groundwater, particularly given the conditions during the site visit. The ground was however at full saturation due to prolonged periods of heavy rainfall.

The borehole to the west of the site, BH211, was visited with the wellhead found to be in good condition. However, the wooden barrier appeared to have been knocked down. The borehole was locked and therefore, a water level reading could not be taken.

Mungret Park was walked over to examine for any surface water features. No ditches or culverts were observed in the park or along the field hedgerows. However, the ground was heavily saturated with ponding observed in the low-lying areas of the park. A wooden fence approximately 0.15m in height was noted in Mungret Park. The area the small fence enclosed was observed to have unkept grass with the ground be saturated, but no ponding observed.

The N69 was driven along with the road ditches examined to inspect the presence of water and the direction of flow. Some streams were observed to be running parallel to the road with their flow directions marked on **Figure 6 - Appendix 2** *Water Quality Assessment*. It is unclear where the stream water is coming from or flow to, however it is considered likely that the stream water flows under the N69 and discharges into Bunlicky Clayfield Pond.

2.8.3 Irish Cement Quarry

The Irish Cement quarry is located approximately 1km to the north of the site. The quarry is a limestone quarry that is actively dewatering the bedrock, a locally important aquifer. The 2017 Industrial Emissions licence for the Irish Cement Limited Castlemungret quarry⁷ states that;

“Water arising at the installation (including groundwater diverted from the quarry, and surface water run-off from the cement works) discharges to Bunlicky Clayfield Pond, part of which is included in the River Shannon and River Fergus Estuaries SPA.”

The Industrial Emissions licence separates the water discharging from the site into Bunlicky Pond into two emission: SW1 and SW2. SW1 comprises cooling water, storm water and quarry water. The volumes to be emitted under SW1 is a maximum in any one day of 18,000m³ with a maximum rate per hour of 740m³. The SW2 emission comprises the discharge from a pump sump in the limestone quarry which is limited by the Industrial Emissions licence to a maximum of 12,000m³ in one day with a maximum rate per hour of 500m³.

The 2016 Environmental Impact Statement (EIS) for Irish Cement Limited⁸ states that all surface water from the site passes through settling tanks and oil interceptors prior to discharge into Bunlicky Clayfield Pond. As part of Irish Cements emissions licence, they are required to monitor the quarry discharge emission point quarterly and the outflow from Bunlicky Pond annually². Bunlicky Clayfield Ponds’ discharge to the River Shannon is controlled via adjustable weir and flap valves³.

The EIS records that the level of the quarry floor at the quarry sump is approximately -26.25m Ordnance Datum (OD), with the groundwater level maintained a few metres below this level. On average 6,200m³/day is pumped from the quarry sump and discharged to the nearby Bunlicky Clayfield Pond. The EIS states that the deepening of the quarry sump over the years has caused a change in the local groundwater flow pattern. Pre-quarrying, it is thought that the groundwater flow would have flown in the direction of the Shannon Estuary, as it would have acted as the topographic low point for the surrounding catchment. However, as the quarry sump is now located below the level of the Shannon Estuary (which is estimated at 0m OD), the groundwater flow is now expected to be towards the quarry sump. Therefore, it is anticipated that groundwater which would have flown towards the Shannon Estuary, now flows towards the quarry sump, from where it is pumped to Bunlicky Clayfield Pond, from where it eventually drains to the Shannon Estuary.

⁷ EPA, 2017. Industrial Emissions License P0029-05. Irish Cement Limited, Company Register Number: 9212. Castlemungret, County Limerick.

⁸ Brady Shipman Martin, 2016. Environmental Impact Statement. Irish Cement Limited. Use of Alternative Fuels and Alternative Raw Materials at Limerick Cement Works.

2.8.4 Groundwater Monitoring

Groundwater monitoring was carried out by Tynan Environmental in three boreholes in the vicinity of the proposed development (**Figure 5 - Appendix 2 Water Quality Assessment**). Groundwater monitoring commenced in September 2018 with the latest results recorded in February 2019. Data loggers and a barometric logger were installed in the three boreholes with three rounds of manual measurements taken. Tynan Environmental note some uncertainty in the logger data, thus, the manual dips are used in this analysis. **Table 3** records the results of the manual measurements from the groundwater monitoring in each borehole over the five-month period.

Table 3: Manually dipped groundwater monitoring data recorded by Tynan Environmental between September 2018 and February 2019.

Borehole No.	BH205	BH211	BH202
Ground level (m OD)	15.72	18.78	9.95
Water level on 18 th September 2018 (m OD)	5.198	11.027	5.897
Water level on 10 th December 2018 (m OD)	10.976	16.5*	8.575
Water level on 4 th February 2019 (m OD)	8.403	15.38	7.916
Average groundwater level (m OD)	8.2	14.1	7.5

**value noted by Tynan Environmental as having a maximum error of 0.47m.*

The groundwater flow direction from the three manual records for the three boreholes shows a general groundwater flow direction to the east-southeast. However, the three boreholes are located on either side of a local topographic divide, which is also assumed to represent a local groundwater divide. Therefore, triangulating the levels from three boreholes may not capture the full detail of groundwater flow movements in the area. A conservative approach has therefore been adopted in the assessment to consider that groundwater flows to both the south and north from the site.

2.8.5 Surface Water Flow Directions

The groundwater to the north of the proposed development is expected to be influenced by the dewatering at the Irish Cement Quarry, thus, groundwater flow is anticipated to be towards the quarry sump, approximately 1.8km north of the site. The site walkover identified surface water north of the site to flow northwards to Bunlicky Clayfield Pond.

It was established that there are multiple groundwater and surface water features to the south of the site at Loughmore Common, with the manmade canal draining the site to the southwest.

It was unclear during the site walkover where surface water on the site would drain to. The walkover survey was conducted after a period of significant rainfall, so the ground was observed to be highly saturated with some mild ponding occurring on the site. However, there was no culvert or drain found to be discharging this ponding water on the proposed development site. Therefore, a review of the topography of the site was conducted to understand where surface water would drain to on the site.

A detailed topographic survey was previously carried out on the proposed development site and its surrounding area. It was found that the site is situated between approximately 10 to 20m OD with an elevated area to the centre of the site, which is flanked by gently sloping lands to the east and west. To the north and south of the site, at Mungret Park and Loughmore Common, the topography declines more steeply. This indicates that the proposed development site is situated on a watershed divide. Thus, the rainfall that lands on the south of the site drains to the south towards the manmade canal in Loughmore Common, which discharges to the southwest of the site into the Barnakyle River.

To the north of the site, it is unclear where surface water would flow to. There was no evidence from the desk study or the site walkover of surface water on the north of the site draining to the north. There was no clear connectivity identified between the site and the culverts identified along the N69 road. Therefore, it is assumed that all surface water that lands to the north of the site percolates through the soil and discharges to ground. This is in keeping with what was identified during the site walkover, as even after a period of significant heavy rainfall there was no surface water flowing on site.

2.8.6 Groundwater Flow Path Assessment

Even though there are no discharges to ground associated with the proposed development, as a conservative assessment, contaminate modelling was carried out to determine the potential impact of an accidental spill of diesel resulting from an overturned construction vehicle.

There are no proposed discharges to ground associated with the site. Therefore, as a conservative assessment, the potential impact of an accidental spill of diesel resulting from an overturned construction vehicle was assessed.

Three organic contaminants representative of diesel spills were examined to monitor their concentrations in the environment; benzene, toluene and xylene. The hydraulic flow directions or pathways for the site are detailed above, these pathways were analysed to examine the concentration of the diesel in the downgradient receptors.

As previously stated, groundwater underneath the site can potentially flow to the north towards the quarry sump. Therefore, the groundwater flow path assessment analysed the quarry sump as the receptor for the diesel contaminants downgradient of the site.

Appendix 4 details the calculations used for the assessment with **Table 4** highlighting the predicted concentration of the contaminants at the receptor, the quarry sump.

The values for effective solubility were obtained from the United States Environmental Protective Agency (EPA) for typical diesel total petroleum hydrocarbons (TPH)⁹. The threshold concentrations for the three contaminants were taken as the annual average value from the Irish Surface Water Regulations from the S.I. No. 272 of 2009¹⁰.

Table 4: Values used and obtained from the contaminant concentrations assessment

Concentrations	Benzene	Toluene	Xylenes
Effective Solubility, C_w (mg/L) / Source Concentration	0.138	0.366	0.162 *(for o-xylene)
Threshold Concentration, C_T (mg/L)	0.01	0.01	0.01
Concentration at inflow to the quarry (mg/L)	0.00048	0.0013	0.00056
Concentration in quarry discharge (mg/L)	0.000016	0.000042	0.000019

Graph 1 shows the benzene concentration against down-gradient distance along the flow path. **Appendix 5** presents the graphs for toluene and xylenes. This analysis is completed using the UK Environment Agency Remedial Threshold Model (RTM) which provides 1D fate and transport modelling for groundwater solutes. The analysis excludes any chemical degradation of the contaminant, which would be expected for hydrocarbons, and is solely based on conservative dilution and dispersion along the flow path.

It can be seen that all three contaminants reduce rapidly in concentration within the first 100 m horizontal distance from the source. Note the analysis shows the final concentrations of the contaminants at the quarry were estimated to be at least ten times lower below the threshold concentrations (**Table 4**). This indicates that a large amount of dilution occurs in the aquifer to reduce the concentration of the contaminants from the source to quarry over an estimated 1.9km horizontal distance pathway.

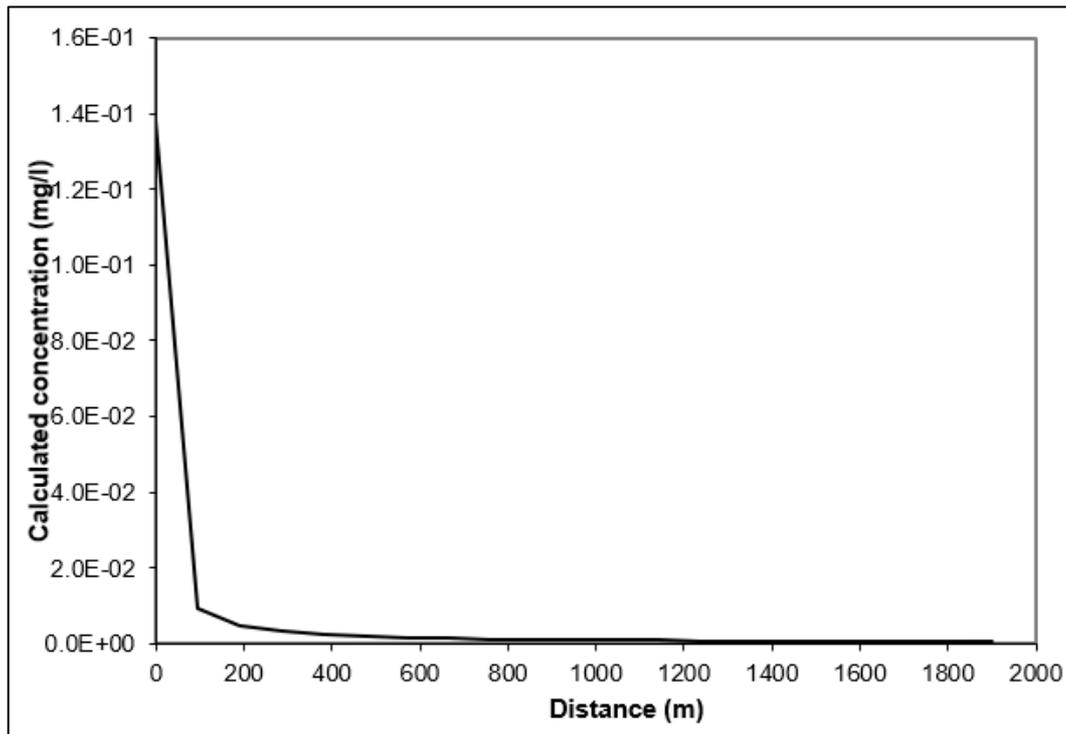
Further dilution is provided at the quarry as the groundwater flow from site is 207m³/d which is blended with the 6,200m³/d total discharge, which is an additional dilution factor of 30.

⁹ EPA, 2016. EPA On-line Tools for Site Assessment Calculation. Link: <https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/es.html>. Accessed on: 05/03/2020.

¹⁰ S.I. No. 272, 2009. European Communities Environmental Objectives (Surface Waters) Regulations.

Additional dilution is then provided as the discharge from the quarry enters the surface water system. Once groundwater reaches the quarry sump, it is pumped into Bunlicky Clayfield Pond, which has an approximate volume of 2.5 million m³.

This will act as further dilution for the contaminants before they flow over the weir discharging Bunlicky Clayfield Pond into the River Shannon. Therefore, it is considered likely that if a contaminant entered the groundwater flow path, it would not likely have a significant effect on the Lower River Shannon SAC. No plausible cumulative effects associated with a spill event have been identified.



Graph 1: Graph showing benzene concentration versus down-gradient distance from source.

Northern Surface Water Flow Path

The flow path for surface water on the north of the site is understood to percolate through the soil and discharge into the ground. Therefore, the flow path for surface water on the north of the site will follow that of the groundwater flow path, discharging to the quarry sump.

Southern Water Flow Path

The area to the south of the site has a steep change in topography. This likely acts as the preferential flow path for surface water to drain from the south of the site, to the lower-lying area of Loughmore Common. Loughmore Common is a highly karstified area with high hydraulic connectivity with the unlined manmade canal draining the area. Therefore, surface water that is situated to the south of the sites' watershed is anticipated to flow south into the canal. The canal discharges to the southwest of the site into the Barnakyle River.

This was also confirmed during the site walkover. The Barnakyle River is a tributary in the River Maigue, which outfalls into the Shannon Estuary.

The southern groundwater flow path from the site is considered to discharge via the springs along the Loughmore Common canal and from there enter the surface water system. Similar groundwater dilution would occur along the flow path from the site to the turlough, and as the analysis has shown for the northern pathway, a significant amount of dilution occurs in the first 100m.

Given the potential hydrological links between the proposed development and watercourses, the possible sources of water contamination arising on the site were reviewed, and the plausible worst-case pollution event was identified and modelled. The results of the contaminant modelling indicate, in the case of an accidental diesel spill on site the water would dilute the concentration of the contaminant to below the threshold concentration within the first 200m horizontal distance from the site. The volume of contaminant modelled is based on the worst-case single spill event of fuel on site, and no plausible cumulative scenario of multiple simultaneous spill events has been identified. To conclude if a diesel spill occurred on the south of the site, it would receive dilution initially from the Loughmore Common canal, then the Barnakyle River then the River Maigue, and finally the Shannon Estuary. The Shannon Estuary is tidally influenced by the North Atlantic Ocean at the confluence with the River Maigue.

Therefore, it is considered likely that if a contaminant entered the southern surface water flow path, it would not likely have a significant effect on the River Shannon and River Fergus Estuaries SPA due to the massive dilution.

2.8.7 River Flow Estimation

An evaluation for the flow in the Barnakyle River at the point where the manmade Loughmore Common canal discharges into was calculated using the EPA HydroNet line segment, with the river flow scaled to the target catchment¹¹. The catchment area was taken from the Flood Studies Update (FSU) HydroNet¹² and the river water bodies (RWD) catchment from the Water Framework Directive (WFD) catchments¹³.

The flow in the Barnakyle River at the point where the unnamed stream discharging from the Loughmore Common canal joins the river was calculated to have a Q_{30} of $0.55\text{m}^3/\text{second}$ ($47,520\text{ m}^3/\text{day}$) and a Q_{95} of $0.06\text{m}^3/\text{second}$ ($5,184\text{m}^3/\text{day}$). The flow which is equalled to or exceeded for 95% of the flow record (Q_{95}) was considered for the assessment of the river water quality in the Barnakyle River.

The Q_{95} for the Barnakyle at the point where the unnamed stream discharge is a similar magnitude to the abstraction rate at the quarry sump ($6,200\text{ m}^3/\text{day}$).

¹¹ EPA, 2020. EPA HydroNet. Link: <https://www.epa.ie/water/wm/hydronet/> Accessed on: 09/03/2020.

¹² OPW, 2020. OPW And HydroNet Flood Studies Update (FSU) Web Portal. Link: <https://opw.hydronet.com/>. Accessed on: 09/03/2020.

¹³ EDEN, 2020. Water Framework Directive. Link: <https://wfd.edenireland.ie/>. Accessed on: 09/03/2020.

A flowrate of this magnitude would have significant dilution for any contaminant in the stream discharging at this location.

2.8.8 Influence of the Proposed Development

The flow path assessment analysed the flow directions and dilutions that would occur if a hypothetical spill occurred on site at present. However, the pathways will be altered during and after construction of the proposed development. A description of the expected surface water and groundwater flow directions for the site during and after construction is detailed below.

During Construction

During construction, it is anticipated that topsoil and some subsoil (sand and gravels or glacial till) may be removed to enable construction works to proceed. From the limited ground investigation data within the vicinity of the site, obtained from the Geological Survey Ireland, limestone bedrock was recorded in boreholes between 0.3m to 3.1m below ground level (bgl).

Groundwater monitoring indicates groundwater levels in the vicinity of the site are approximately 2.5 to 8.0mbgl. As the proposed development has no basements, it is anticipated that dewatering will not be required for the site. Therefore, the groundwater flow direction will not be altered during construction.

After Construction

The proposed development consists of a network of surface water drains along the roads and in the housing development which will channel the surface water and discharge it into the surface water sewers to the north and east of the site. The groundwater flow path is not envisaged to be impacted by the proposed development.

2.8.9 Summary

Arup hydrogeologists completed a desktop study and data compilation including a review of previous groundwater monitoring by Tynan Environmental. This was followed by a site walkover of the proposed development and surrounding area. The results of the desk study and site walkover were used to inform an assessment of groundwater and surface water flow paths at the site and form the basis of a 1D contaminant modelling along the assumed flow paths.

The results of the flow path assessment indicate that the site is situated on a water divide with water to the north and the south of the site flowing differently. The groundwater to the north of the site is anticipated to flow to the actively dewatering quarry sump, approximately 1.9km to the northwest of the site. The groundwater that flows to the quarry sump is discharged into Bunlicky Clayfield Pond which outfalls to the River Shannon. Surface water to the north of the site is understood to percolate through the soil and discharge into the ground, thus following the groundwater flow path to the quarry sump.

Surface water that is situated to the south of the site's watershed is anticipated to flow south into the Loughmore Common canal.

The Loughmore Common canal drains to the southwest where it joins the Barnakyle River, and further downstream the River Maigue which discharges into the Shannon Estuary. Groundwater to the south of the site is considered to discharge via the springs along Loughmore Common and from there enters the surface water system at the canal.

The results of the contaminant modelling indicate, in the case of an accidental diesel spill on site which discharged into the groundwater, that the groundwater would dilute the concentration of the contaminant to below the threshold concentration within the first 200m horizontal distance from the site. As the quarry sump and Loughmore Common are approximately 1.9km and 290m respectively, the concentration of the contaminant at these groundwater discharge locations is anticipated to be well below the threshold concentrations.

For the southern surface water flow path that discharges to the Loughmore Common canal, it is understood that the discharge for the canal will receive a large amount of dilution when it flows into the Barnakyle River. The low flow for the Barnakyle River was estimated to be 5,184m³/day. The Barnakyle River joins the River Maigue, where it will receive even greater dilution before discharging into the Shannon Estuary. Therefore, the predicted impact on the habitat from any accidental discharge on site is negligible.

3 References

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Rory Dalton Ecology Services (2017) *Bat Survey of Mungret College*

Tynan Environmental (2019) *Groundwater Monitoring*

Appendix 1

Mungret Link Streets Project
Ecological Impact Assessment
(Mott MacDonald)



Mungret Link Streets Project

Ecological Impact Assessment (EclA)

14 May 2019

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Ecological Impact Assessment (EclA)

14 May 2019

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1 Introduction

1.1 Introduction

This Ecological Impact Assessment (EclA) has been prepared by Mott MacDonald on behalf of Limerick City and County Council for the proposed Mungret Link Street Project. The Mungret Link Street Project (hereafter referred to as the Project) consists of the provision of 1.7km of new public road within the Mungret / Loughmore Common area of County Limerick. Further details on the Project are provided in section 1.2.

The report follows the CIEEM (2018) *“Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine”*.

1.2 Project Description

The Mungret Link Streets project consists of the provision of ca. 1.7km of new public road within the Mungret / Loughmore Common area of County Limerick. The project includes the following associated infrastructure:

- Driving Lanes,
- Cycleways,
- Footpaths,
- Roadside Parking,
- Surface water drainage / sustainable urban drainage, and
- Street lighting

The purpose of the project is to accommodate the future construction of new residential development in Mungret, Limerick (Limerick 2030 housing), within lands zoned for residential development under the Southern Environs Local Area Plan 2011 – 2017 (Extended until May 2021).

Ducting for the provision of services detailed below will also be installed to facilitate the future implementation of the area masterplan.

- Foul water drainage connection into Limerick Main Drainage Scheme
- Water mains
- Gas Mains
- Telecommunications

The Project will require the excavation of lands which are predominantly in agricultural use. The aim of the design will be to achieve an optimal cut/fill balance such that excavated material is reused on site where possible thereby minimising waste. Several old farm sheds will likely be removed to accommodate the road. A number of field boundaries will be removed to accommodate the road.

The works area will be accessed via the R859 and R510 roads.

Drainage from the road will be to two attenuation basins.; one servicing the eastern extent of the road and one servicing the western extent of the road. The road drainage has been designed to accommodate drainage from future residential development within lands zoned for development

under the Southern Area Local Area Plan 2011-2017 (as extended). The attenuation basins will drain in to the existing drainage networks associated with the R859 and R510 roads.

1.3 Aims and Objectives

The main objectives of this assessment are to:

- Identify any habitats or flora of ecological value including those protected under the Wildlife Act (under Flora Protection Order) or the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) which could be impacted by the proposed development.
- Identify fauna (and/or their breeding and resting places) protected under the Wildlife Act or the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) which could be impacted by the proposed development.
- Recommend mitigation measures as appropriate to prevent adverse effects to habitats and species of ecological value which might be impacted by the proposed development.

2 Methodology

2.1 Legislation and Best Practice Guidelines

This EclA was prepared in accordance with the following legislative requirements:

- Planning and Development Acts and Regulations 2000-2015;
- Wildlife Act 1976 and Wildlife (Amendment) Act 2000;
- Flora (Protection) Order 2015;
- EU Water Framework Directive 2000/60/EC; and
- European Communities (Birds and Natural Habitats) Regulations 2011 (as amended).

In addition, the assessment was carried out having regard to the following guidance documents:

- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018)
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (National Roads Authority, 2009);
- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (National Roads Authority, 2009);
- Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes (National Roads Authority, 2005);
- Guidelines for the Treatment of Bats During the Construction of National Road Schemes (National Roads Authority, 2005);
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (National Roads Authority, 2006);
- A Guide to Habitats in Ireland (Fossit, 2000);
- Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2011); and
- Bat Tree Habitat Key. AECOL, Bridgwater. Andrews, H et al. (2013).

2.2 Study Area

The study area comprises all lands located within the zone of influence of the Project. The current guidance on ecological assessments (CIEEM, 2018) states that:

“The ‘zone of influence’ for a project is the area over which ecological features may be subject to significant effects as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries.” and that “The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change.”

The zone of influence was defined through desk assessment, having regard to the sensitivity of habitats and species likely to be present / previously recorded in the locality of the Project. The main habitats within the proposed development site comprise agricultural grasslands, hedgerows, treelines, a canal and swamp habitat. The main species likely to occur within the habitats include badger (*meles meles*), bat (*Chiroptera*), frog (*Rana temporaria*), breeding bird species and whorl snail (*Vertigo spp.*).

The National Road Authority (NRA) 'Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes' (NRA, 2005) which states that disturbance from construction works can impact breeding badger setts within 150m of the works (this has been construed to pertain to all the protected mammals listed above, with the exception of bats). The study area was therefore defined as the proposed development site plus a 150m buffer zone from the proposed development site boundary. Ecological connectivity (e.g. linear habitats / ecological corridors) and hydrological connectivity (e.g. the canal) were also taken into consideration when defining the zone of influence.

Figure 1: Survey Area



2.3 Desktop Assessment

A desktop review was carried out to identify features of ecological importance within the zone of influence of the proposed development site. The ecological assessment included designated and sensitive areas in the vicinity of the study area, to enable sufficient assessment to identify and quantify any significant impacts on the habitats, flora and fauna likely to arise with regard to the proposed development.

Principal sources of information utilised for the desktop assessment included:

- Existing relevant mapping and databases e.g. species and habitat distribution etc. (sourced from the Environmental Protection Agency (EPA), the National Biodiversity Data Centre (NBDC) and the National Parks and Wildlife Services (NPWS));

- Published and unpublished NPWS reports on protected habitats and species including Irish Wildlife Manual reports, Species Action Plans and Conservation Management Plans;
- Conservation Status Assessment Reports (CSARs), Backing Documents and Maps prepared in accordance with Article 17 of the Habitats Directive;
- Published data from Bat Conservation Ireland;
- Published data from BirdWatch Ireland; and
- Published documents from Inland Fisheries Ireland.

2.4 Consultations

A consultation letter was issued to the Development Applications Unit (DAU) on 31/10/2017 (DAU reference: G Pre00222/2017). A formal response was not received via the DAU, rather a meeting was arranged with NPWS Conservation Ranger Pat Foley in January 2018. Mr Foley identified the requirement for winter bird survey. A bird survey was therefore carried out in February and March 2018 (the survey report is presented in Appendix A).

2.5 Field Assessment

An ecological field assessment was undertaken on the 15th of September 2017 and on the 6th and 7th of June 2018 by Mott MacDonald Ecologists. Weather on all three days was warm and dry. Equipment used for the surveys included base maps, iPad, template target notes, digital camera, Explorer Premium wireless inspection endoscope (Model 8003AL) and binoculars.

The aim of the survey was to determine the presence or absence of habitats and species of ecological value/significance, including Annex I habitats and Annex II and IV species, Wildlife Act species and Flora Protection Order species. The survey was also undertaken to assess the suitability of the habitats along the proposed development site to support protected species. The methodologies employed during the field survey are set out hereunder.

Habitats and Flora Survey

Habitat survey was carried out with regard to '*Best Practice Guidance for Habitat Survey and Mapping*' (Heritage Council, 2011). Habitats were classified in accordance with '*A Guide to Habitats in Ireland*' (Fossitt, 2000).

The area was searched for evidence of invasive plant species listed in Part 1 of the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011.

Species protected under Flora (Protection) Order, 2015 (S.I. No. 356 of 2015) were also searched for.

Volant Mammals¹ Survey

Bat surveys comprised a daytime visual assessment survey and an emergency/re-entry survey which were carried out in accordance with *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)* (Collins, 2016).

The daytime ground level visual assessment was carried out in line with *Bat Tree Habitat Key* (Andrews, H et al., 2013) to determine potential roost features. Trees were examined for potential roost features which included:

- Horizontal / vertical cracks along tree limbs / trunk

¹ Mammals capable of flight

- Knot holes and cankers in trees
- Voids in trees
- Crevices including lifting bark or thick ivy growth (where stems are a minimum of 50mm diameter)

Similarly, buildings / structures were assessed externally for potential access points, gaps, cracks, voids, and crevices. The internal features of the buildings were not examined for health and safety reasons. The suitability of habitat features for bats, within the survey area, were assessed in accordance with Collins (2016) as described in Table 1 below.

Table 1: Guidelines for Assessing Potential Bat Roosts

Suitability	Description/Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	<p>A structure with one or more potential roost sites that could be used by individual bats opportunistically.</p> <p>However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions, and/or suitable surrounding habitat likely to be used on a regular basis by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation).</p> <p>A tree of sufficient size and age to contain potential roost features but with none seen from the ground or with features seen only with very limited roost potential.</p>	<p>Habitats, that could be used by small numbers of commuting bats such as gappy hedgerows or unvegetated streams, but are isolated, i.e. not very well connected to the surrounding landscape by other habitat.</p> <p>Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.</p>
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions, and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	<p>Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens.</p> <p>Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland, or water.</p>
High	A structure with one or more potential roost sites that could be used that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions, and surrounding habitat.	<p>Continuous high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edges.</p> <p>High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses, and grazed parkland.</p> <p>Site is close to and connected to known roosts.</p>

Source: Collins, 2016

The emergence/re-entry survey was undertaken on the 6th and 7th of June 2018. The emergency/dusk survey was started 15 minutes before sunset until 1.5 – 2 hours after sunset and the re-entry/dawn survey was commenced 1.5 – 2 hours before sun rise until approximately 15 minutes after sunrise in accordance with *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn) (Collins, 2016)*. Bat activity was recorded using a bat detector (Bat

Box Duet) and visual observations were made to determine whether potential roost features (PRF) were being used.

Non-Volant Mammal Surveys

Mammal surveys were carried out with regard to Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA 2009) and included surveys for breeding and resting places of protected mammal species and survey for direct evidence of mammals.

The methodologies and assessment criteria used were based on current published guidance.

Badger survey followed *Surveying Badgers (Harris et. al. 1989)* Signs of badger were searched for which included:

- Latrines and dung pits
- Hair
- Path and footprints
- Scrapes
- Snuffle holes
- Setts including:
 - A description of the sett location: hedgerows, earth banks, woodland or scrub habitat
 - Type of sett and level of usage: main, maternity, ancillary, abandoned etc.
 - Signs of activity: discarded bedding, spoil heaps etc.)

The proposed development site was determined as unsuitable to support otter. The Loughmore Canal which traverses the site has a low volume of water (depth of approximately 5cm) and no fishery value.

The potential for the study area to support additional protected mammal species such as Irish hare (*Lepus timidus*), pine marten (*Martes martes*), red squirrel (*Sciurus vulgaris*), pygmy shrew (*Sorex minutus*), Irish stoat (*Mustela erinea Hibernica*), hedgehog (*Erinaceus europaeus*) etc. was assessed during the field surveys.

Aquatic Habitat & Fisheries

Aquatic habitat assessments in relation to fish and aquatic ecological interests were carried out using the methodology given in the Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual*' (EA, 2003).

Bird Survey

Observations of ornithological activity within the study area were made during the field survey. The bird species recorded were typical farmland bird species.

A wintering bird survey was undertaken between February and March 2018.

2.6 Ecological Assessment

The criteria used in evaluating ecological features as set out in the *Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)* is described in Table 2 below.

Table 2: Site Evaluation Criteria

Ecological Valuation	Description
Internationally Important	<ul style="list-style-type: none"> ● Sites designated (or qualifying for designation) as an SAC or SPA under the EU Habitats or Birds Directives ● Undesignated sites that fulfil criteria for designation as a European Site ● Features essential to maintaining the coherence of the Natura 2000 network ● Sites containing ‘best examples’ of the habitat types listed in Annex I of the Habitats Directive ● Resident or regularly occurring populations of birds listed in Annex I of the Birds Directive and species listed in Annex II and/or Annex IV of the Habitats Directive ● Ramsar Sites ● World Heritage Sites ● Biosphere Reserves ● Sites hosting significant species populations under the Bonn Convention ● Sites hosting significant populations under the Berne Convention ● Biogenetic Reserves ● European Diploma Sites ● Salmonid waters
Nationally Important	<ul style="list-style-type: none"> ● Sites or waters designated or proposed as an NHA ● Statutory Nature Reserves ● Refuge for fauna and flora protected under the Wildlife Acts ● National Parks ● Undesignated sites fulfilling criteria for designation as a NHA; Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act and/or a National Park ● Resident or regularly occurring populations (assessed to be important at the national level) of species protected under the Wildlife Acts and/or species listed on the relevant Red Data list) ● Site containing viable areas of the habitat types listed in Annex I of the Habitats Directive.
County Importance	<ul style="list-style-type: none"> ● Areas of Special Amenity ● Area subject to a Tree Preservation Order ● Area of High Amenity, or equivalent, designated under the County Development Plan ● Resident or regularly occurring populations (assessed to be important at the County level) of species of birds listed in Annex I of the Birds Directive, species listed in Annex II and/or IV of the Habitats Directive, species protected under the Wildlife Acts and/or species listed on the relevant Red Data list ● Site containing area(s) of the habitat types listed in Annex I of the Habitats Directive that do not fulfil criteria for valuation as of International or National Importance ● County important populations of species, or viable area of semi-natural habitats or natural heritage features identified in the National or Local Biodiversity Action Plan ● Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county ● Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level
Local Importance (higher value)	<ul style="list-style-type: none"> ● Locally important populations of priority species or habitats or natural heritage features identified in the Local Biodiversity Action Plan ● Resident or regularly occurring populations (assessed to be important at the Local level) of species of birds listed in Annex I of the Birds Directive, species listed in Annex II and/or IV of the Habitats Directive, species protected under the Wildlife Acts and/or species listed in the relevant Red Data list ● Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality ● Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value
Local Importance (lower value)	<ul style="list-style-type: none"> ● Sites containing small areas of semi-natural habitat that are of some local importance for wildlife ● Sites of features containing non-native species that are of some importance in maintaining habitat links

Source: NRA 2009

2.6.1 Impact Assessment Criteria

Impacts were assessed and characterised in accordance with the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' EPA (May 2017)* as described in Table 3.

Table 3: Impact Magnitude and Duration Criteria

Impact magnitude	Definition
Quality of Effects	Positive Effects A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral Effects No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative/adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Significance of Effects	Imperceptible An effect capable of measurement but without significant consequences.
	Not significant An effect which causes noticeable changes in the character of the environment but without significant consequences.
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects An effect which obliterates sensitive characteristics
Duration and Frequency of Effects	Momentary Effects Effects lasting from seconds to minutes
	Brief Effects Effects lasting less than a day
	Temporary Effects Effects lasting less than a year
	Short-term Effects Effects lasting one to seven years
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years
	Reversible Effects Effects that can be undone, for example through remediation or restoration

Impact magnitude

Definition

	Frequency of Effects
	Once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually

Source: EPA, 2017

3 Baseline Environment

3.1 Site location

The proposed Project will be located within agricultural grasslands within the Mungret / Loughmore Common area, approximately 4.5km south-west of Limerick city.

The proposed development site is currently used for agricultural purposes and the fields are lightly grazed by cattle. Residential development occurs to the east and south-west of the survey area. The R526 regional road is located to the south-east of the survey area and the R859 regional to the north of the survey area. Mungret House and Woods occur towards the centre of the survey area. A school and sport fields are located at the north-western area of the survey area. Loughmore Common Turlough pNHA (000438) and Loughmore Canal are located along the southern section of the survey area. Loughmore Canal which forms part of the pNHA site and flows in east to west direction.

3.2 Output of Desktop Assessment

Designated Sites of International Importance

The Birds Directive (2009/147/EC) and the Habitats Directive (92/42/EEC) put an obligation on EU Member States to establish the Natura 2000 network of sites of highest biodiversity importance for rare and threatened habitats and species across the EU. In Ireland, the Natura 2000 network of European sites comprises Special Areas of Conservation (SACs, including candidate SACs) and Special Protection Areas (SPAs, including proposed SPAs). SACs are selected for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are selected for the conservation of Annex I birds and other regularly occurring migratory birds and their habitats.

Mott MacDonald prepared a report for Screening for Appropriate Assessment which investigated the potential for the proposed Mungret Link Street Project to have significant effects on all European Sites. This screening report is included as part of the planning package.

The screening assessment concluded that there is no source-pathway-receptor connectivity between the Project and European Sites, there is therefore no potential for significant effects.

Designated Sites of national Importance

Natural Heritage Areas (NHA) are the basic wildlife designation in Ireland. The areas are considered important for the habitats present or which holds species of plants and animals whose habitats needs protection. Under the Wildlife Amendment Act (2000), NHAs are legally protected from damage from the date they are formally proposed for designation (source: www.npws.ie). Proposed Natural Heritage Areas (pNHA) were published on a non-statutory basis in 1995 and have not since been statutorily proposed or designated.

All NHA's and pNHA's located within 15km of the Project site, or where connectivity exists (physically, ecologically or hydrologically), were identified using GIS Software. Table 4 shows the location of the Mungret Link Streets Project in relation to these sites, the features of interests for which they have been designated and identifies source-pathway-receptors for each.

No source-pathway-receptor was identified between the project and Natural Heritage Areas.

Table 4: National Sites within 15km or with connectivity to the Project

Site Name and Code	Distance to National Site	Feature of Interests	Source-Pathway-Receptor
National Heritage Sites			
Woodcock Hill Bog NHA (002402)	8.8km north of the Project. There is no hydrological connectivity to the site.	Peatlands	There is no potential for impact to the site due to distance and lack of connectivity to the Project site.
Proposed National Heritage Site			
Loughmore Common Turlough (000438)	180m south of the Project.	Turlough habitat	The proposed road will be constructed approximately 180m to the north of the pNHA. The road drainage will connect to the existing road drainage. There will be no discharge to ground. There is no physical or hydrological connectivity to the turlough.
Inner Shannon Estuary – South Shore (000435)	Located ca. 1km north of the Project	Estuarine complex supporting wintering and migrating waterfowl.	There is no hydrological or physical connectivity between the pNHA and the project. Bird survey did not identify any wetland birds using the proposed development site. There is no potential for impact to the pNHA.
Fergus Estuary and Inner Shannon, North Shore (002048)	Located ca. 2.5km north of the Project.	Estuarine complex supporting wintering and migrating waterfowl. Triangular Clubrush	There is no hydrological or physical connectivity between the pNHA and the project. Bird survey did not identify any wetland birds using the proposed development site. There is no potential for impact to the pNHA.
Knockalisheen Marsh (002001)	Located ca. 6.2km north of the Project. There is no hydrological connectivity to the site.	Wet grassland and fen communities	There is no potential for effects due to distance between the sites.
Garrannon Wood (001012)	Located ca. 8.3km north-west of the Project. There is no hydrological connectivity to the site.	Oak woodland habitat	There is no potential for effects due to distance between the sites.
Dromore & Bleach Loughs (001030)	Located ca. 8.6km west of the Project. There is no hydrological connectivity to the site.	Lake habitat	There is no potential for effects due to distance between the sites.
Adare Woodlands (000429)	Located ca. 9km west of the Project. There is no hydrological connectivity to the site.	Broad-leaved woodland habitat	There is no potential for effects due to distance between the sites.
Tory Hill (000439)	Located ca. 9km south of the Project. There is no hydrological connectivity to the site.	Wooded limestone Orchid-rich calcareous grassland	There is no potential for effects due to distance between the sites.
Skoolhill (001996)	Located ca. 11km south-east of the Project. There is no hydrological connectivity to the site.	<i>Festuca heterophylla</i>	There is no potential for effects due to distance between the sites.
Curraghchase Woods (000174)	Located ca. 13km south-west of the Project. There is no hydrological connectivity to the site.	Woodland and grassland habitats	There is no potential for effects due to distance between the sites.

Source: NPWS

3.2.1.1 Records of protected species and habitats

National Biodiversity Data Centre

A review of records from National Biodiversity Data Centre (NBDC) within the two 2km square grids (R55L and R55G) which encompasses the Project site was undertaken and is presented in Table 6 below.

Table 5: Records of protected and invasive species within the 2km square grids (R55L and R55G) which encompass the Project

Name	Date of record Title of dataset	Title of Dataset	Location in relation to the Project site	Designation
Common Frog (<i>Rana temporaria</i>)	31/07/1974	Reptiles and Amphibians Distribution Atlas 1978 (An Foras Forbartha)	Frog have been recorded within the 10km square grid which encompasses the Project.	Protected Species: EU Habitats Directive Protected Species: EU Habitats Directive >> Annex V Protected Species: Wildlife Acts
Common Linnet (<i>Carduelis cannabina</i>)	31/12/2011	Bird Atlas 2007 - 2011	Linnet have been recorded within the 10km and 2km square grids which encompasses the Project.	Protected Species: Wildlife Acts Threatened Species: Birds of Conservation Concern Threatened Species: Birds of Conservation Concern >> Birds of Conservation Concern - Amber List
Common Wood Pigeon (<i>Columba palumbus</i>)	31/12/2011	Bird Atlas 2007 - 2011	Wood pigeon have been recorded within the 10km and 2km square grids which encompasses the Project.	Protected Species: Wildlife Acts Protected Species: EU Birds Directive Protected Species: EU Birds Directive >> Annex II, Section I Bird Species Protected Species: EU Birds Directive >> Annex III, Section I Bird Species
Meadow Barley (<i>Hordeum secalinum</i>)	31/12/1998	BSBI tetrad data for Ireland	Meadow Barley was previously recorded approximately 600m south-east of the Project site boundary.	Protected Species: Flora Protection Order Threatened Species: Endangered
Opposite-leaved Pondweed (<i>Groenlandia densa</i>)	31/12/1999	BSBI tetrad data for Ireland	Opposite-leaved pondweed has been recorded within Loughmore Common Canal.	Protected Species: Flora Protection Order Threatened Species: Endangered
Eurasian Badger (<i>Meles meles</i>)	24/03/2010	Road Kill Survey	A dead badger was recorded on the R510 regional road 20m south of the Project.	Protected Species: Wildlife Acts
Eurasian Red Squirrel (<i>Sciurus vulgaris</i>)	31/12/2012	Irish Squirrel Survey 2012	A red squirrel was previously recorded approximately 700m south-east of the Project site boundary.	Protected Species: Wildlife Acts
European Otter (<i>Lutra lutra</i>)	23/04/2009	Road Kill Survey	A dead otter was recorded on the R526 regional road approximately 200m south-east of the Project site boundary.	Protected Species: EU Habitats Directive Protected Species: EU Habitats Directive >> Annex II Protected Species: EU Habitats Directive >> Annex IV Protected Species: Wildlife Acts

Name	Date of record Title of dataset	Title of Dataset	Location in relation to the Project site	Designation
Pipistrelle (<i>Pipistrellus pipistrellus sensu lato</i>)	16/06/2014	National Bat Database of Ireland	Soprano pipistrelle bat was previously recorded 1.2km south-east of the Project site boundary.	Protected Species: EU Habitats Directive Protected Species: EU Habitats Directive >> Annex IV Protected Species: Wildlife Acts
Soprano Pipistrelle (<i>Pipistrellus pygmaeus</i>)	16/06/2014	National Bat Database of Ireland	Soprano pipistrelle bat was previously recorded 1.2km south-east of the Project site boundary.	Protected Species: EU Habitats Directive Protected Species: EU Habitats Directive >> Annex IV Protected Species: Wildlife Acts
Eastern Grey Squirrel (<i>Sciurus carolinensis</i>)	31/12/2012	Irish Squirrel Survey 2012	An Eastern grey squirrel was previously recorded approximately 700m south-east of the Project site boundary.	Invasive Species: Invasive Species Invasive Species: Invasive Species >> High Impact Invasive Species Invasive Species: Invasive Species >> EU Regulation No. 1143/2014 Invasive Species: Invasive Species >> Regulation S.I. 477 (Ireland)

Source: NBDC

A review of past ecological surveys which were carried out within the study area was also undertaken. Roger Goodwillie undertook a vegetation survey and evaluation of Loughmore Turlough in 1992. Goodwillie described the turlough as dry and likely fed from a swallow hole located at the north-eastern end. Salt marsh plants were identified within the turlough which suggests either a slight salt influence in the floodwater or might be due to the turlough's close proximity to the Shannon Estuary. Goodwillie identified the presence of the rare species; slender spikerush (*Eleocharis uniglumis*), greater bird's-foot-trefoil (*Lotus pedunculatus*) and opposite-leaved pondweed (*Groenlandia densa*) within the turlough.

3.3 Output of the Field Assessment

3.3.1 Habitats and Flora

A description of the habitats within the site are presented hereunder. Habitats were described in accordance with Fossitt (2000). A habitat map of the proposed development is provided in Figure 2 below.

Improved Agricultural Grassland (GA1)

The Project site predominantly comprises improved agricultural grassland which is dominated by rye-grass (*Lolium spp.*). The fields are currently used as grazing for beef cattle and sheep. The habitat was assessed as having Local Importance (lower value) due to the low species diversity.

Hedgerows (WL1)

The agricultural fields are separated by mature hedgerows which predominantly comprise hawthorn (*Crataegus monogyna*) and blackthorn (*Prunus spinose*), with intermittent ash (*Fraxinus excelsior*) and elder (*Sambucus nigra*), and with an undergrowth of bramble (*Rubus fruticosus agg.*). Sections of hedgerows will be required to be removed to facilitate the proposed

road. The hedgerow habitat was assessed as having Local Importance (lower value) due to the low species diversity.

Treelines (WL2)

A number of treelines form the boundary of the grassland fields. The treelines predominantly comprise ash, sycamore (*Acer pseudoplatanus*), horse chestnut (*Aesculus hippocastanum*) and elder (*Sambucus nigra*). The treelines within the study area were assessed as having Local Importance (lower value) due to the low species diversity.

A mature treeline which comprised beech (*Fagus sylvatica*), sycamore, horse-chestnut and cypress (*Cupressus x leylandii*) occur along towards the rear of the school. This treeline was assessed as having Local Importance (higher value) as it was confirmed to support bats.

Loughmore Canal Turlough pNHA (000438)

Loughmore Common **Turlough (FL6)** is located, at its nearest point, 180m south of the proposed road.

The pNHAh comprises areas of heavily grazed **calcareous grassland (GS1)** comprising red fescue (*Festuca rubra*), creeping bent (*Agrostis stolonifera*), silverweed (*Potentilla anserine*), red clovers (*Trifolium pratense*), white clover (*Trifolium repens*), creeping buttercup (*ranunculus repens*), meadowsweet (*Filipendula ulmaria*), common sedge (*Carex nigra*), and tawny sedge (*Carex hostiana*). Two early marsh orchids (*Dactylorhiza incarnata*) and three common spotted-orchids (*Dactylorhiza fuchsia*) were also identified within the calcareous grassland habitat. This habitat does not equate to Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) in accordance with the Interpretation Manual of European Union Habitats - EUR28.

Further west, species typical of wetter conditions were present which included a high frequency of hard rush (*Juncus inflexus*), compact rush (*Juncus conglomeratus*) common sedge (*Carex nigra*), glaucous sedge (*Carex flacca*), hairy sedge (*Carex hirta*) with occasional devil's-bit scabious (*Succisa pratensis*) quaking grass (*Briza media*) crested dog tail (*Cynosurus crstatus*) and black bog rush (refer to Image 2).

Image 1 Orchids within Calcareous Grassland



Source: Mott MacDonald 06/06/2018

Image 2 Calcareous grassland GS1



Source: Mott MacDonald 15/09/2017

Reed and large sedge swamp (FS1)

An area of large sedge swamp (Image 3) occurs immediately south of the Loughmore Canal, within the pNHA boundary. This swamp is ca. 0.5ha in area. The road is not located in proximity to this habitat. This habitat is wet under foot and is dominated by reed canary-grass (*Phalaris arundinacea*). Other frequently occurring species include bulrush (*Typha latifolia*), yellow-flag iris (*Iris pseudacorus*), long-stalked yellow-sedge (*Carex viridula* ssp. *Brachyrrhyncha*), water horsetail (*Equisetum fluviatile*), timothy (*Phleum pratense*), meadowsweet (*Filipendula ulmaria*), silverweed, marsh cinquefoil (*Potentilla palustris*), glaucous sedge, common vetch (*Vicia sativa*), water mint (*Mentha aquatica*), and short-fruited willowherb (*Epilobium obscurum*). This habitat has a high degree of biodiversity and is of National importance given it occurs within the pNHA boundary.

A second smaller patch of large sedge swamp was identified immediately north of the canal and was dominated with pendulous sedge (*Carex pendula*). A patch of **tall-herb swamp (FS2)** occurs immediately east of the sedge swamp habitat. Species identified within the habitats were dominated with hard rush, compact rush, water horsetail, water mint and occasional lesser water-plantain (*Baldellia ranunculoides*), water forget-me-not (*Myosotis scorpioides*). Two adult common frogs (*Rana temporaria*) were recorded within the habitat.

Rich Fen and flush (PF1)

An area of rich fen habitat occurs towards the centre of the pNHA site. The habitat is dominated with black bog rush (*schoenus nigricans*) sedge species (*Carex spp.*) and *Campylium stellatum* in the ground layer. Tussocks of rush, devil's bit scabious and marsh cinquefoil.

Canal (FW3)

Loughmore Canal traverses the southern section of the pNHA and forms part of Loughmore Common Turlough pNHA. The canal flows to the Barnakyle River, a tributary of the River Maigue (which is part of the Lower River Shannon SAC: some 7.7 river kilometres downstream).

The rare plant species opposite-leaved pondweed (*Groenlandia densa*) has been recorded in the canal in the past. None however, was recorded during the survey. The water in the canal was stagnant and approximately 5cm deep. Vegetation within the canal was dominated with water-cress (*Nasturtium officinale*) with frequent pendulous sedge (*Carex pendula*), bulrush (*Typha latifolia*), yellow iris (*Iris pseudacorus*), soft rush (*Juncus effusus*), water-plantain. Some individual willow trees are also present on the banks of the canal (refer to Image 4).

Image 3 Sedge swamp habitat



Source: Mott MacDonald 06/06/2018

Image 4 Loughmore Canal



Source: Mott MacDonald 06/06/2018

Scrub Habitat (WS1) and Mature Trees

There are several areas of blackthorn (*Prunus spinose*) and hawthorn (*Crataegus monogyna*) scrub within the site which are of local ecological value. Many of these are associated with archaeological features e.g. ringfort LI013-011, ringfort LI013-007, enclosure LI013-133 and enclosure LI013-008. The ringforts and enclosures are included on the National Monument Service Records. The road alignment is outside of the zone of notification for these records. A disused cattle path at Baunacloka (Image 5) will be removed to accommodate the road.

The scrub habitats within the site are in use by badger and act as stepping stones within the agricultural lands. The ringforts and enclosures will not be affected by the Project. A section of the cattle path will be removed to accommodate the road. The scrub and ringfort/enclosure habitats were assessed as having Local Importance (higher value) due to the potential for the habitats to support badger.

Image 5 Disused cattle path



Source: Mott MacDonald 15/09/2017

Image 6 Treeline within the study area



Source: Mott MacDonald 06/06/2018

Woodlands

The pNHA encompasses an area of planted ash (*Fraxinus excelsior*) woodland with a boundary of Pedunculate Oak (*Quercus robur*) to the south of the canal. Immediately east of the ash woodland is planted conifer. The habitats were assessed as having Local Importance (higher value).

Buildings (BL3)

Mungret House occurs towards the centre of the study area. The proposed new road link will be located approximately 100m south of the building. A primary school and sport fields (**amenity grassland GA2**) occurs towards the north-west boundary of the site.

There are a number of derelict farm sheds located to the south-west of the school, which will be removed to facilitate the proposed works (refer to Image 10). The sheds were assessed as having 'Moderate' bat roost potential. Due to the building's potential to support protected bat species, the habitat was assessed as having Local Importance (higher value).

Residential developments occur towards the north-eastern boundary of the site, either side of the proposed road.

Protected and invasive plant species

No Floral Protection Order (FPO) species or invasive plant species were recorded within the survey area.

3.3.2 Fauna

Badger

Badgers and their setts are protected under the Wildlife Act. One disused badger sett (annex set with one entrance) was observed within the ringfort LI013-01 located approximately 500m south-west of the proposed road link (refer to Image 7). No other badger setts were identified during the surveys. Badger paths, snuffle holes and prints (refer to Image 8) were also observed within scrub habitat, particularly in proximity to Mungret House.

Scrub habitat, particularly in proximity to Mungret House and along the western boundary of the site boundary was identified as important habitats for badgers.

Image 7 Badger Sett Entrance



Source: Mott MacDonald 15/09/2017

Image 8 Badger Prints



Source: Mott MacDonald 15/09/2017

Other Mammal Species

No evidence of otter was recorded within the study area. The canal was identified as unsuitable to support otter due to the low volume of water and lack of fishery value.

No other mammal species were recorded during the surveys. It is likely however that fox (*Vulpes Vulpes*), Irish hare, pygmy shrew and hedgehog occur within the study area.

Bats

All bat species in Ireland are protected under both national and European legislation. There is additional protection for lesser horseshoe bat (*Rhinolophus ferrumequinum*).

The suitability of the landscape associated with the proposed Project site to support bat species was determined with regard to the bat 'habitat suitability' index presented on www.maps.biodiversityireland.ie/#/Map. The bat 'habitat suitability' index is the research outcome of a study by (Lundy *et al.* 2011) examining the relative importance of landscape and habitat associations across Ireland for bats. The 'habitat suitability' index ranges from 0 to 100 with 0 being least favourable and 100 most favourable for various bat species. The habitat / landscape at the Project site has a high bat suitability index score of 37.11. The bat 'habitat suitability' index score was referred to in scoping the field assessment for bats and bat habitat.

A daytime ground-level visual assessment of the treelines and derelict sheds within the Project site was undertaken. Only the mature treeline located immediately west of the school and sports fields was assessed as having 'High' bat roost potential. All other treelines within the study area were assessed as having 'Negligible' suitability to support bats due to the lack of suitable roost features. It is likely however that the treelines within the study area are used as foraging and commuting routes by bats. The derelict farm sheds were assessed as having 'Moderate' bat roost potential.

The emergency/dusk survey was therefore undertaken at the treeline line west of the school and sports field and at the derelict farm sheds.

Sunset was at 21:53 so the survey was commenced at 21:35 (15 minutes prior to sunset). The first bat, a soprano pipistrelle (*Pipistrellus pygmaeus*), was recorded at 22:20 foraging along the tree line. Two more soprano pipistrelles were recorded a short time later also foraging along the tree line. A fourth soprano pipistrelle was observed emerging from a roost within the beech tree, which confirmed the tree as an active bat roost. Two common pipistrelles (*Pipistrellus pipistrellus*) were recorded foraging along the southern section of the tree line. No bats were recorded emerging from the derelict farm sheds during the emergency survey.

The re/entry dawn survey was commenced at 03:45 (1.5 hours before sunrise). Both soprano pipistrelle and common pipistrelles were again observed foraging along the treeline.

Image 9 Treeline located along the north-western boundary of the site confirmed as an important foraging and commuting route for bats



Source: Mott MacDonald, 06/06/2018

Image 10 Derelict farm buildings



Source: Mott MacDonald, 06/06/2018

Birds

All wild bird and their nests are protected under the Wildlife Act (1976 and 2000). The study area comprises numerous hedgerows and treeline which are likely to provide suitable nesting sites for breeding bird species.

During the field surveys undertaken by the Mott MacDonald Ecologists a number of bird species were recorded within the study area. Species recorded included magpie (*pica pica*), woodpigeon (*Columba palumbus*), robin (*Erithacus rubecula*), jackdaw (*Corvus*), swallow (*Hirundo rustica*) and a buzzard (*Buteo buteo*). All species are Green-listed in Ireland with the exception of swallow which are Amber-listed in Ireland due to concerns over the entire European population (source: www.birdwatchireland.ie).

A winter bird survey was undertaken by Ecofact in February and March 2018 assess the bird species using the site. The survey report is presented in Appendix A. There were 2 species on the BoCCI red list, Meadow Pipit and Grey Wagtail.

The Loughmore Common turlough area and the Loughmore canal have the better ecological value within the survey area from a bird conservation point of view.

Invertebrates, Herpetofauna and Reptiles

A number of butterflies and damselflies were recorded during the survey which included Red admiral (*Vanessa Atalanta*), common blue (*Polyommatus icarus*) and common blue damselfly (*Enallagma cyathigerum*).

Two common frogs were recorded in the tall-herb swamp habitat located adjacent to the canal. Both the canal and fen habitats are likely to provide optimal habitat for frogs. The spawning season for frogs occurs between 1st of March – 31st June inclusive. No frog spawn was

recorded during the survey however there is potential that tadpoles had already hatched at this point. Frogs are listed on Annex V of the EU Habitat Directive (92/42/EEC) and are protected under the Wildlife Act.

The sedge swamp habitat within the pNHA site was identified as suitable habitat for whorl snail species. Three species of whorl snail, (*Vertigo geyeri*), (*V. angustior*) and (*V. moulinsiana*) are protected under Annex II of the Habitat Directive. A whorl snail survey of the swamp habitat was carried out on 18th of October 2018 (within the ideal survey window for *Vertigo*). Weather conditions at the time of the survey were clear and dry, 16°C. Liaison with National Parks and Wildlife confirmed that there is no requirement for license to undertake this survey.

The survey was carried out as per Moorkens & Killeen (2011). Initially a transect through the suitable habitat was identified, with defined intervals every 5m. Evidence of any management of the site overall was recorded eg grazing, weed cutting, or grass mowing. At each interval, the habitat condition was recorded. This required recording vegetation height and dominant plant species. Ground moisture classes (on a scale of 1-5 with 1 being dry, and 5 being standing water over 5cm deep) were also recorded at each interval.

At each interval a 1m² beating sheet was placed on the ground. The vegetation above was then agitated. This was repeated on either side of the transect line at each 5m interval. Any whorl snails which fell on to the sheet were identified and recorded on site using a hand lens, and the key "*Identifying British Vertiginidae*" (Buckle 2012). To allow for identification, the key makes use of features including the direction of coiling of shell, the shape of the apertural lip, overall size and shape of shell, and the number and position of the "teeth".

The results from the survey are presented in Table 1. Location refers to the defined 5m intervals, while A and B corresponds to the left and right sides of the transect respectively. Moisture level corresponds to the scale provided in Morkens & Killeen (2011).

Table 6 Whorl snail survey results

Location	Replicate	Height of vegetation	Dominant plant species	Moisture level	Vertigo recorded
0m	A	1m	Reed canary grass (<i>Phalaris arundinacea</i>)	1	None
	B	1m	Reed canary grass	1	None
5m	A	1m	Reed canary grass	1	None
	B	1m	Reed canary grass	1	None
10m	A	1m	Reed canary grass	2	None
	B	1m	Reed canary grass	2	None
15m	A	1m	Reed canary grass	2	None
	B	1m	Reed canary grass	2	None
20m	A	1.3m	Reed canary grass	2	None
	B	1.3m	Reed canary grass	2	None

Location	Replicate	Height of vegetation	Dominant plant species	Moisture level	Vertigo recorded
25m	A	1m	Bulrush (<i>Typha latifolia</i>)	2	None
	B	1m	Bulrush	2	None
30m	A	1.3m	Bulrush	2	None
	B	1.3m	Bulrush	2	None
35m	A	1.3m	Pedunculate Sedge (<i>Carex pedunculata</i>) and Bulrush	3	4 adult striated whorl snail (<i>Vertigo substriata</i>)
	B	1.3m	Pedunculate Sedge (<i>Carex pedunculata</i>) and Bulrush	3	1 adult striated whorl snail
40m	A	1m	Pedunculate Sedge (<i>Carex pedunculata</i>) and Bulrush	3	None
	B	1m	Pedunculate Sedge (<i>Carex pedunculata</i>) and Bulrush	3	None

Conditions within the study area on the day of the survey were generally very dry, with conditions as per the scale ranging from 1-Dry (No visible moisture on ground surface) to 3- Wet (water rises under light pressure). No standing water was recorded along the transect. The water table was likely below typical levels as a result of the extremely dry summer experienced this year. There was no evidence of any grazing or cutting of vegetation within the suitable habitat at the time of the survey.

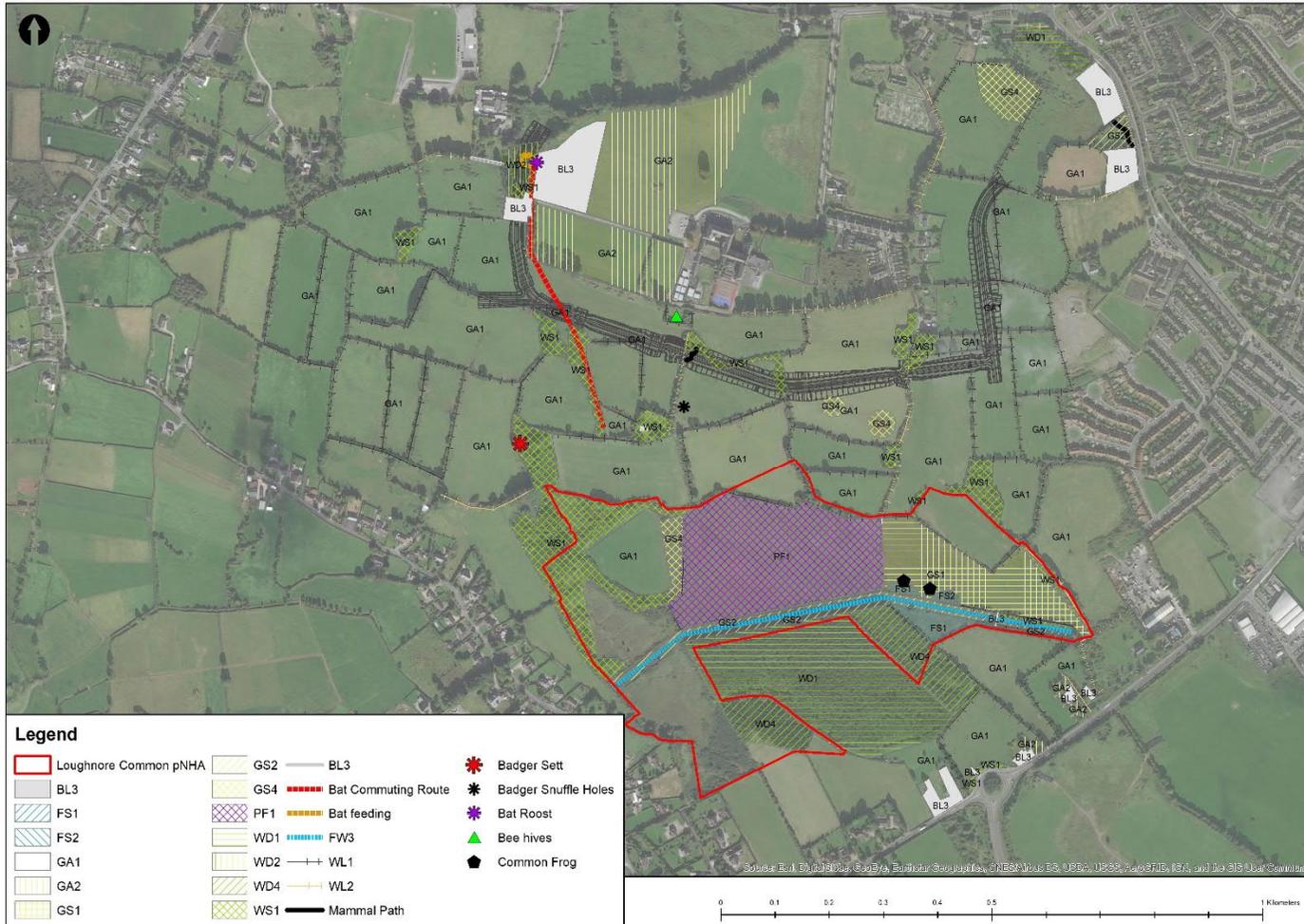
A total of 5 adult striated whorl snail (*Vertigo substriata*) were recorded along the transect. These were recorded within the mixed pedunculate sedge and bulrush portion of the turlough. Striated whorl snails are listed as “Near Threatened” in the Irish Red List of species. The species is not listed under Annex II of the Habitat’s Directive.

No whorl snails listed under Annex II of the Habitat’s Directive were recorded during the survey.

The striated whorl snail is listed as “Near Threatened” in the Irish Red List for Non-Marine Molluscs. The habitats with which the species is associated, sedge swamps and other wetland habitats, are rare in the wider landscape. Within the sedge swamp striated whorl snail (*Vertigo striata*) were only recorded within a very small area. The restriction of the snails to this pocket may be due to low water tables. The lower water tables caused by summer drought may have resulted in individuals remaining low down in the vegetation. They may therefore have been missed during the survey. However, it is of note that the outer fringes of the habitat appeared degraded, possibly caused by nitrification of adjacent watercourses, and draining of surrounding lands.

Given the rarity of sedge swamps within the wider landscape, the listing of striated whorl snails as “near threatened” on the Red List, both the snails and associated habitat are considered to be of **Local Importance (Higher Value)**.

Figure 2: Habitat Map



4 Description of Likely Impacts

The impact assessment and significance of impacts during both the construction and operational phases was assessed with respect to the key ecological receptors identified within the proposed study area.

4.1 Construction Phase

4.1.1 Loss of Habitat

The proposed Project will be approximately 1.7km in length. No protected plant species of conservation value were identified within the study area. There will be no direct damage to protected flora or to habitats protected under the Habitat Directive.

Habitat required to be removed will include agricultural grassland, scrub habitat, sections of hedgerows and treelines and a number of derelict buildings. These habitats were assessed as having Local Importance (higher and lower value). The loss of habitat within the study area will not constitute a significant effect.

The road will not pass through Loughmore Common Turlough pNHA. Loughmore Common Turlough pNHA which is assessed as having National Importance. The road is located 180m north of the turlough at its closest point, and is separated from the habitat by treelines, hedgerows and agricultural grassland. There will be no dust effects or surface water runoff to the turlough during construction given the distance from the site and the intervening habitat which will form a natural barrier.

Sections of hedgerows and treelines will be removed to facilitate the proposed road link. The treelines and hedgerows were identified as important foraging and commuting sites for bats. The loss of foraging and commuting route has the potential to impact local bat populations within the area. The treeline located immediately west of the school and sports fields was identified as having High bat roost potential. A beech tree located within the treeline was confirmed as an active bat roost during the emergency survey.

The derelict farm sheds located south-west of the school will be removed to facilitate the proposed Project. The sheds were identified as having 'Moderate' bat roost potential. No bats were recorded emerging or entering the sheds during the bat surveys, however there is potential that bat may utilise the sheds in the future.

Treelines and hedgerows within the study area are also likely to provide suitable nesting sites for breeding birds. Removal of hedgerows and treelines within the study area would have a moderate effect (depending on the area vegetation cleared) on the carrying capacity of the local environment for nesting birds.

The canal and tall-herb swamp habitats were identified as optimal habitat for common frog. These areas will not be disturbed to facilitate the works. There will be no impact on frogs.

No invasive species listed under Part 1 of the Third Schedule of S.I No. 477 of 2011 were recorded within the study area during the field surveys. Machinery and material movement between sites however can result in the introduction of invasive species. The risk of spreading / translocating invasive species during construction works must be controlled and managed.

4.1.2 Noise / Disturbance

During the construction phase, there will be a temporary increase in noise. The existing background noise levels within the study area is low and characteristic of rural-agricultural areas. The background noise levels increase slightly towards the outer site boundaries which are located in proximity to regional roads and residential areas.

A badger sett was identified approximately 320m from the proposed road. The sett was not in use however there is potential that the sett may be utilised in the future. The NRA guidelines (NRA, 2005) state that no construction works should be undertaken within 50m of active setts and no blasting or piling should be undertaken within 150m of active setts. As the sett occurs 320m from the proposed works area there is no potential for disturbance.

A bat roost was confirmed within a beech tree located at the north-western corner of the site. The treeline is also used as a foraging and commuting route by two species of bat. All other treelines within the study area were identified as having Negligible suitability to support bat roosts but are used as foraging and commuting routes by bats. The derelict farm sheds were identified as having 'Moderate' bat roost potential. Highway sounds, both from construction and operation can create a loud noise environment that may potentially interfere with bats' abilities to hear and respond to the many other biologically important sounds that surround them (The California Department of Transportation, 2016). Therefore, in the event that construction works are undertaken after sunset and before sunrise when bats are active, in proximity to the treelines and confirmed bat roost, there is potential for disturbance to the bats. However, this would not be considered significant given the ample availability of alternative high quality hedgerows for foraging and commuting in the locality.

4.1.3 Pollution

During the construction phase there is potential for spills and leaks of oils, fuels and chemicals from storage areas, plant, and equipment used during construction to impact on the surrounding habitats. Accidental spills of fuels, oils and construction materials (e.g. concrete) can affect habitat quality through deposition of materials in the environment. The works are removed from any habitats of significant ecological value. The surrounding agricultural grasslands will form a natural swale to any accidental spill.

The excavation activities are likely to generate small amounts of dust within the works area. The deposition of dust on habitats can inhibit effective photosynthesis and transpiration. The proposed road is located at such a distance from sensitive ecological receptors that dust deposition will not occur within such habitats.

The use of lighting is likely to be necessary during the construction phase of the Project. Any direct illumination of a bat roost would constitute a significant effect as it could affect bat emergence from the roost.

4.2 Operational Phase Impacts

4.2.1 Pollution

Drainage will be to attenuation basins which will connect to existing road drainage. The proposed drainage system will be designed in accordance with the NRA guidelines *Drainage Design for national Road Schemes – Sustainable Drainage Options (NRA, 2014)* which will ensure effective surface water drainage. There is no potential for impact to the receiving waters during the operational phase.

4.2.2 Noise / Disturbance

The operation of the road link will result in a change in noise levels within the area due to the redistribution in traffic along the new roads. The roads however are located in proximity to existing regional roads and residential area and existing background noise are likely to be slightly elevated. The increase in noise level is therefore unlikely to have a significant impact on the surrounding environment.

The risk of traffic related mortality of mammals during the operation of the road is considered low. Traffic on the roads will be slow flowing due to the presence of a number of roundabouts.

4.2.3 Lighting

Street lighting will be installed along the proposed roads which will result in an increase of artificial lighting within the immediate surrounding area. An increase in light can deter nocturnal fauna, in particular bat species. Lighting can impact bats' roosting sites, commuting routes and foraging areas (Bat Conservation Ireland, 2010). A treeline located west of the school was assessed as having high bat roost potential. A bat roost was confirmed within the beech within the treeline. The treeline was also confirmed to be used as a foraging and commuting route by two species of bat. Direct illumination of a bat roost or commuting and foraging routes is likely to affect bat emergence from the roost, alter feeding patterns, and deter bats from commuting along affected corridors, ultimately affecting the bat population.

5 Mitigation Measures

Mitigation which should be employed to ensure no significant effects on biodiversity from the Project are described hereunder.

Mitigation is prescribed in accordance with the hierarchical hierarchy set out in the CIEEM guidelines; *Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater and Coastal (2016)* which states that a sequential process should be adopted to avoid, mitigate and compensate ecological impacts.

5.1 Construction Phase

5.1.1 Vegetation Clearance

Birds

Under subsection 1 of Section 40 of the Wildlife Acts 1976 to 2012, it is not an offence to clear vegetation in the course of road or other construction works or in the development of preparation of sites on which any building or other structure is intended to be provided. However, the Contractor shall aim to limit disturbance to breeding birds and their nests/eggs as far as possible. Where feasible, vegetation clearance should be carried out outside of the bird breeding season. If this is not possible, a pre-construction survey must be undertaken by an ecologists/ornithologist who will identify any nests present along the proposed road route. Where an amber or red listed species nest is identified, the nest will be isolated until such a time that the chicks have fledged or where breeding has failed.

Bats

A bat roost was confirmed within a beech tree located immediately west of the primary school and sports field. In the event that the tree is required to be removed to facilitate the proposed road link a derogation license under the Wildlife Act should be sought from NPWS prior to the works commencing. Proposed mitigation measures agreed with NPWS as part of the derogation license will be implemented to minimise impacts to bats.

The remaining trees within the treeline were identified as having high bat roost potential and should be retained where possible. If the trees are required to be felled a pre-construction bat survey of the remaining trees within the treeline should be undertaken to determine the presence or absence of bat roosts. If a bat roost is confirmed a derogation license should be sought from NPWs in order to fell the tree(s).

All trees required to be felled to facilitate the Project should be felled in accordance with NRA guidelines.

In the event that the derelict farm sheds are required to be removed to facilitate the Project, a pre-construction bat survey of the derelict farm sheds should also be undertaken to determine the presence of any new bat roosts. If a bat roost is confirmed within the derelict sheds a derogation license to destroy the building will be required from NPWS.

It is recommended that bat boxes are installed to provide alternative, safe roosting sites for bats. The bat boxes should be designed in accordance with Bat Conservation Ireland guidelines; *Bats and Bat Boxes Guidance Notes for: Agri-environmental Scheme (2015)*. The bat boxes should

be erected prior to the construction works commencing and should not be placed in lit up areas or areas of future development.

Frog

No impacts on frog are likely.

Rare and protected plant species

No protected plant species were recorded within the study area, however opposite-leaved pondweed has previously been recorded within the pNHA site. No works will take place in proximity to the canal. No mitigation is required.

A number of early marsh orchids and common spotted orchids were identified within the calcareous grassland. The two species of orchid are not protected but are considered rare. These will not be affected directly or indirectly by the road. As such no mitigation is necessary.

5.1.2 Pollution control

For the purpose of general environmental protection, pollution control measures should be employed during construction. These should be designed, installed and maintained in accordance with the CIRIA (C648) guidelines; *Control of water pollution from linear construction projects Technical guidance*.

In order to comply with regulations under 49 and 50 of the European Communities (Birds and Natural Habitat) Regulations (2011) the appointed Contractor should ensure biosecurity measures are implemented during the construction phase to ensure the introduction and translocation of invasive species is prevented. The biosecurity measures should include the visual inspection of vehicles for evidence of attached plant or animal material prior to entering and leaving the works area. All machinery and equipment should be dry and disinfected (if previously used in a contaminated site).

5.2 Operational Phase

5.2.1 Lighting

Lighting requirements in proximity to the confirmed bat roost (if retained) or to the bat boxes should be designed in accordance with the Bat Conservation Ireland guidelines; *Bats and Lighting Guidance Notes: Planners, engineers, architects and developers*. It is of note the lighting will likely be LED lights. Directional lighting and light shields should be used where possible to minimise light spill.

5.3 Residual Impacts

It is anticipated that with the implementation of mitigation measures (as detailed above), the construction and operational phases of the proposed Mungret Link Streets Project is unlikely to impact significantly on the fauna and flora of the study area and surroundings.

6 References

- Andrew H., et al (2013) *Bat Tree Habitat Key A Ecol*, Brightwater
- *Bat Conservation Ireland (2015) Bats and Bat Boxes Guidance Notes for: Agri-environmental Scheme.*
- *Bat Conservation Ireland (2010) Bats and Lighting Guidance Notes for: Planners, engineers, architects and developers.*
- *CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater and Coastal.*
- *CIRIA C741(2015) Environmental good practice on site guide (fourth edition).*
- *Environmental Agency (2003) Field Survey Guidance manual: 2003 Version.*
- *Fossit (2000) A Guide to Habitats in Ireland*
- *Goodwillie, R., (1992). Turloughs Over 10ha, Vegetation Survey & Evaluation. A report for the National Park & Wildlife Service, Office of Public Works.*
- *NRA (2014) Drainage Design for National Road Scheme – Sustainable Drainage Options*
- *NRA (2009a) Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*
- *NRA (2009b) Guidelines for Assessment of Ecological Impacts of National Road Schemes*
- *NRA (2005a) Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes*
- *NRA (2005b) Guidelines for the Treatment of Bats During the Construction of National Road Schemes*
- *NRA 2006) Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes*
- *The California Department of Transportation. (2016). Technical Guidance for the Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Bats. July. (Contract 43A0306.) Sacramento, CA.*
- *Smith et al., (2011) Best Practice Guidance for Habitat Survey and Mapping*

Appendices

A. Wintering Bird Survey

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A. Wintering Bird Survey

Winter Bird Survey of lands at Mungret, Co. Limerick



Version: 19th June 2018



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INTRODUCTION

This report outlines the results of a winter bird survey completed at lands at Mungret, Co Limerick, during February and March 2018. The purpose of the survey was to assess the bird species using the site during this period using a combination of walkover and vantage point surveys. Figure 1 illustrates the location of the lands at Mungret, Co. Limerick. The site consists mainly of grass fields bounded by hedgerows. To the south of the site there is an area of rough/wet grassland and a small area of planted broadleaved woodland.

METHODOLOGY

A desktop study was undertaken to identify bird species that have the potential to occur on the proposed development site.

A review of records of birds from the area was undertaken by reviewing the websites of the National Biodiversity Data Centre (NBDC) and the National Parks and Wildlife Service (NPWS). The Bird Atlas 2007-2011 was also used to gather information on bird species that may occur in the Mungret Area (Balmer, D.E., *et al.*, 2013). A full bibliography of information sources reviewed is given in the reference section.

The site was visited on the 17th February 2018, 23rd February 2018, 8th March and 24th March 2018. On these days site the site was surveyed using a combination of vantage point watching and walkover surveying from dawn to the early afternoon. The surveys coincided with dry bright days and were considered to be ideal survey conditions. All bird species seen and heard were recorded. A dusk survey was also completed on the 17th February 2018. The surveys were completed by Kevin Collins and Dr. Will O'Connor.

RESULTS

Desk study

A full list of bird records from the NBDC online maps for the lands at Mungret, Co. Limerick and the likelihood of these species occurring on the site is included in Appendix 1.

Desk study involved review of available data from the most recent Atlas 2007-2001. The site falls into two tetrads, R55G and R55L. For R55G there were no winter records. Breeding season records were of a Cuckoo in song. For R55L there were 10 species in winter; Woodpigeon, Collared Dove, Blackcap, Great Tit, Magpie, Rook, Chaffinch, Goldfinch, Linnet and Redpoll. There was a record of Buzzard present during the breeding season.

Field survey

The lands at Mungret, Co. Limerick are located approximately 360m south of Mungret, covering a wide area consisting mostly of agricultural grassland with small sections of woodland and buildings. The south and south-east of the site borders part of the R526 for ca. 2.3km, the east of the site roughly borders the R510 for ca. 1.6km, the north of the site with the R859 for ca. 2km and the west of the site cuts through farmland areas for approximately 3.3km. Mungret Woods housing estate is located in the middle of the site with Mount Mungret Estate to the east in the Liskelly townland. No watercourses occur on the site, but a large drain runs through the south of the site. No Natura 2000 Sites, including SPAs, occur within the lands at Mungret, Co. Limerick. The locations of the Lower

River Shannon SAC and River Shannon and River Fergus Estuaries SPA, in relation to the site, are indicated in Figure 2.

Overall, a total of 34 bird species were recorded during this site visit. Details of the species recorded, their BoCCI status (Colhoun & Cummins 2013), and which habitat they are associated with, are given in Table 1.

The bird species recorded were considered to be typical farmland bird species. Buzzards were recorded during all site visits are likely to breed on the site. Kestrels were also regularly noted and will breed on the proposed development site.

Snipe were observed in the wet grassland area to the north of the lands at Mungret. Coot, Sparrowhawk and Mallard were some of the other species noted to occur on the site.

Most species are associated with hedgerows and fields. Many of these species are also associated with woodland. Hedgerow birds are really birds of the woodland edge. Most of the species associated with the area of wet/rough grassland are classed as either amber or red on the BoCCI list.

A section of broadleaved woodland is present to the south of the site which would provide suitable habitat and shelter for woodland bird species such as Cuckoo, which could potentially occur during the breeding season.

There is a large drain to the south of the site just north of the section of broadleaved woodland. The drain was noted to be heavily overgrown with vegetation and is likely to have poor water quality. There are various other small drains scattered around the lands at Mungret. These drains are likely to contribute to insect production in the area serving as an attraction for bird species. Coot, Mallard, Grey Heron and Snipe were recorded along this drain.

The hedgerows on the site are considered to be of good quality, with dense coverage and scattered mature trees. This provides suitable habitat for farmland birds which occur on the site. The woodland and hedgerows present on site support bird species such as Blue Tit, Great Tit, Coal Tit, Blackbird, Rook, Jackdaw, Song Thrush, Wren, Blackbird, Dunnock and many others.

Wet grassland is present in the southern part of the site which provides suitable habitat for bird species such as Snipe.

Other ecological observations

The site is used by Hares and they are likely to breed on the site.

CONCLUSIONS AND RECOMMENDATIONS

The number of species found at this site and the species composition are in line with what would be expected in farmland in Co. Limerick. There were no species on Annex 1 of the EU Birds Directive. There were also no species associated with the River Shannon and River Fergus estuaries SPA recorded on the site. It is considered unlikely that they would use the site.

There were 2 species on the BoCCI red list, Meadow Pipit and Grey Wagtail. These two species were added because of a steep decline in their numbers during the severe winters of 2009/10 and 2010/11. These populations have since recovered.

Grey Wagtails were recorded along the drain on the south-eastern side of the site. These are common and widespread breeding birds in Ireland but suffered a severe decline following the very cold winters of 2009/10 to 2011/12. This species has shown a strong recovery since then (Crowe *et al.* 2017). As the decline in the breeding population of Grey Wagtails was due to severe winter conditions, and not habitat loss, I do not believe that mitigation measures are required.

The numbers of Snipe on the site, roughly 20, is well short of the threshold for national importance of 100.

The area of wet/rough grassland is the most important from a bird conservation point of view, but it is too small and isolated to support important populations of species of concern.

The most important habitat on the site for birds is the wet grassland habitat. The hedgerows and treelines are also of importance. Water quality in the drain on the site is poor but if that was improved this would be an important ecological feature on the site. Any development on the site should try to protect the wet grassland area, protect hedgerows and mature trees and also address the apparent water quality problems in the drain.

Table 1 Result of the winter bird survey at the lands at Mungret, Co Limerick.

	BoCCI status	Fields/Hedgerows	Rough/Wet Grass	Woodland	Drain
Grey Heron			*		*
Common Buzzard		*	*	*	
Kestrel	Amber	*	*		
Sparrowhawk	Amber			*	
Snipe	Amber		*		
Wood Pigeon		*		*	
Magpie		*			
Jackdaw		*			
Rook		*			
Hooded Crow		*			
Great Tit		*		*	
Long-tailed Tit		*		*	
Blue Tit		*		*	
Wren		*		*	
Goldcrest	Amber	*		*	
Starling	Amber	*			
Blackbird		*		*	
Mistle Thrush	Amber	*		*	
Redwing		*			
Fieldfare		*	*		
Song Thrush		*		*	
Stonechat	Amber		*		
Robin	Amber	*			
Duncock		*			
Pied Wagtail		*			
Grey Wagtail	Red		*		
Meadow Pipit	Red		*		
Chaffinch		*		*	
Goldfinch		*		*	
Linnet	Amber	*			
Bullfinch		*			
Coot					*
Mallard					*
Snipe					*



 Site Location	Date: 20.02.2018	Drawn by: Amy Butler Checked by: William O'Connor
Location of lands at Mungret, Co. Limerick for Winter Bird Survey		

Figure 1 Location of Lands at Mungret, Co. Limerick for Winter Bird Survey.

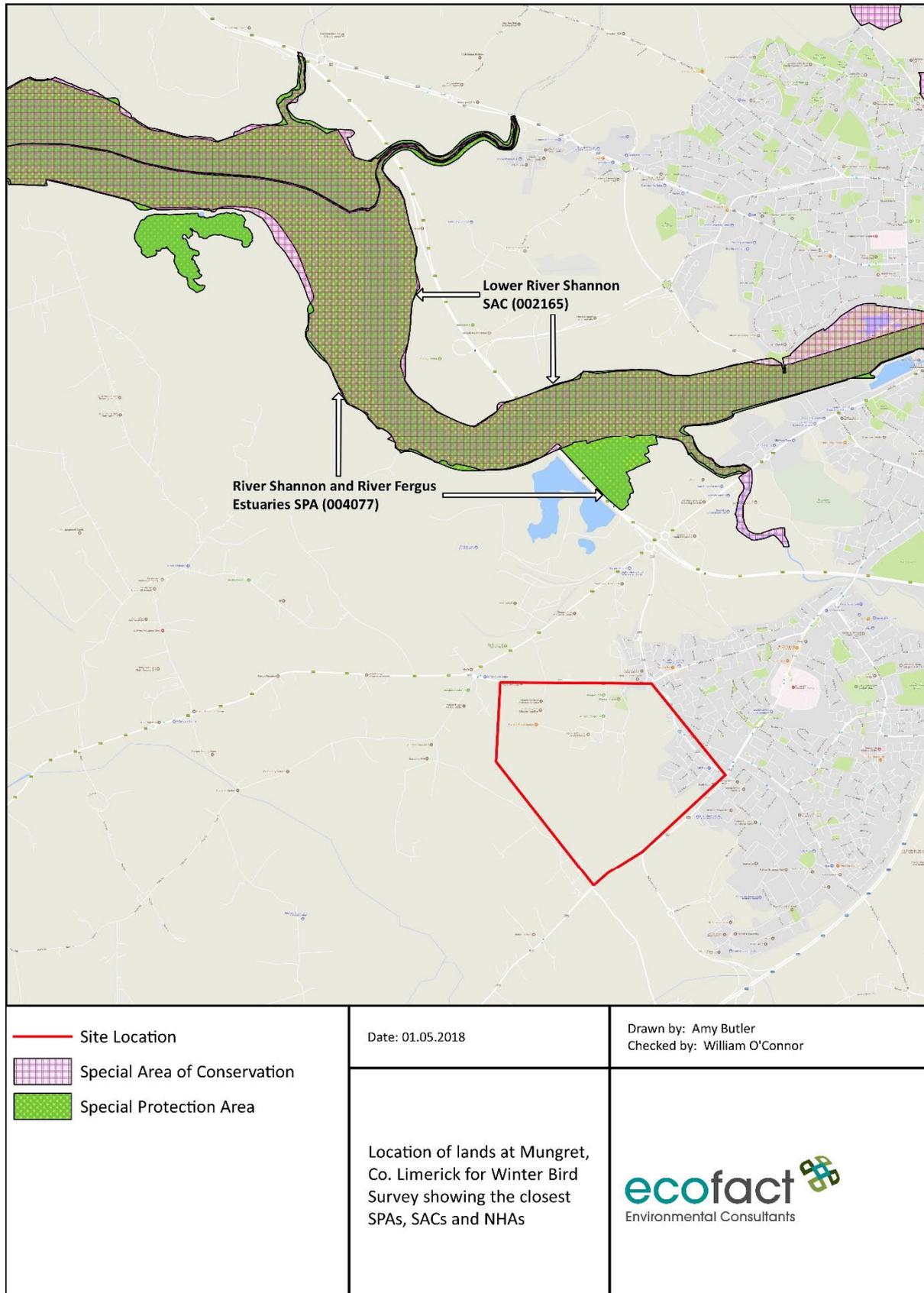


Figure 2 Locations of the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA, in relation to the lands at Mungret.

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Crowe, O. Coombes, R. Tierney, T. Walsh, A. OHalloran, J. (2017). *Countryside Bird Survey Report 1998-2016*, BirdWatch Ireland, Wicklow.

PLATES



Plate 1 Wet grassland at the Mungret site.



Plate 2 Large drain bordering planted broadleaved woodland at the Mungret site.



Plate 3 Improved agricultural grassland at the Mungret site.



Plate 4 Improved agricultural grassland at the south of the Mungret site.



Plate 5 Planted broadleaved woodland.



Plate 6 Buzzard flying over site, February 2018.



Plate 7 Grey Heron on wet grassland on the site, February 2018.



Plate 8 Fieldfare on the Mungret site, February 2018.



Plate 9 Redwing are also winter visitors and were recorded during the current survey.



Plate 10 Redwing and Mistle thrush on the Mungret site, February 2018.



Plate 11 Sparrowhawk flying into woodland on the site.



Plate 12 Stonechat on the Mungret site, February 2018.

APPENDIX 1

Table A.1 The NBDC online maps show records of the bird species below found in the 10km Grid Square R55 which includes the lands at Mungret, Co. Limerick.

Common Name	Scientific Name	Likely to occur on the site
Mute Swan	<i>Cygnus olor</i>	
Whooper Swan	<i>Cygnus cygnus</i>	
Greylag Goose	<i>Anser anser</i>	
Common Shelduck	<i>Tadorna tadorna</i>	
Wigeon	<i>Anas penelope</i>	
Gadwall	<i>Anas strepera</i>	
Teal	<i>Anas crecca</i>	
Pintail	<i>Anas acuta</i>	
Shoveler	<i>Anas clypeata</i>	
Pochard	<i>Aythya ferina</i>	
Tufted Duck	<i>Aythya fuligula</i>	
Scaup	<i>Anas marila</i>	
Goldeneye	<i>Bucephala clangula</i>	
Red-breasted Merganser	<i>Mergus serrator</i>	
Goosander	<i>Mergus merganser</i>	
Pheasant	<i>Phasianus colchicus</i>	✓
Cormorant	<i>Phalacrocorax carbo</i>	
Little Egret	<i>Egretta garzetta</i>	
Grey Heron	<i>Ardea cinerea</i>	✓
Little Grebe	<i>Tachybaptus ruficollis</i>	
Great Crested Grebe	<i>Podiceps cristatus</i>	
Hen Harrier	<i>Circus cyaneus</i>	
Sparrowhawk	<i>Accipiter nisus</i>	✓
Kestrel	<i>Falco tinnunculus</i>	✓
Merlin	<i>Falco columbarius</i>	
Peregrine	<i>Falco peregrinus</i>	
Water Rail	<i>Rallus aquaticus</i>	
Moorhen	<i>Gallinula chloropus</i>	✓
Coot	<i>Fulica atra</i>	✓
Oystercatcher	<i>Haematopus ostralegus</i>	
Ringed Plover	<i>Charadrius hiaticula</i>	
Golden Plover	<i>Pluvialis apricaria</i>	
Lapwing	<i>Vanellus vanellus</i>	
Dunlin	<i>Calidris alpina</i>	
Jack Snipe	<i>Lymnocyptes minimus</i>	
Snipe	<i>Gallinago gallinago</i>	✓
Woodcock	<i>Scolopax rusticola</i>	
Black-tailed Godwit	<i>Limosa limosa</i>	
Curlew	<i>Numenius arquata</i>	
Greenshank	<i>Tringa nebularia</i>	
Redshank	<i>Tringa totanus</i>	
Turnstone	<i>Arenaria interpres</i>	
Black-headed Gull	<i>Larus ridibundus</i>	
Common Gull	<i>Larus canus</i>	
Lesser Black-backed Gull	<i>Larus fuscus</i>	
Herring Gull	<i>Larus argentatus</i>	
Great Black-backed Gull	<i>Larus marinus</i>	
Rock Dove / Feral Pigeon	<i>Columba livia</i>	✓
Stock Dove	<i>Columba oenas</i>	✓
Woodpigeon	<i>Columba palumbus</i>	✓
Cuckoo	<i>Cuculus canorus</i>	✓
Barn Owl	<i>Tyto alba</i>	
Long-eared owl	<i>Asio otus</i>	
Kingfisher	<i>Alcedo atthis</i>	

Common Name	Scientific Name	Likely to occur on the site
Magpie	<i>Pica pica</i>	✓
Swift	<i>Apus apus</i>	✓
Jay	<i>Garrulus glandarius</i>	✓
Skylark	<i>Alauda arvensis</i>	✓
Sand Martin	<i>Riparia riparia</i>	
House Martin	<i>Delichon urbicum</i>	✓
Treecreeper	<i>Certhia familiaris</i>	✓
Dipper	<i>Cinclus cinclus</i>	
Brambling	<i>Fringilla montifringilla</i>	✓
Linnet	<i>Carduelis cannabina</i>	✓
Lesser Redpol	<i>Carduelis flammea cabaret</i>	✓
Jackdaw	<i>Corvus monedula</i>	✓
Rook	<i>Corvus frugilegus</i>	✓
Hooded Crow	<i>Corvus cornix</i>	✓
Raven	<i>Corvus corax</i>	✓
Goldcrest	<i>Regulus regulus</i>	✓
Blue Tit	<i>Parus caeruleus</i>	✓
Great Tit	<i>Parus major</i>	✓
Coal Tit	<i>Parus ater</i>	✓
Swallow	<i>Hirundo rustica</i>	✓
Long-tailed Tit	<i>Aegithalus caudatus</i>	✓
Chiffchaff	<i>Phylloscopus collybita</i>	✓
Willow Warbler	<i>Phylloscopus trochilus</i>	✓
Blackcap	<i>Sylvia atricapilla</i>	✓
Whitethroat	<i>Sylvia communis</i>	✓
Grasshopper Warbler	<i>Locustella naevia</i>	✓
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	✓
Wren	<i>Troglodytes troglodytes</i>	✓
Starling	<i>Sturnus vulgaris</i>	✓
Blackbird	<i>Turdus merula</i>	✓
Fieldfare	<i>Turdus pilaris</i>	✓
Song Thrush	<i>Turdus philomelos</i>	✓
Redwing	<i>Turdus iliacus</i>	✓
Mistle Thrush	<i>Turdus viscivorus</i>	✓
Spotted Flycatcher	<i>Muscicapa striata</i>	✓
Robin	<i>Erithacus rubecula</i>	✓
Stonechat	<i>Saxicola torquata</i>	
Dunnock	<i>Prunella modularis</i>	✓
House Sparrow	<i>Passer domesticus</i>	✓
Grey Wagtail	<i>Motacilla cinerea</i>	✓
Pied Wagtail	<i>Motacilla alba yarrellii</i>	✓
Meadow Pipit	<i>Anthus pratensis</i>	✓
Chaffinch	<i>Fringilla coelebs</i>	✓
Greenfinch	<i>Carduelis chloris</i>	✓
Goldfinch	<i>Carduelis carduelis</i>	✓
Siskin	<i>Carduelis spinus</i>	✓
Bullfinch	<i>Pyrrhula pyrrhula</i>	✓
Reed Bunting	<i>Emberiza schoeniclus</i>	✓



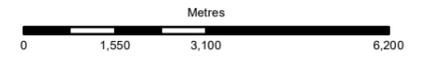
Appendix 2

Figures from Water Quality Assessment Report



— Site Boundary

Coordinate System: IRENET95 Irish Transverse Mercator



Rev	Date	By	Chkd	Appd
D1	2020-09-09	LC	MK	GB

ARUP

50 Ringsend Road
 Dublin D04 T6X0
 t: +353 1 233 4304
 www.arup.com

Client
Limerick City and County Council

Project Title
**Appropriate Assessment Screening
 for Mungret Residential
 Development**

Drawing Title
Figure 1: Site location

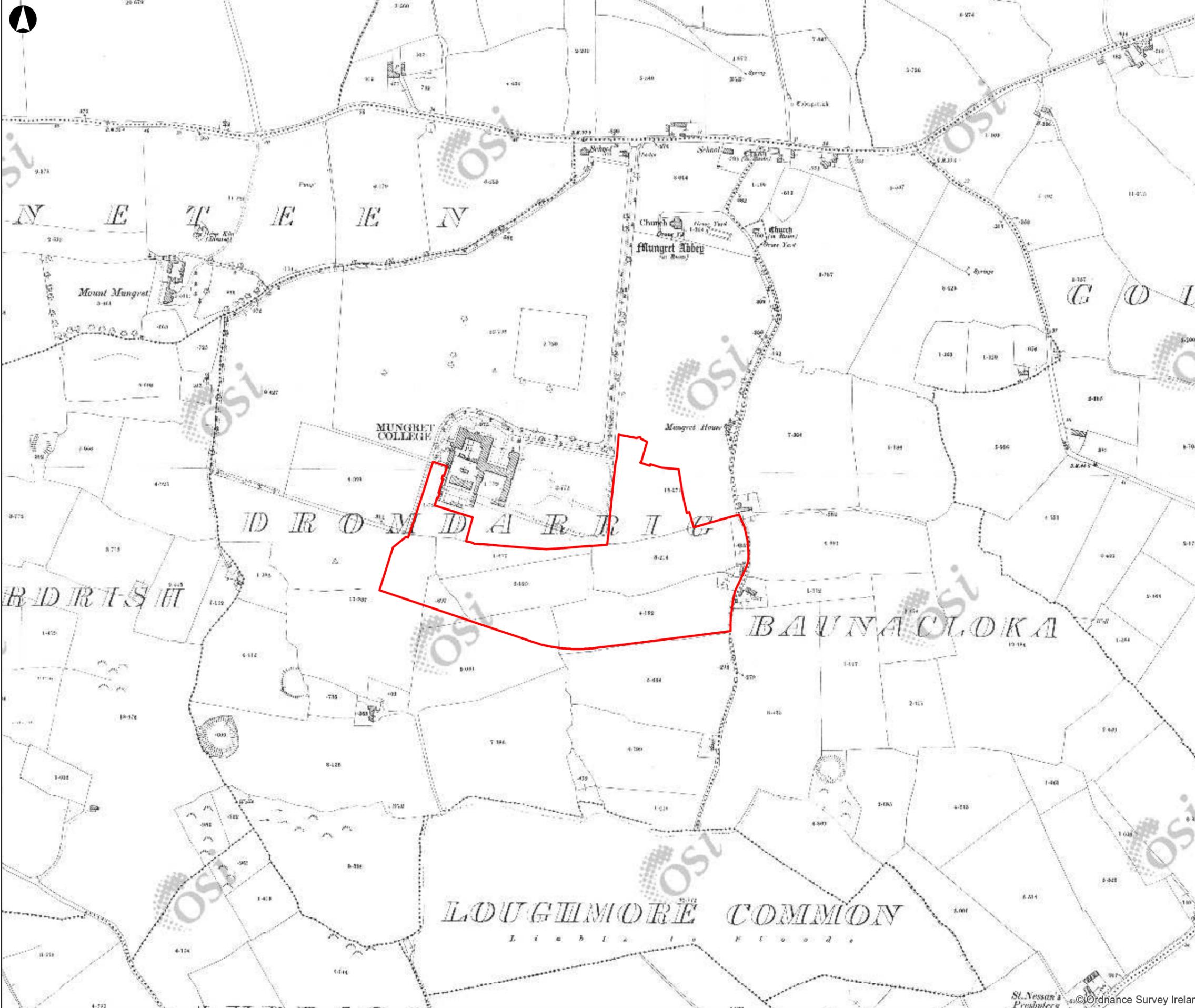
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1:120,000

Role
Hydrogeology

Suitability
Issue

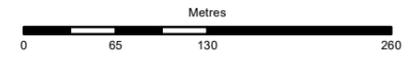
Arup Job No 261585	Rev Issue
------------------------------	---------------------

Name
001



— Site Boundary

Coordinate System: IRENET95 Irish Transverse Mercator



Rev	Date	By	Chkd	Appd
D1	2020-09-09	LC	MK	GB

ARUP

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Client
Limerick City and County Council

Project Title
**Appropriate Assessment Screening
 for Mungret Residential
 Development**

Drawing Title
**Figure 2: OSI historic 25 inch map
 (1888-1913)**

Scale at A3
1:5,000

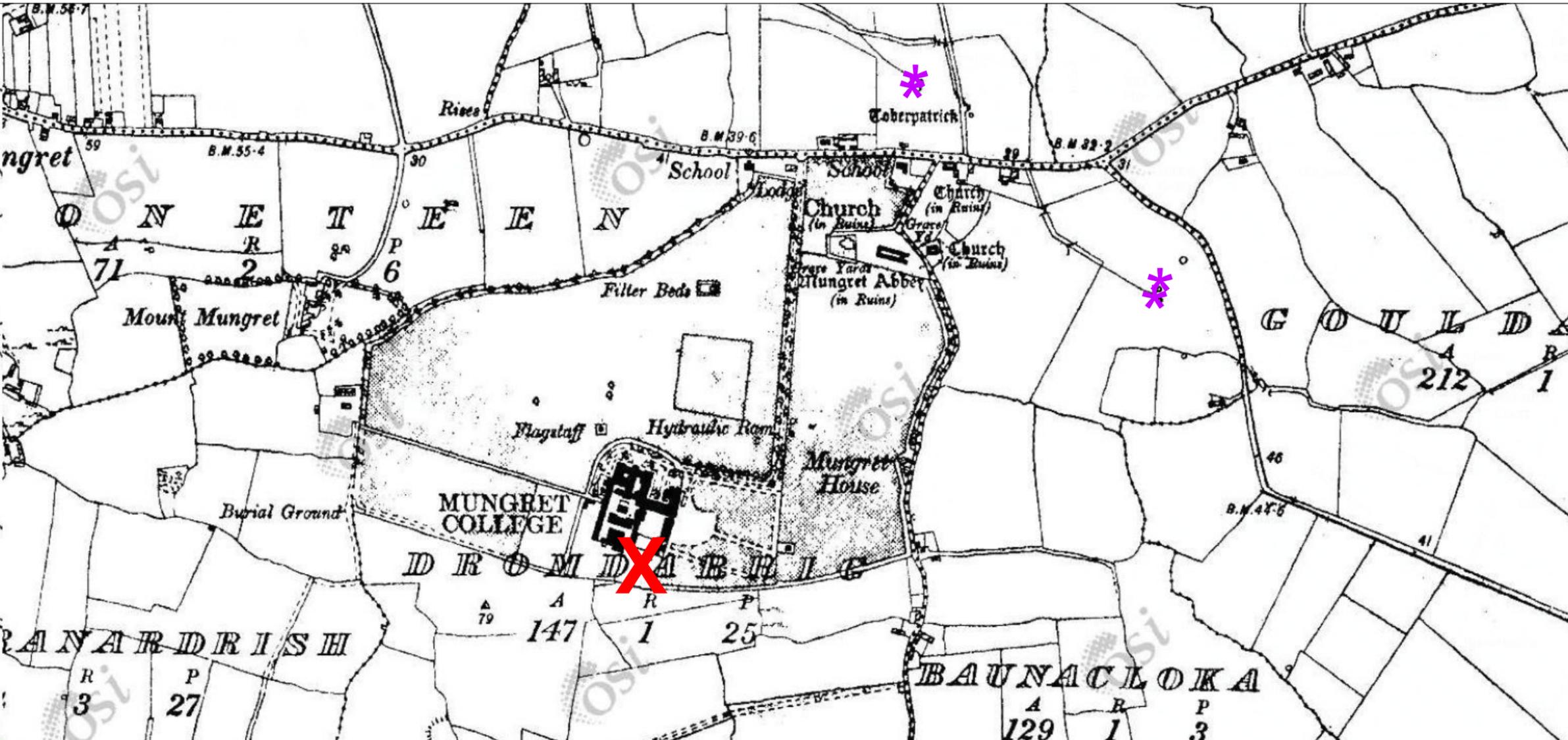
Role
Hydrogeology

Suitability
Issue

Arup Job No
261585

Name
002

Rev
Issue



- X Site Boundary
- * Spring Features

Coordinate System: IRENET95 Irish Transverse Mercator

D1	2020-09-09	LC	MK	GB
Rev	Date	By	Chkd	Appd

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Dublin D04 T6X0
t: +353 1 233 4304
www.arup.com

Client
Limerick City and County Council

Project Title
**Appropriate Assessment Screening
for Mungret Residential
Development**

Drawing Title
**Figure 3: OSI historic 6 inch map
(1888-1913)
Not to Scale**

Scale at A3

Role
Hydrogeology

Suitability
Issue

Arup Job No 261585	Rev Issue
------------------------------	---------------------

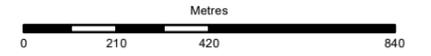
Name
003



Legend

- Site Boundary
 - BH Groundwater monitoring boreholes
 - Karst features
 - ▶ Canal / stream flow direction
 - ▶ N69 surface water drains
 - Surface water features
 - ▶ River flow direction arrows
- SAC and SPA**
- Lower River Shannon SAC
 - A999 Wetlands and Waterbirds

Coordinate System: IRENET95 Irish Transverse Mercator



D1	2020-09-09	LC	MK	GB
Rev	Date	By	Chkd	Appd

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50 Ringsend Road
 Dublin D04 T6X0
 t: +353 1 233 4304
 www.arup.com

Client
Limerick City and County Council

Project Title
Appropriate Assessment Screening for Mungret Residential Development

Drawing Title
Figure 4: Surface water flow directions, groundwater monitoring boreholes and karst features in Loughmore Common

Scale at A3
1:16,000

Role
Hydrogeology

Issue

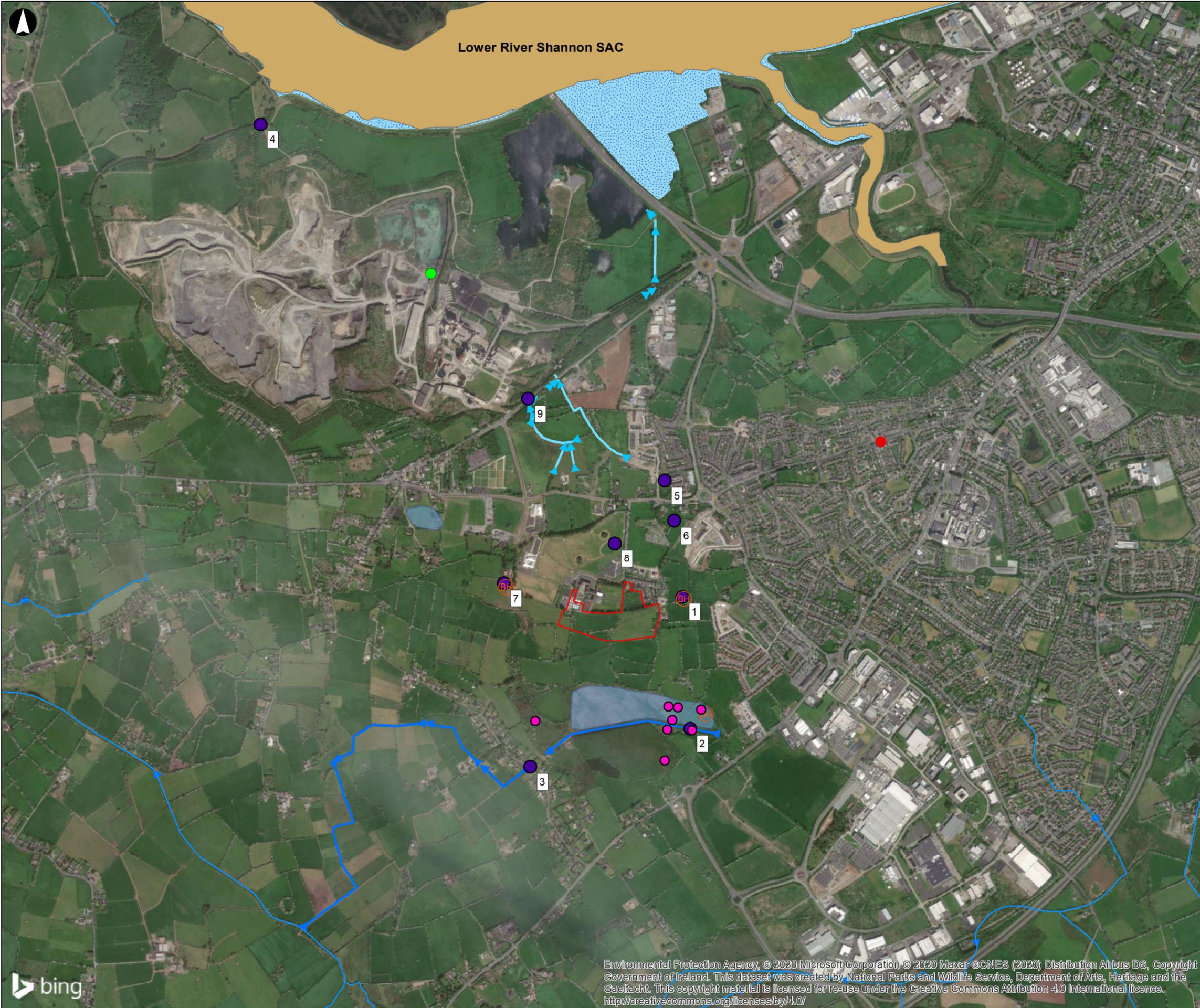
Arup Job No
261585

Rev
Issue

Name
004

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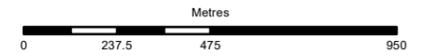
Legend

- Site Boundary
- Quarry sump
- Karst Features
- Ⓟ Groundwater monitoring boreholes
- Site Features
- Dye outfall location
- ➡ Canal / stream flow direction
- ➡ N69 surface water drains
- ▭ Surface water features
- ➡ River flow direction arrows

SAC and SPA

- ▭ Lower River Shannon SAC
- ▨ A999 Wetlands and Waterbirds

Coordinate System: IREN95 Irish Transverse Mercator



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Client
Limerick City and County Council

Project Title
Appropriate Assessment Screening for Mungret Residential Development

Drawing Title
Figure 5: Location of features identified during site walkover

Scale at A3
1:18,000

Role
Hydrogeology

Issue

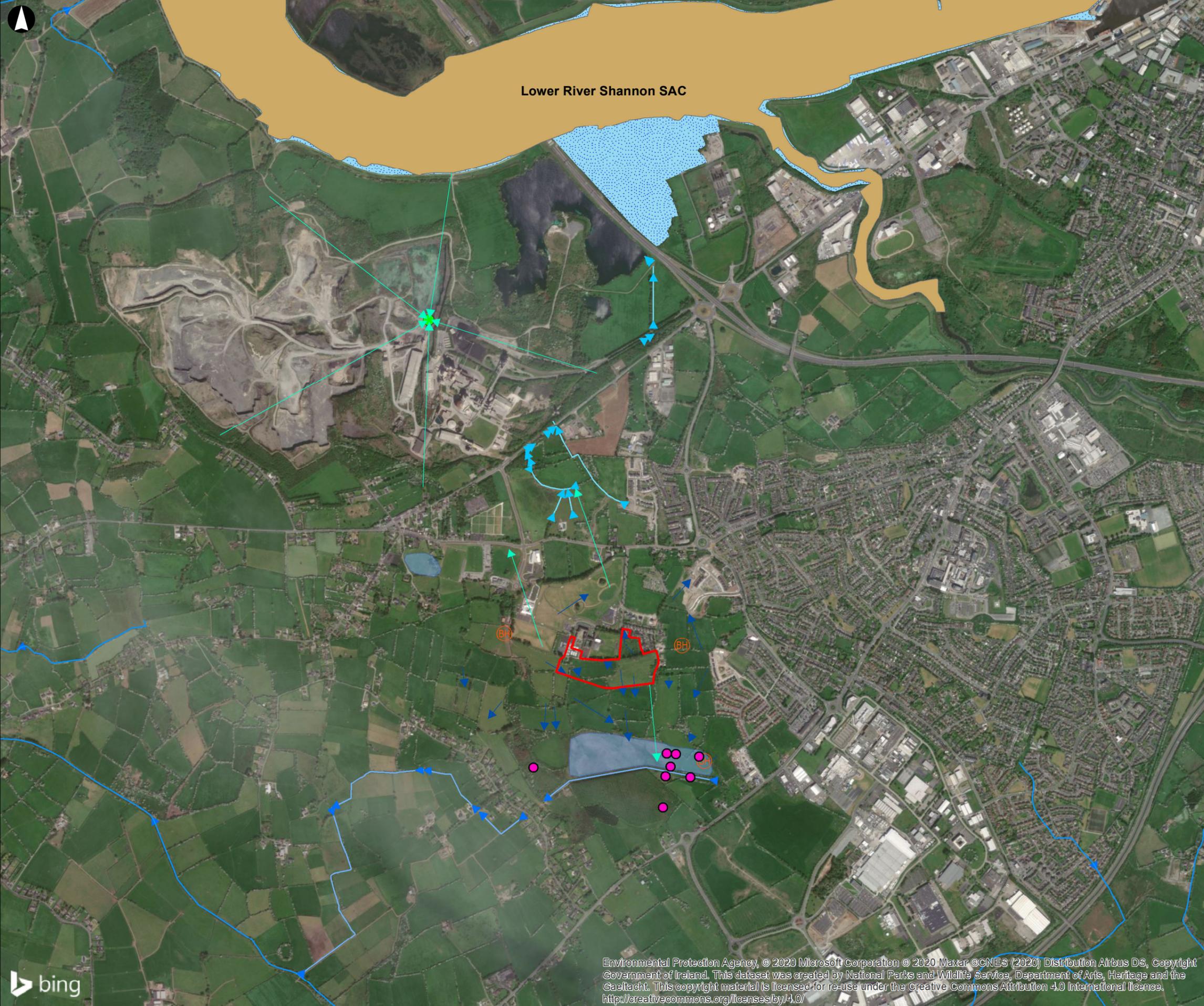
Arup Job No
261585

Rev
Issue

Name
005

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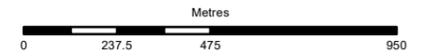




Legend

- Site Boundary
 - Surface water pathway
 - Groundwater pathway
 - ★ Quarry sump
 - Karst Features
 - BH Groundwater monitoring boreholes
 - Canal / stream flow direction
 - N69 surface water drains
 - Surface water features
 - River Flow Direction Arrows
- SAC and SPA**
- Lower River Shannon SAC
 - A999 Wetlands and Waterbirds

Coordinate System: IRENET95 Irish Transverse Mercator



D1	2020-03-09	LC	MK	GB
Rev	Date	By	Chkd	Appd

ARUP

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 t: +353 1 233 4304
 www.arup.com

Client
Limerick City and County Council

Project Title
**Appropriate Assessment Screening
 for Mungret Residential
 Development**

Drawing Title
**Figure 6: Surface water and
 groundwater flow directions**

Scale at A3
1:18,000

Role
Hydrogeology

Issue

Arup Job No
261585

Rev
Issue

Name
006

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Appendix 3

Photographs from Site Walkover

Photographs from Site Walkover (27th February 2020)



Image 1: Photograph taken on the proposed development site. Ponding observed on site after prolonged period of rainfall.



Image 2: Photograph taken on the proposed development site.



Image 3: Photograph taken of BH205. Wellhead is secure with protective fencing erected.



Image 4: Photograph of manmade canal and toe drain



Image 5: Water features from left to right: turlough, manmade canal and toe drain.



Image 6: Historic spring site beside housing development fenced-off at time of site visit.



Image 7: Photograph taken of BH211. Wellhead is locked, protective fencing can be seen on the ground.



Image 8: Photograph taken in Mungret Park. Ponding observed in the lower gradients of the site.



Image 9: Photograph taken in Mungret Park showing fenced off feature.



Image 10: Photograph taken from the N69 showing culvert perpendicular to the road flowing north

Appendix 4

Calculations from Contaminate Concentration Assessment

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		Benzene		from Level 1
Target Concentration	C _T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to pollutants in all phases (e.g. field derived value)

Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C ₀	1.38E-01	mg/l
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days
Calculated decay rate	λ	7.70E-101	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m
Plume thickness at source	Sy	5.00E+00	m
Saturated aquifer thickness	da	5.00E+01	m
Bulk density of aquifer materials	ρ	2.00E+00	g/cm ³
Effective porosity of aquifer	n	1.10E-02	fraction
Hydraulic gradient	I	2.30E-02	fraction
Hydraulic conductivity of aquifer	K	3.60E-01	m/d
Distance to compliance point	x	1.90E+03	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	1.00E+100	days
Parameters values determined from options			time variant options only
Partition coefficient	Kd	0.00E+00	l/kg
Longitudinal dispersivity	ax	1.90E+02	m
Transverse dispersivity	ay	1.90E+01	m
Vertical dispersivity	ay	1.90E+00	m

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.53E-01 m/d
Retardation factor	Rf	1.00E+00
Decay rate used	λ	7.70E-101 d ⁻¹
Rate of contaminant flow due to retardation	u	7.53E-01 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	4.80E-04 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	2.87E+02

Remedial Targets

Remedial Target	Value	Unit	For comparison with measured groundwater concentration.
Domenico - Steady state	2.87E+00	mg/l	
Distance to compliance point	1900	m	
Concentration of contaminant at compliance point	C _{ED} /C ₀	4.80E-04	mg/l Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

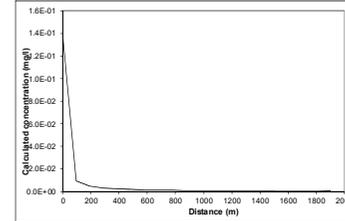
Entry if specify partition coefficient (option)	Kd	0.00E+00	l/kg
Soil water partition coefficient	Kd		
Entry for non-polar organic chemicals (option)	foc		fraction
Fraction of organic carbon in aquifer	foc		
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)	K _{oc,ion}		l/kg
Sorption coefficient for related species	K _{oc,ion}		
Sorption coefficient for ionised species	K _{oc,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	0.00E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Variable	Enter value	Calc. value Xu & Eckstein	Unit
Longitudinal dispersivity	ax	1.90E+02	m
Transverse dispersivity	ay	1.90E+01	m
Vertical dispersivity	ay	1.90E+00	m

Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{0.41}; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included; the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration	mg/l
0		1.4E-01
95.0		9.24E-03
190.0		4.71E-03
285.0		3.16E-03
380.0		2.38E-03
475.0		1.91E-03
570.0		1.59E-03
665.0		1.37E-03
760.0		1.20E-03
855.0		1.06E-03
950.0		9.58E-04
1045.0		8.71E-04
1140.0		7.98E-04
1235.0		7.38E-04
1330.0		6.85E-04
1425.0		6.40E-04
1520.0		6.00E-04
1615.0		5.65E-04
1710.0		5.33E-04
1805.0		5.05E-04
1900.0		4.80E-04

Site being assessed:	Mungret
Completed by:	Lindsay Connolly
Date:	#####
Version:	1

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		Toluene		from Level 1
Target Concentration	C _T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to pollutants in all phases (e.g. field derived value)

Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C ₀	3.66E-01	mg/l
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days
Calculated decay rate	λ	7.70E-101	days ⁻¹
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m
Plume thickness at source	Sy	5.00E+00	m
Saturated aquifer thickness	da	5.00E+01	m
Bulk density of aquifer materials	ρ	2.00E+00	g/cm ³
Effective porosity of aquifer	n	1.10E-02	fraction
Hydraulic gradient	I	2.30E-02	fraction
Hydraulic conductivity of aquifer	K	3.60E-01	m/d
Distance to compliance point	x	1.90E+03	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	1.00E+100	days
Parameters values determined from options			time variant options only
Partition coefficient	Kd	0.00E+00	l/kg
Longitudinal dispersivity	ax	1.90E+02	m
Transverse dispersivity	ay	1.90E+01	m
Vertical dispersivity	ay	1.90E+00	m

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	V	7.53E-01 m/d
Retardation factor	Rf	1.00E+00
Decay rate used	λ	7.70E-101 d ⁻¹
Rate of contaminant flow due to retardation	u	7.53E-01 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.27E-03 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	2.87E+02

Remedial Targets

Remedial Target	Value	Unit	For comparison with measured groundwater concentration.
Domenico - Steady state	2.87E+00	mg/l	
Distance to compliance point	1900	m	
Concentration of contaminant at compliance point	C _{ED} /C ₀	1.27E-03	mg/l Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

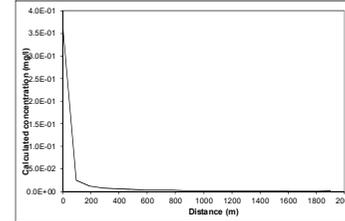
Soil water partition coefficient	Kd	0.00E+00	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,rel}		l/kg
Sorption coefficient for ionised species	K _{oc,i}		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	0.00E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

Variable	Enter value	Calc. value Xu & Eckstein	Unit
Longitudinal dispersivity	ax	1.90E+02	m
Transverse dispersivity	ay	1.90E+01	m
Vertical dispersivity	ay	1.90E+00	m

Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{0.44}; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included; the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Domenico - Steady state
From calculation sheet

Distance	Concentration
0	3.7E-01
95.0	2.45E-02
190.0	1.25E-02
285.0	8.39E-03
380.0	6.31E-03
475.0	5.06E-03
570.0	4.22E-03
665.0	3.62E-03
760.0	3.17E-03
855.0	2.82E-03
950.0	2.54E-03
1045.0	2.31E-03
1140.0	2.12E-03
1235.0	1.96E-03
1330.0	1.82E-03
1425.0	1.70E-03
1520.0	1.59E-03
1615.0	1.50E-03
1710.0	1.41E-03
1805.0	1.34E-03
1900.0	1.27E-03

Site being assessed:	Mungret
Completed by:	Lindsay Connolly
Date:	#####
Version:	1

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note



Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant	Xylenes			From Level 1
Target Concentration	C _T	1.00E-02	mg/l	From Level 1

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)	Kd	0.00E+00	l/kg
Soil water partition coefficient	K _{d,sw}		l/kg
Entry for non-polar organic chemicals (option)	f _{oc}		fraction
Fraction of organic carbon in aquifer	K _{oc}		l/kg
Organic carbon partition coefficient	K _{oc,ion}		l/kg
Entry for ionic organic chemicals (option)	K _{oc,i}		l/kg
Sorption coefficient for related species	pH		
Sorption coefficient for ionised species	pKa		
pH value	f _{oc}		fraction
acid dissociation constant	Kd	0.00E+00	l/kg
Fraction of organic carbon in aquifer			
Soil water partition coefficient			

Select analytical solution (click on brown cell below, then on pull-down menu)

Domenico - Steady state Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to pollutants in all phases (e.g. field derived value)

Initial contaminant concentration in groundwater at plume core	C ₀	1.62E-01	mg/l	US EPA Effective solubility calculator
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days	Assume no decay
Calculated decay rate	λ	7.70E-101	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	Assumed spill area
Plume thickness at source	Sy	5.00E+00	m	Assumed plume depth
Saturated aquifer thickness	da	5.00E+01	m	From Conceptual Understanding of Aquifers
Bulk density of aquifer materials	ρ	2.00E+00	g/cm ³	Assumed typical rock density
Effective porosity of aquifer	n	1.10E-02	fraction	GSJ 2015 Irish Aquifer Properties
Hydraulic gradient	I	2.30E-02	fraction	See calculation sheet
Hydraulic conductivity of aquifer	K	3.60E-01	m/d	GSJ 2015 Irish Aquifer Properties
Distance to compliance point	x	1.90E+03	m	Measured from approx. centre of site.
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	0.00E+00	l/kg	see options
Longitudinal dispersivity	ax	1.90E+02	m	see options
Transverse dispersivity	az	1.90E+01	m	see options
Vertical dispersivity	ay	1.90E+00	m	see options

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

	ax	Enter value	Calc. value Xu & Eckstein	m
Longitudinal dispersivity	ax	1.90E+02	1.90E+02	
Transverse dispersivity	az	1.90E+01	1.90E+01	
Vertical dispersivity	ay	1.90E+00	1.90E+00	

Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{0.44}; az = ax/10, ay = ax/100 are assumed

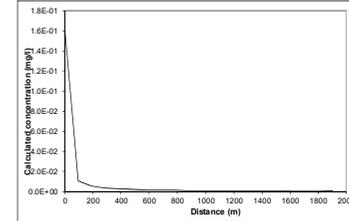
Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.53E-01 m/d
Retardation factor	Rf	1.00E+00
Decay rate used	λ	7.70E-101 d ⁻¹
Rate of contaminant flow due to retardation	u	7.53E-01 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	5.63E-04 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	2.87E+02

Remedial Targets

Remedial Target	2.87E+00	mg/l	For comparison with measured groundwater concentration.
Domenico - Steady state			
Distance to compliance point	1900	m	
Concentration of contaminant at compliance point	C _{ED} /C ₀	5.63E-04	mg/l Domenico - Steady state

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included; the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Mungret
Completed by:	Lindsay Connolly
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Domenico - Steady state

From calculation sheet

Distance	Concentration
0	1.62E-01
95.0	1.00E-02
190.0	5.63E-03
285.0	3.71E-03
380.0	2.79E-03
475.0	2.24E-03
570.0	1.87E-03
665.0	1.60E-03
760.0	1.40E-03
855.0	1.25E-03
950.0	1.12E-03
1045.0	1.02E-03
1140.0	9.38E-04
1235.0	8.66E-04
1330.0	8.04E-04
1425.0	7.51E-04
1520.0	7.04E-04
1615.0	6.63E-04
1710.0	6.26E-04
1805.0	5.93E-04
1900.0	5.63E-04

<h1>ARUP</h1>	Job No.	Sheet No.	Rev.
	261585	1	D1
Job Title	Member/Location		
Mungret Phase One Appropriate Assessment Screening Report	Dublin Office		
Calculation	Drg. Ref.		
Horizontal flow of groundwater in the limestone aquifer	Made by	Date	Chd.
	LC	06-03-2020	MK

Hydraulic Gradient was calculated for BH211 from:

$$i = (h_2 - h_1) / d$$

Where:

i = hydraulic gradient (m/m).

h1 = upgradient head (m). Taken as the highest value from the Tynan Environmental groundwater monitoring of BH211.

h2 = downgradient head (m). Value taken as base of quarry sump from the EIS 2016 report for the Irish Cement Castlemungret quarry

d = horizontal distance between the two wells (m).

$$i = (-26.25 - (+16.5)) / 1550$$

$$\therefore i \approx -0.028$$

Hydraulic Gradient was calculated for BH205 from:

$$i = (h_2 - h_1) / d$$

Where:

i = hydraulic gradient (m/m).

h1 = upgradient head (m). Taken as the highest value from the Tynan Environmental groundwater monitoring of BH205.

h2 = downgradient head (m). Value taken as base of quarry sump from the EIS 2016 report for the Irish Cement Castlemungret quarry

d = horizontal distance between the two wells (m).

$$i = (-26.25 - (+10.976)) / 1995$$

$$\therefore i \approx -0.019$$

As the proposed development is situated between the two groundwater level monitoring points, the average hydraulic gradient

$$\therefore \text{Average } i \approx -0.023$$

Darcy's Law for groundwater flow:

$$Q = KiA$$

Where:

Q = groundwater flow rate in aquifer (m³/d).

K = hydraulic conductivity (m/d). Value from the GSI 2015 Irish Aquifer Properties - A Reference Manual and Guide.

Hydraulic conductivity estimate derived from transmissivity value for a locally important, moderately productive aquifer (Lm).

i = hydraulic gradient (m/m). From previous calculation

A = cross-sectional area of part of the aquifer (m²).

Area calculated as the length of the site (approx. 500m) by an assumed 50m thick productive zone in the limestone aquifer

$$Q = (0.360)(0.023)(25000)$$

$$\therefore Q \approx 207 \text{ m}^3/\text{d}$$

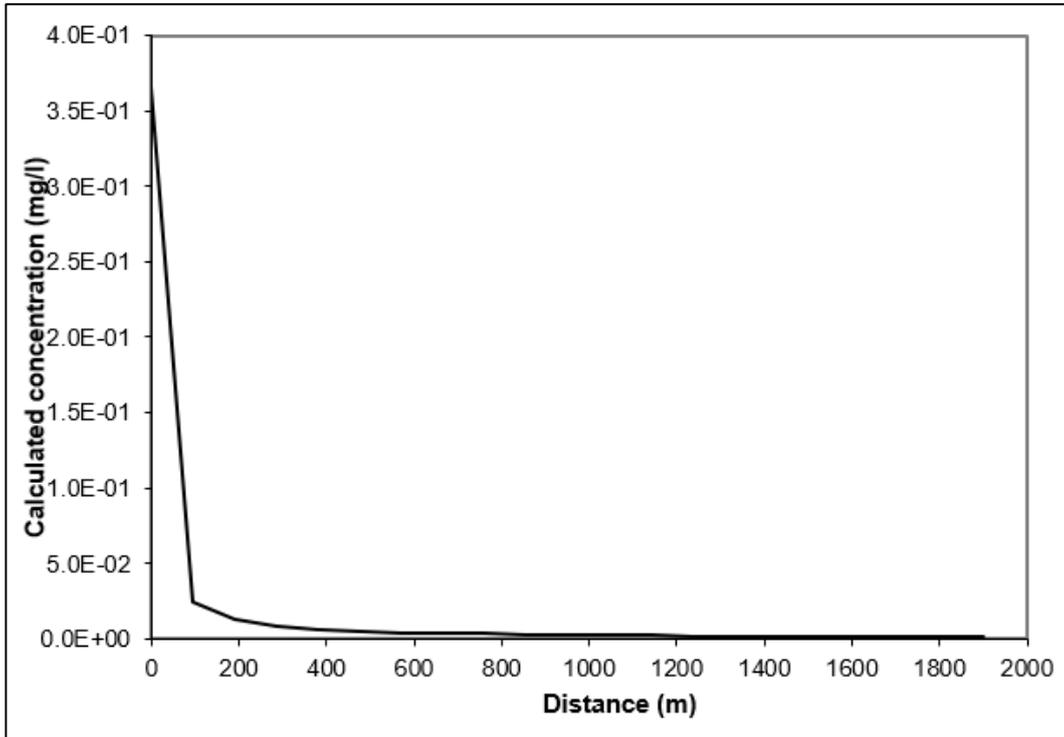
Source:

Calculation from the EPA Guidance on the Authorisation of Discharges to Groundwater Appendix A. 2011

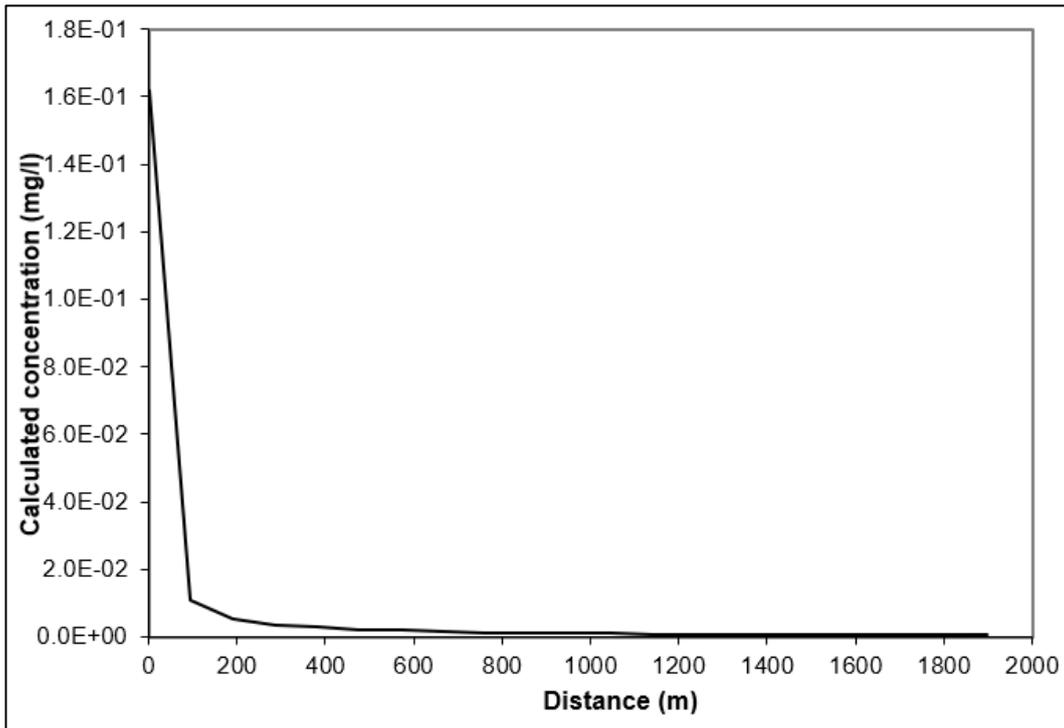
Appendix 5

Graphs from Contaminant Concentration Assessment

Graphs for toluene and benzene from contaminant concentration assessment



Graph 2: Graph showing toluene concentration versus distance from source



Graph 3: Graph showing xylene concentration versus distance from source

Appendix C

Construction Environmental Management Plan



Mungret Residential Development
Construction Environmental Management
Plan

Proposed Development at Dromdarrig, Mungret, Co. Limerick

January 2021

Application prepared with



Limerick City & County Council
Mungret Residential Development
Construction Environmental
Management Plan

Issue 1 | 29 January 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 261585-00

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ARUP

Document verification

ARUP

Job title		Mungret Residential Development		Job number	
				261585-00	
Document title		Construction Environmental Management Plan		File reference	
Document ref					
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Issue 1	29 Jan 2021	Description	Issue 1		
			Prepared by	Checked by	Approved by
		Name	Naoimh O'Regan	Dan Garvey	Keith Greville
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
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		Name			
		Signature			
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1 Introduction

This Construction Environmental Management Plan (CEMP) has been prepared by Arup to support Limerick City & County Council's proposed development of new residential units and associated infrastructure in Mungret, County Limerick, hereafter referred to as "*the proposed development*".

The purpose of the CEMP is to demonstrate how the proposed construction works can be delivered in a logical, sensible and safe sequence with the incorporation of specific environmental control measures relevant to construction works of this nature. The CEMP sets out the mechanism by which environmental protection is to be achieved during the construction phase of the proposed development. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum.

The CEMP has been prepared in accordance with industry best practice guidance including:

- TII's Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan;
- CIRIA in the UK, Environmental Good Practice on Site Guide, (4th Edition) (2015).

The CEMP has been prepared in conjunction with the Screening Determination for Environmental Impact Assessment (EIA) having regard to the surveys undertaken by specialists and environmental consultants. The environmental controls described in this CEMP are good construction practices. The potential for adverse effects on Natura 2000 sites has been assessed and is documented in a separate report for screening for Appropriate Assessment, which considers this potential in the absence of mitigation.

This CEMP is structured as follows:

- **Section 1** introduces the proposed development and outlines the purpose of the CEMP;
- **Section 2** describes in detail the proposed development;
- **Section 3** sets out the framework and mechanisms through which environmental requirements will be managed;
- **Section 4** outlines the procedures to be employed during construction to manage environmental aspects;
- **Sections 5 and 6** describe the general requirements and environmental measures to be implemented to minimise likely significant negative effects, as far as practicable, during the construction of the proposed development; and
- **Section 7** provides a concluding statement.

It is intended that this CEMP will be expanded and further developed prior to the commencement of any construction activities on site.

The CEMP is a dynamic document and will remain up to date for the duration of the construction period. The CEMP may need to be altered during the different phases of the construction period to take account of monitoring results, legislative changes, outcomes of third-party consultations etc.

Following appointment, the Contractor will be required to develop more specific Method Statements that are cognisant of the proposed construction activities, equipment and plant usage and environmental monitoring plan for the proposed development. This CEMP should not be considered a detailed Construction Method Statement as it will be the responsibility of the Contractor, appointed to undertake the individual works, in association with Limerick City & County Council, to implement appropriate procedures and progress this documentation prior to commencement of construction.

2 Proposed Development

The site area for the proposed development is 7.2 hectares and will be comprised of 253 residential units (plots A1- A4), creche, community facility, local shops, associated roads, carparking, public open spaces, public toilet, local services and ancillary utilities infrastructure. The proposed development is located adjacent to Mungret College, Co. Limerick.

The development includes two distinct elements; a standard housing development, plots A1 to A3, which comprises of 186 housing units and an Independent Living for Older Persons development, plot A4, which includes 55 apartments for Independent Living and a further 12 apartments which will be standard units open to any occupancy.

In addition to the Creche, Community Facility and local shops a number of Public Open Spaces (POS) will be included in the proposed development, including a public square (S1). Refer to **Figure 1**.

The proposed development consists of the following:

- 253 residential units located in plots as follows
 - A1 (2.2 ha)
 - A2 (0.96ha)
 - A3 (2.1ha)
 - A4 (0.91ha)
- Public Open Spaces;
 - POS - A1 and A3 (approximately 0.2ha)
 - POS - A2 (approximately 0.2ha)
- Public Square - S1 (approximately 0.2ha);
- Community Facility including a café - (gross area of approximately 341m²);
- Creche - (gross area of approximately 476m²); and
- Local shops which include a beauty salon and corner shop - (gross area of approximately 200m²).



Figure 1: Site Layout | Not to scale | Based on information provided by: EML Architects

2.1 Residential Units

As previously mentioned, the 253 residential units are divided into a standard housing development, plots A1 to A3, and an Independent Living for Older Persons development, plot A4. The heights of each building will range from 2- 3 storeys.

A total of 372 car parking spaces will be provided as part of the proposed development. The parking strategy for the housing and apartment units in plots A1, A2 and A3 will differ to that for the Independent Living for Older Person Units in plot A4.

For plot A1, 127 car parking space will be provided, plot A2, will have a total of 43 car parking spaces and for plot A3 104 spaces will be provided. A total of 98 on-street car parking spaces will be provided to serve plot A4 including the Independent Living for Older Person Residential units, the local shop, creche and the community facility. The creche and corner shop will be provided with full car parking in accordance with development plan standards.

Of the total number of car parking spaces included in the proposed development 36 spaces will be designated charging points for electric vehicles.

2.2 Community Facility

A Community Facility, which a gross area of approximately 341m² will be constructed to the north of the public square (S1) and plot A4. This building will have three community rooms and an auxiliary café area.

2.3 Creche

A proposed creche, with a gross area of approximately 476m², will be constructed on a hardstanding area north of the community facility. The creche will provide approximately 70 child places for ages up to 6 years and a small after-school club. An outdoor play area will be located on the south side of the creche for use by the creche. Parking will be provided at the public square S1.

2.4 Local Shop(s)

A corner shop is proposed for the south west corner of the building within plot A4; this will be a convenience shop with a gross area of approximately 100m². Located next to the corner shop is a proposed beauty salon/ hairdressers that will be linked to the A4 apartment blocks and will have a gross area of approximately 100m². Parking for these units will be provided at the public square S1.

2.5 Construction Compounds

The construction programme for the proposed development is planned over a five-year period and will be constructed in three phases: Phase 1, Phase 2 and Phase 3.

Each phase will be served by a local construction compound located in the green /open area of the relevant phase. The ground within the construction compound will be levelled and hardcored with hoarding/ fencing erected to secure the area. Towards the end of each construction phase the compounds will be removed and depending on location, replanting and landscaping will be undertaken. The construction compounds will be opened and closed in line with the construction programme. Locations of the construction compounds are shown in **Figure 2**.

Each of the construction compounds will be safely secured and a Construction Traffic Management Plan (CTMP) will be further developed by the Contractor to ensure safe access during the construction phase.

All construction compounds will provide the following:

- Space for materials lay down;
- Wheel wash;
- Construction waste storage;
- Site Offices;
- Electricity supplied by mains and /or an onsite generator;
- IT/telecommunication connection;
- Water supplied from the public watermain; and
- Mobile welfare facilities – either mobile welfare vans, towed units or self-contained units will be provided for construction personnel and will be fully bunded with foul sewage disposed of by removal off-site.

A designated bunded refuelling area on an impermeable surface will be provided at all construction compounds. Refuelling of vehicles will be restricted to these designated areas.

The Surface Water Management Plan (SWMP), refer to **Section 6.7**, will be further developed by the Contractor and will specify the environmental controls to be put in place. Site drainage will be provided at each of the construction compounds to collect surface water runoff, which will be directed into the existing local drainage network. Surface water or contaminants within the site compounds will not be released from the site to any waters or the bed and banks of any waters (including ground water).

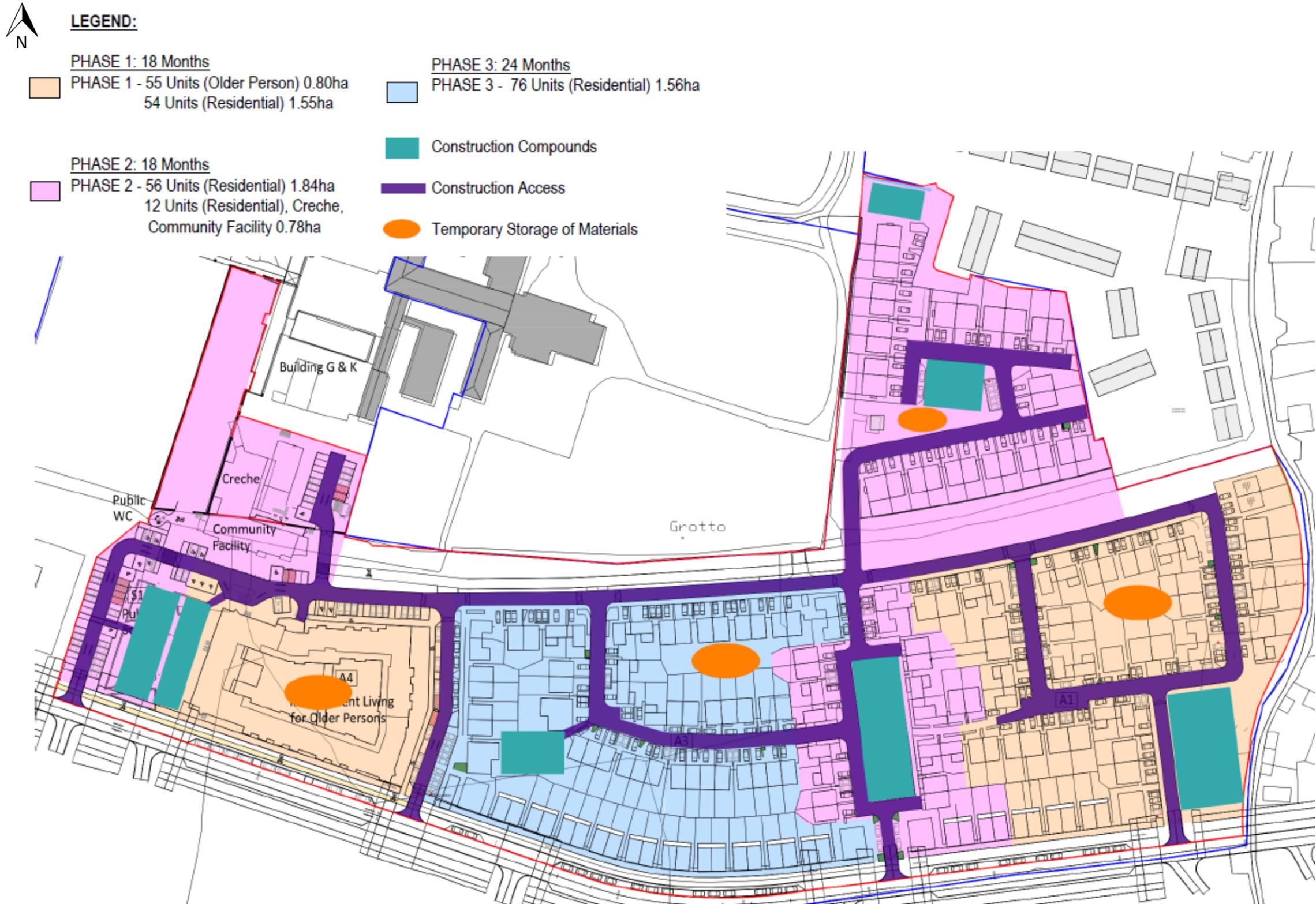


Figure 2: Phasing Plan | Not to scale | Based on information provided by: EML Architects

2.6 Construction Timeline and Phasing

Construction of the proposed development is likely to be completed over approximately five years and will be carried out in three phases. Activities within or across the phases may be carried out simultaneously depending on how the contractor chooses to construct the scheme. The three construction phases are identified as Phase 1, Phase 2 and Phase 3. These phases are illustrated in **Figure 2**.

Phase 1 will commence with the construction of 55 Independent Living for Older Persons units in the western part of the site and the construction of approximately 54 residential units in the eastern part of the site. Approximately 700m² of the Public Square (S1) will be construction during Phase 1 along with the public open space (POS A1&A3) located to the south east of the site. It is estimated that construction of Phase 1 will take approximately 18 months to complete.

Phase 2 will consist of the construction of 56 residential units (to the west of the 54 units planned as part of Phase 1) and construction works to the proposed Creche, Community Facility and 12 residential units (located to the north of the Independent Living for Older Persons units) respectively. During Phase 2 the remaining area of the Public Square (S1) will be construction in addition to the public open spaces (POS A1& A3 and POS A2). Phase 2 will take approximately 18 months to complete.

Phase 3 will consist of the construction of 76 residential units and will complete the works on the site. It is estimated that Phase 3 will be completed in the 24 months following completion of the previous phases.

3 Environmental Management Framework

3.1 Overview

The contract(s) awarded for the proposed development will include a requirement for the Contractor to comply with relevant documentation including all conditions of any statutory approvals received and this CEMP.

As part of the environmental management framework contractors will need to comply with all relevant environmental legislation and take account of published standards, accepted industry practice, national guidelines and codes of practice appropriate to the proposed development. Due regard should be given to the guidance and advice given by ISO 14001 standard¹ and CIRIA guidance^{2,3,4}.

The appointed Contractor will be required to develop and implement an Environmental Management System (EMS) that follows the principles of ISO 14001. Further, the appointed contractor's EMS should include an environmental policy, operational, monitoring and auditing procedures to ensure compliance with all environmental requirements and to monitor compliance with environmental legislation and the environmental management provisions outlined in the relevant documentation.

3.2 Responsibilities

3.2.1 Employer

Limerick City & County Council will be the employer responsible for ensuring that competent parties are appointed to undertake construction and that sufficient resources are made available to facilitate the appropriate management of risks to the environment.

Limerick City & County Council will also ensure that the engineer setting out the works is fully aware of the ecological constraints and construction management requirements associated with the proposed development.

3.2.2 Employers Representative

Limerick City & County Council and/or the Employers Representative (ER) appointed by Limerick City & County Council will be responsible for monitoring compliance with the CEMP. The ER may be required to appoint temporary or permanent specialists with appropriate skills and experience as required to implement on site procedures and monitor construction on behalf of the employer, i.e. competent experts in biodiversity, noise, vibration, dust, waste, soils, contamination and/or water.

¹ ISO (2015) ISO 14001:2015 Environmental management systems -- Requirements with guidance for use

² CIRIA (2015) Environmental Good Practice on Site guide (fourth edition) (C741)

³ CIRIA (2015) Coastal and marine environmental site guide (second edition) (C744)

⁴ CIRIA (2002) Brownfield development sites: ground-related risks for buildings (X263)

3.2.3 The Contractor

The Contractor(s) appointed will be responsible for the organisation, direction and execution of environmental related activities during the detailed design and construction of the proposed development. The Contractor is required to undertake all activities in accordance with the relevant environmental requirements including the consent documentation and other regulatory and contractual requirements.

3.2.4 Site Manager

A Site Manager will be appointed by the Contractor to oversee the day-to-day management of working areas within the site and ensure that effective, safe, planned construction activities are delivered on an ongoing basis to the highest standards. The Site Manager will be a suitably qualified, competent and experienced professional that will oversee site logistics, communicate regularly with construction staff, accommodate project-specific inductions for staff on site and ensure that all work is compliant with the relevant design standards and health and safety legislation.

3.2.5 Environmental Manager

An Environmental Manager will be appointed by the Contractor to ensure that the CEMP is effectively implemented. The Environmental Manager will be a suitably qualified, competent and experienced professional that will perform the necessary tasks, review environmental procedures and consult with the members of the construction team and stakeholders as required. The Environmental Manager will be responsible for:

- Developing, maintaining and implementing the CEMP;
- Establishing, implementing, and maintaining the EMS in line with ISO 14001;
- Conducting regular environmental inspections and audits as specified in the contract and checking adherence to the CEMP;
- Ensuring that construction occurs in accordance with the relevant environmental requirements and that such compliance is adequately recorded and documented;
- Completing a site inspection and compiling an environmental compliance record as agreed and specified in the CEMP;
- Consulting with relevant stakeholders on an on-going basis;
- Attending site and stakeholder meetings as required;
- Keeping up to date with relevant environmental best practice and legislative changes;
- Liaising with the relevant staff to prepare Method Statements and relevant plans for all activities where there is a risk of environmental damage;

- Having a detailed level of knowledge on all aspects of environmental information associated with the proposed development;
- Ensuring all personnel have undertaken adequate environmental inductions, awareness briefings and training (including subcontractors);
- Dealing with environmental complaints; and
- Managing and responding to environmental incidents and ensuring that all incidents are recorded and reported in an appropriate manner.

3.2.6 Community Liaison Manager

A Community Liaison Manager will be appointed and will be responsible for managing such tasks as the following:

- Briefing neighbours on progress and issues as necessary;
- Liaison with stakeholders and emergency services as appropriate;
- Liaison with local Gardaí, particularly in relation to traffic movements and permits where necessary.

Contact details for the liaison manager will be posted on all construction site notice boards and on any other information or correspondence, which may be distributed from time to time.

3.2.7 Environmental Specialists engaged by the Contractor

To fulfil its obligations under the CEMP and to support its Environmental Manager, the Contractor will be responsible for engaging suitably qualified and experienced professionals including where necessary the following (i.e. depending on the scope of the contract) competent experts:

- Project archaeologist;
- Project ecologist;
- Noise and vibration specialist;
- Air quality and dust specialist;
- Land, soils and contamination specialist(s); and
- Water specialist.

3.3 Communication Procedures

3.3.1 Community and Stakeholder Engagement

The Community Liaison Manager and Contractor will take all reasonable steps to engage with stakeholders in the local community, focusing on those who may be affected by the construction works including residents, businesses, community resources and specific vulnerable groups.

Communication with the local community and other relevant stakeholders will be undertaken at an appropriate level and frequency throughout construction.

Where communications are related to environmental issues the Environmental Manager will be informed and engaged with, as appropriate.

3.3.1.1 Community Liaison

Limerick City & County Council recognises the importance of effective community liaison in order to reduce nuisance to residents, to ensure public safety and welfare and to help ensure the smooth running of construction activities. As mentioned in **Section 3.2.6**, Limerick City & County Council will appoint a Community Liaison Manager for the proposed development.

Important issues in ensuring good relations are:

- Providing information for the public during the construction phases, (particularly nearby sensitive receptors);
- Providing the correct points of contact and being responsive; and
- Ensuring good housekeeping in all aspects of the operations.

A ‘good neighbour’ policy will be implemented, as far as possible. Key aspects of this policy include:

- Early implementation of the policy i.e. from the commencement of construction;
- Reduction of nuisance factors;
- Maintaining access to neighbouring premises;
- Clear and concise information; and
- Undertaking timely liaison with stakeholders.

3.3.2 Advance Notice of Works

The Community Liaison Manager and Contractor will ensure that local residents, businesses, occupiers, general users of the area and stakeholders are informed in advance of construction activities that may affect them. Relevant obligations and procedures in relation to advance notice of works will be identified in the CEMP(s) as they are further developed by the Contractor(s) and in the Communications Management Plan.

All notifications will detail the nature, estimated duration and working hours. All notifications will include a project-specific contact number to which any enquires can be directed. The Community Liaison Manager and Contractor will be responsible for preparing and issuing the notifications subject to the relevant approval and consents.

Limerick City & County Council and the Community Liaison Manager in consultation with statutory stakeholders will decide whether to arrange any further targeted consultation with the public or relevant stakeholders in advance of specific construction activities on a local basis.

3.3.3 Emergency Contacts

An emergency contact list will be established and made available to all construction staff employed. The contact list will be displayed prominently on site as well as at suitable locations where construction activity is being carried out around working areas. The contact list will include key environmental representatives that may need to be contacted in the event of an incident.

3.3.4 Enquiries and Complaints

The Contractor will establish a process for handling all enquires including complaints. All enquires will be recorded and a log will be maintained to include details of the response and action taken. This will be available upon request for inspection. All enquiries, whether a query or a complaint, will be dealt with in a timely manner.

The Environmental Manager will be immediately informed of any environmental-related issues that have been raised. Where appropriate, the Environmental Manager will be responsible for informing relevant stakeholders and statutory bodies.

4 Environmental Management Procedures

4.1 Training, Awareness and Competence

The Contractor (and its subcontractors) will be selected with due consideration of relevant qualifications and experience. The Contractor will be required to employ construction staff with appropriate skills, qualifications and experience appropriate to the needs of the works to be carried out during construction.

A site induction will be provided to all construction staff before they commence work on site. Where appropriate, the Contractor will identify specific training needs for the construction workforce and will ensure that appropriate training requirements are fulfilled. Two-way communication will be encouraged to promote a culture of environmental protection.

The Contractor will establish an Environmental Training and Awareness Programme and ensure that all personnel receive adequate training prior to the commencement of construction activities. A baseline level of environmental awareness will be established through the site induction programme. Key environmental considerations and objectives will be incorporated into this induction. Specifically, site inductions will cover the following as a minimum:

- Introduction to the Environmental Manager;
- Description of the CEMP and consequences of non-compliance;
- The requirements of due diligence and duty of care;
- Overview of conditions of consents, permits and licences;
- Requirements associated with community engagement and stakeholder consultation;
- Identification of environmental constraints and notable features within the site; and
- Procedures associated with incident notification and reporting including procedures for dealing with damage to the environment.

Nobody will work on site without first receiving environmental induction. This induction will relate to works being carried out adjacent to sensitive receptors and to re-emphasise the precautions that are required as well as the construction management measures to be implemented. Signed records of environmental training will be established, maintained and made available to the Employers Representative.

Site briefings and talks will be carried out on a regular basis to ensure that construction staff have an adequate level of knowledge on environmental topics and community relations and can effectively follow environmental control procedures throughout construction.

4.2 Meetings

Limerick City & County Council and/or the Employer's Representative will arrange regular meetings to discuss environmental matters and ensure effective coordination to be attended by:

- Limerick City & County Council;
- The Employer's Representative;
- Contractor (including Site Manager);
- Community Liaison Manager;
- Environmental Manager; and
- Environmental Specialists – engaged by either Limerick City & County Council and/or the Contractor.

The Environmental Manager will be responsible for arranging and holding monthly meetings and site walk overs with the Employer's Representative. The Environmental Manager will develop and distribute minutes of the monthly meetings and distribute them accordingly.

4.3 Monitoring, Inspections and Audits

For the duration of the contract(s), the environmental performance of the Contractor will be monitored through site inspections and audits. The programme for monitoring, inspections and audits will be specified in the contract and it is likely to be a combination of internal inspections and audits that may be either random or routine.

Records of all inspections carried out will be recorded on standard forms and all actions are to be closed out in a reasonable time. The CEMP as it is further developed by the Contractor will include additional details of inspection procedures.

4.3.1 Monitoring

Monitoring will be carried out in accordance with the requirements described in this CEMP and the EIA Screening Report so that construction activities are undertaken in a manner that does not give rise to significant negative effects. Suitable monitoring programmes will need to be developed, implemented, documented, and assessed.

The results of all environmental monitoring activities will be reviewed by the Environmental Manager on an ongoing basis to enable trends or exceedance of criteria to be identified and corrective actions to be implemented as necessary. The Contractor will be required to inform the Employer's Representative of any continuous exceedances of criteria.

4.3.2 Inspections

Inspections of construction activities will be carried out by the Environmental Manager daily to ensure all necessary environmental measures relevant to the construction activities are being effectively implemented by construction staff, ensuring legal and contractual conformity.

More detailed inspections will be undertaken by the Environmental Manager on a weekly basis.

The weekly inspections will be appropriately documented by the Environmental Manager and copies of these records and any action required to be undertaken will be made available to the Employer's Representative.

Each month one of the weekly inspections will include a review of environmental documentation and records. The monthly inspection will be recorded on a standard form and reported to the Employer's Representative within five days of the inspection taking place. This standard form will address the following as a minimum:

- Summary of compliance/non-compliance with the CEMP;
- Results and interpretation of the monitoring programme;
- Key issues noted in inspections and/or audits;
- Summary record of non-conformities, incidents and corrective actions;
- Summary of environmental complaints and queries received in relation to environmental matters; and
- Summary record of environmental training undertaken by staff.

4.3.3 Audits

The Environmental Manager will carry out audits during the construction phase and will advise on compliance with applicable environmental regulatory requirements, the efficacy of the environmental management approaches used, and recommendations for reducing identified environmental risks (if considered appropriate).

Further, regulatory and statutory bodies may undertake site visits to monitor compliance with legislative and regulatory requirements. These site visits may occur randomly throughout the construction period. The Contractor will facilitate these visits and the Environmental Manager will be available to provide information as required and deal with any issues that may arise during, or as a result of, these visits.

Planned and documented audits aimed at evaluating the conformance of the EMS will also be carried out by the Environmental Manager. The Environmental Manager will establish a schedule for internal audits and this inspection calendar will be made available to the Employer's Representative. These environmental audits will be scheduled at least once every three months.

Standard forms for reporting and audit items will be prepared and will include but not be limited to the following activities:

- Review of environmental documentation to establish if relevant requirements are being achieved and if continual improvement is occurring;
- Site inspection and interviews with onsite personnel; and
- Reporting with recommendations.

For any environmental non-conformities found, a Corrective Actions Report (refer to **Section 4.4.1**) will be prepared and will describe and record the findings of the non-conformance. The verification of previous Corrective Actions Reports will also be recorded.

Upon completion of an audit, the Environmental Manager will review all Corrective Actions Reports and prepare an Audit Report to summarise:

- Corrective action requests raised;
- Previous corrective action requests closed; and
- Observations made during the audit.

Once complete the Environmental Manager will issue the Audit Report to the Employer's Representative and a copy is provided to the Contractor within five working days of the audit. The Audit Report will detail the findings from the auditor, specify non-conformances identified and outline the proposed corrective actions.

4.4 Incident Response

4.4.1 Corrective Actions

4.4.1.1 Overview

Corrective actions are measures to be implemented to rectify any non-conformances (i.e. exceedance of criteria or targets) identified during monitoring, inspections and/or audits.

In the first instance, an investigation will be undertaken by the Environmental Manager to identify the cause of any non-conformances. Appropriate remedial measures will be identified and implemented as soon as practicable to prevent further exceedances. If necessary, the appropriate statutory authority and stakeholders will be notified.

Where new or amended measures are proposed, the relevant CEMP will be updated accordingly by the Environmental Manager and the Employer's Representative will be informed at the earliest opportunity.

4.4.1.2 Corrective Action Reports

As previously mentioned, a Corrective Actions Report is prepared on foot of any non-conformances identified during environmental monitoring, inspections and/or audits on site. The Corrective Actions Report will describe in detail the cause and effect of a non-conformance on site and describe the recommended corrective action that is required to remedy it.

An appropriate timeline for closing out the corrective actions will be identified by the Contractor as well as arrangements for the Environmental Manager verifying the Corrective Actions Report and informing appropriate authorities and stakeholders in a timely manner.

4.4.2 Emergency Incidents

4.4.2.1 Overview

Emergency incidents are those occurrences that give rise to significant negative environmental effects including but not limited to the following:

- Any malfunction of any control measures and/or environmental protection system;
- Any emission that does not comply with the requirements of the contract and relevant licences;
- Any circumstance with the potential for environmental pollution;
- Any emergency that may give rise to environmental effects: e.g. release or spill of hazardous substance such as fuel, oil, concrete or a flooding event caused by extreme rainfall.

As discussed in **Section 3.3.3** an emergency contact list will be established and made available to all construction staff employed. The contact list will be displayed prominently on site as well as at suitable locations where construction activity is being carried out around working areas. The contact list will include key environmental representatives that may need to be contacted in the event of an incident.

4.4.2.2 Spill Control Measures

Every effort will be made to prevent pollution incidents associated with spills during the construction of the proposed development. The risk of oil/fuel spillages will exist on the site and any such incidents will require an emergency response procedure.

The following steps provide the procedure to be followed in the event of an oil/fuel spill occurring on site:

- Identify and stop the source of the spill and alert people working in the vicinity;

- Notify the Environmental Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action;
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill;
- If possible, clean up as much as possible using the spill control materials;
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited;
- The Environmental Manager will inspect the site as soon as practicable and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring; and
- The Environmental Manager will notify the appropriate stakeholders such as Limerick City & County Council, National Parks and Wildlife Service, Department of Communications, Climate Action and Environment and Department of Housing, Planning and Local Government and/or the EPA.

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be reported, recorded and investigated.

4.4.2.3 Emergency Incident Response Plan

A set of standardised emergency response procedures will govern the management of emergency incidents. The Contractor will be required to detail emergency incident response procedures and to develop an Emergency Incident Response Plan.

The Emergency Incident Response Plan will contain emergency phone numbers and the method of notifying local authorities, statutory authorities and stakeholders. Contact numbers for key personnel will also be included therein. Contractors will be required to adhere to and implement these procedures and ensure that all staff and personnel on site are familiar with the emergency arrangements.

In the case of work required in an emergency, or which if not completed would be unsafe or harmful to workers, the public or local environment, Limerick City & County Council will be informed as soon as reasonably practicable of the reasons and likely duration. Examples may include where the ground needs stabilising if unexpected ground conditions are encountered, concrete pouring taking longer than anticipated due to delayed deliveries or equipment failure.

In the event of an emergency incident occurring, the Contractor will be required to investigate and provide a report including the following, as a minimum:

- A description of the incident, including location, the type and quantity of contaminant and the likely receptor(s);
- Contributory causes;

- Negative effects;
- Measures implemented to minimise adverse effects; and
- Any recommendations to reduce the risk of similar incidents occurring.

The Contractor will consult with the relevant statutory authorities, stakeholders and relevant parties such as the Health and Safety Authority, the Fire Authority, the Ambulance Service, the EPA and utilities companies when preparing and developing response measures. Further, if any sensitive receptor is impacted, the appropriate environmental specialists will be informed and consulted with accordingly.

Any response measures will be incorporated into an updated Emergency Incident Response Plan that will be disseminated accordingly to construction staff, Limerick City & County Council and the Employer's Representative.

4.4.2.4 Emergency Access

The Contractor will be required to maintain emergency access routes throughout construction and identify site access points for each working area.

This will be developed in partnership with the emergency services and documented as part of the Emergency Incident Response Plan.

4.4.3 Extreme Weather Events

The Contractor will consider the effects of extreme weather events and related conditions during construction. The Contractor will use a short to medium range weather forecasting service from Met Eireann or other approved meteorological data and weather forecast provider to inform environmental control measures.

All measures deemed necessary and appropriate to manage extreme weather events will be considered and will specifically cover training of personnel and prevention and monitoring arrangements for staff. As appropriate, method statements will also consider extreme weather events where risks have been identified, e.g. construction works adjacent to public roads and business premises.

4.4.4 Unexpected Discoveries

Appropriate procedures will be put in place in the event of encountering unexpected archaeological or cultural heritage assets or subsurface contamination during intrusive ground works. However, archaeological test trenching, which was carried out by Aegis in October 2019, did not identify any features of archaeological interest. The *Archaeological Test Trenching & Impact Assessment Report* is included with the Part 8 documentation.

Control measures as described in **Section 6.5** will be implemented and the Environmental Manager will ensure that specialists (e.g. archaeologist) are facilitated to ensure management in accordance with industry best practice and effective compliance with the relevant legislation. All unexpected discoveries will

be reported to the appropriate authorities and documented in an appropriate manner.

4.5 Reporting

4.5.1 Environmental Compliance Report

The Contractor will be required to submit a monthly report to the Employer's Representative for review and approval. The report will include the items outlined in **Section 4.3.2**.

4.5.2 Incident Investigation Reports

The Contractor will inform the Employer's Representative of all emergency incidents immediately and prepare an initial report within 24 hours setting out the details of the incident and cause(s) if known. The Contractor will be required to complete the Environmental Incident Report and any further documentation requested by the Employer's Representative in relation to the incident within 7 days of the incident occurring. The Contractor will respond to all comments made by the ER on any incident.

The Environmental Incident Report will contain details of the incident including the location, known and suspected causes and weather conditions. It will define the scale and effects (short, medium, long term, temporary/permanent) as well as required corrective actions and control/ remediation/compensation measures (as appropriate).

4.6 Environmental Records

Records of all environmental documentation will be maintained including monitoring, test results, method statements and plans. All records will be kept up to date and be made available for audits, inspections and periodical reporting. The Contractor will maintain the following environmental records (as a minimum) that will be made available for inspection to the Employer's Representative and the relevant authorities, if required:

- Management Plans;
- Records of environmental incidents;
- Monthly environmental reports;
- Records of environmental training;
- Register of environmental complaints;
- Corrective Action Reports;
- Environmental inspection and audit reports;
- All monitoring data;
- Waste and chemical inventories; and

- Health and Safety records.

5 General Requirements

5.1 Good Housekeeping

A “good housekeeping” policy will be employed at all times. This will include, but not necessarily be limited to, the following requirements:

- General maintenance of working areas and cleanliness of welfare facilities and storage areas;
- Provision of site layout map showing key areas such as first aid posts, material storage, spill kits, material and waste storage, welfare facilities etc;
- Maintain all plant, material and equipment required to complete the construction work in good order, clean, and tidy;
- Keep construction compounds, access routes and designated parking areas free and clear of excess dirt, rubbish piles, scrap wood, etc. at all times;
- Details of site managers, contact numbers (including out of hours) and public information signs (including warning signs) will be provided at the boundaries of the working areas;
- Provision of adequate welfare facilities for site personnel;
- Installation of appropriate security, lighting, fencing and hoarding at each working area;
- Effective prevention of oil, grease or other objectionable matter being discharged from any working area;
- Provision of appropriate waste management at each working area and regular collections to be arranged;
- Excavated material generated during construction will be reused on site as far as practicable and surplus materials/soil, should it be deemed a by-product, will be recovered or if considered to be waste material, disposed of to a suitably authorised waste facility site;
- Effective prevention of infestation from pests or vermin including arrangements for regular disposal of food and material attractive to pests will be implemented. If infestation occurs appropriate action will be taken to eliminate and prevent further occurrence;
- Maintenance of wheel washing facilities at each of the construction compounds and other contaminant measures as required;
- No discharge of site runoff or water without agreement of the relevant authorities and an appropriate discharge licence, if relevant;
- Open fires will be prohibited at all times;
- The use of less intrusive noise alarms which meet the safety requirements, such as broadband reversing warnings, or proximity sensors to reduce the requirement for traditional reversing alarms;

- Maintenance of public rights of way, diversions and entry/exit areas around working areas for pedestrians and cyclists where practicable and to achieve inclusive access; and
- Material handling and/or stockpiling of materials, where permitted, will be appropriately located to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.

5.2 Working Hours

The timing of construction activities, core working hours and the rate of progress of construction works are a balance between efficiency of construction and minimising nuisance and significant effects.

The core construction working hours for the proposed development will be:

- 7am – 7pm: Monday to Friday; and
- 8am – 2pm: Saturday.

The hours above correspond to the current construction programme.

All rock breaking activities will be undertaken during daytime hours. The removal of waste material off site by road and regular deliveries to site will be generally confined to daytime hours but outside of peak traffic hours (i.e. 10am to 4pm).

It may be necessary in exceptional circumstances to undertake certain activities outside of the core construction working hours. Any construction outside of the core construction working hours will be agreed in advance with Limerick City & Council Council and scheduling of such works will have regard to nearby sensitive receptors.

5.3 Security

Adequate security will be provided to prevent unauthorised entry to or exit from any working areas. The following measures may be used to prevent unauthorised access:

- Install CCTV and alarm systems where required;
- CCTV and security systems will be sited and directed so that they do not intrude into occupied residential properties;
- Provide adequate security guards and patrols;
- Consult with neighbouring properties and local crime prevention officers including Limerick City & Council Council and An Garda Síochána on site security matters as required; and
- Prevent access to restricted areas and neighbouring properties by securing equipment on site such as scaffolding and ladders.

5.4 Hoarding and Fencing

A site boundary hoarding will be established around each of the construction compounds and associated working areas before any significant construction activity commences.

The hoarding, which will be 2.4m high and have a density of at least 7kg/m², will provide a secure boundary to what can be a hazardous environment for those that have not received the proper training and are unfamiliar with construction operations.

Site hoarding will also perform an important function in relation to minimising nuisance and effects including:

- Noise emissions (by providing a buffer);
- Visual impact (by screening the working areas, plant and equipment); and
- Dust minimisation (by providing a buffer).

The erection of hoarding will be of a similar nature to that provided on most construction sites. Mounting posts will be erected by using a mini-digger and the posts will be set in concrete. The hoarding will be positioned appropriately within the works area to minimise the noise transmitted to nearby receptors from plant, equipment and vehicles entering or leaving the working area.

Where practicable, hoarding and fencing will be retained and re-configured and re-used between working areas as the construction activities progress.

Mammal gates, which will be designed in accordance with TII standards⁵, will be incorporated into the hoarding. These will be located wherever external hedgerows intersect the site hoarding and will facilitate the continued movement of mammals across the construction site.

The following measures will be applied in relation to hoarding and fencing:

- Maintenance of adequate fencing and hoardings to an acceptable condition to prevent unwanted access to working areas and provide noise attenuation, screening, and site security where required;
- Appropriate sight lines/visibility splays will be maintained around working areas to ensure safety of both vehicles and pedestrians is preserved;
- Use of different types of fencing and hoarding (e.g. mesh fence of solid hoarding including hoardings used for noise control);
- Temporary fences may be used in certain areas, such as for short term occupation of working areas;
- Display information boards with out of hours contact details, telephone helpline number (for comments/complaints) and information on the works;

⁵ TII Publications (2009) *Specification for Road Works Series 300 - Fencing and Environmental Barriers*

- Erect notices on site boundaries to warn of hazards on site such as deep excavations, construction access, etc.;
- Ensure suitable measures for tree protection are implemented as required;
- Keep hoarding and fencing free of graffiti or posters;
- Retain existing walls, fences, hedges and earth banks as far as reasonably practicable; and
- Appropriate positioning of the fencing or hoarding to minimise the noise transmitted to nearby receptors or from plant, equipment and vehicles entering or leaving the working area.

5.5 Services and Lighting

5.5.1 Services and Utilities

Site services will be installed as part of the enabling works in parallel with the rearrangement and diversion of existing utilities. Working areas will be powered by mains supplies or diesel generators where an electrical supply is not available.

5.5.2 Lighting

Site lighting will typically be provided by tower mounted 1000W metal halide floodlights. The floodlights will be cowled and angled downwards to minimise spillage to surrounding properties. The following measures will be applied in relation to site lighting:

- Lighting will be provided with the minimum luminosity sufficient for safety and security purposes. Where practicable, precautions will be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas;
- Motion sensor lighting and low energy consumption fittings will be installed to reduce usage and energy consumption; and
- Lighting will be positioned and directed as not to unnecessarily intrude on adjacent buildings and land uses, ecological receptors and structures, nor to cause distraction or confusion to passing motorists.

5.6 Welfare Facilities

Welfare facilities will be provided for construction staff and personnel such as toilets, lockers, showers etc. The construction compounds, located at the proposed public open spaces, will be used as the primary location for worker welfare facilities, however where required mobile welfare facilities will also be provided.

5.7 Reinstatement of Working Areas on Completion

All working areas and construction compounds will be closed and reinstated in line with the construction programme.

All plant, equipment, materials, temporary infrastructure and vehicles will be removed at the earliest opportunity and the surface of the ground restored as near as practicable to its original condition.

5.8 Health and Safety

All health and safety, fire safety and security requirements will be provided for in co-ordination with Limerick City & County Council. The Construction Traffic Management Plan (**Section 6.1**) will protect the public in the vicinity of the working areas during the construction phase of the works and will include all suitable temporary signage, barriers and hoarding as necessary.

All construction staff and operatives will be inducted into the security, health and safety and logistic requirements on site prior to commencing work.

All contractors will be required to progress their works with reasonable skill, care and diligence and to proactively manage the works in a manner most likely to ensure the safety, health and welfare of those carrying out construction works, all other persons in the vicinity of the working areas and interacting stakeholders.

All aspects of works and project facilities will comply with legislation, good industry practice and all necessary consents.

The requirements of the Safety, Health and Welfare at Work Act 2005 (Government of Ireland, 2005), the Safety, Health and Welfare at Work (Construction) Regulations, 2013 (Government of Ireland, 2013), as amended, (the “Regulations”) and other relevant Irish and EU safety legislation will be complied with at all times.

As required by the Regulations, a Health and Safety Plan will be formulated which will address health and safety issues from the design stages through to completion of the construction and maintenance phases. This plan will be reviewed and updated as required, as the development progresses.

In accordance with the Regulations, a ‘Project Supervisor Design Process’ has been appointed and a ‘Project Supervisor Construction Stage’ will be appointed as appropriate.

The Project Supervisor Construction Stage will assemble the Safety File as the project progresses. In response to Covid-19, the Contractor will follow the latest public health advice and identify and implement suitable control measures to minimise the risk of Covid-19 infection in the workplace. Such measures are to be communicated to all relevant employees and others at the place of work.

5.9 Cranage

The construction works will require the use of mobile cranes on site. The cranes will be required for the moving of building materials on site such as concrete pipes, reinforcement, precast concrete, steelwork, plant and general building materials.

Heavy machinery transport on the road network to and from the working areas will be restricted to outside of peak hours.

6 Environmental Management

This section describes the specific environmental requirements identified as part of the design and EIA Screening Report that will be adhered to during the construction phase.

It should be noted that the measures in this CEMP provide a summary of minimum requirements that will be developed as the project progresses. It is intended that the measures set out herein will be discussed in more detail with relevant stakeholders as required to support the identification of any additional measures to be taken account of during construction.

6.1 Construction Traffic Management Strategy

The Construction Traffic Management Strategy (CTMS) outlines the measures to be implemented in relation to traffic and transportation during construction. Prior to commencement of works the appointed Contractor will prepare a detailed Construction Traffic Management Plan (CTMP) to ensure that construction traffic will be managed and monitored safely and efficiently throughout the construction phase.

The CTMP will take cognisance of the measures identified below and any conditions of statutory approvals, attached to the proposed development. Given the proposed development will be constructed over a five-year period the Contractor will prepare a specific CTMP for each of the construction phases taking into consideration the continual development of the project such as the opening and closing of construction compounds, occupancy of residential units etc.

To access the site construction traffic will use Mungret Link Streets Project which is expected to be complete or close to completion prior to the commencement of construction of the proposed development.

Light vehicles, such as cars and vans, will be used by site operatives travelling to and from the site. Heavy Construction Vehicles (HCV) will be required to deliver general construction materials, such as concrete, to the site.

6.1.1 Site Access and Egress

Advanced warning signs, in accordance with *Traffic Signs Manual Chapter 8: Temporary Traffic Measures and Signs for Roadworks (August 2019)*, will be displayed on the approach to the site access locations a minimum of one week prior to construction works commencing. Signage will clearly indicate site access and the locations of the different compounds for site staff and deliveries.

All site access and egress points will be provided with adequate sight lines. Construction operatives will use the Mungret Link Streets Project, which is expected to be completed prior to works starting on site, thereby allowing access from both the east and west access points. If the Mungret Link Streets Project is not complete it is expected to be in the final phases which will not prevent site

access and impact the commencement of works on site. Completion of any remaining activities on the Mungret Link Streets Project (such as landscaping, signage, road markings etc.) will have no significant effect on the proposed development. All and any site access will be agreed with the Mungret Link Streets Project contractor in advance if required. The Mungret Link Streets Project will connect to the R510 and R859 respectively and will be fully complete prior to the occupation of the residential units.

Construction access for Phase 1 will be via the entrances provided as part of the Mungret Link Streets Project which is expected to be completed or close to completion prior to works starting on site. Access will be permitted from both the east and west access points.

For Phase 2 most of the construction traffic will enter and leave the site via the Mungret Link Streets Project, again by entrances provided in advance.

Finally Phase 3, which consists of the final 76 residential units will also be accessed via the entrances provided on the Mungret Link Streets Project. All construction traffic will be limited to the entrances provided to them for each Phase, and no construction traffic will enter or leave a completed Phase of the development.

A site boundary in the form of hoarding or fencing will be established around each of the construction compounds. The hoarding/fencing will be c. 2.4m high to segregate members of the public from the construction site.

6.1.2 Deliveries to Site

Deliveries of materials will be planned and programmed to ensure that the materials are delivered only as they are required at the working areas. Works requiring multiple vehicle deliveries, such as concrete pours, will be planned so as to ensure there will no queuing on the public roadways. Deliveries will be limited to outside of peak hours.

To avoid disruption to residents, local businesses and road users, the transport of abnormal loads to site will be done outside of peak traffic hours. Should any road closures be necessary on sections of the route to facilitate transport of abnormal loads, applications for these road closures will be advertised and will be carried out in accordance with the requirements determined by the Roads Department of Limerick City & County Council. Service providers will also be contacted to be advised that abnormal loads will be traveling along the nominated route and any overhead services (ESB and telecoms) will be temporarily diverted if necessary.

All necessary permits for transport of abnormal loads will be sought from the local authority, Transport Infrastructure Ireland (TII), and An Garda Síochána as appropriate. The contract haulage firm nominated for the transportation of the abnormal loads will undertake the preparation and lodging of these permit applications under the guidance of the Contractor. Any conditions attached to these permits will be fulfilled prior to transport to ensure safe and timely delivery of the items.

Transportation of the large prefabricated elements will be limited to off-peak hours to limit effects on traffic within the city. Routes and times will be agreed and coordinated with Limerick City & County Council and An Garda Síochána in advance.

6.1.3 Construction Traffic

The following measures will be implemented in relation to traffic and transportation during construction:

- Construction access to the site will be from the Mungret Link Streets Project, which will connect the R510 and R859;
- Deliveries of materials will be planned and programmed to ensure that the materials are delivered only as they are required at the working areas and will avoid peak hours for set-up and removal of equipment;
- Works requiring multiple vehicle deliveries, such as concrete pours, will be planned so as to ensure there will be no queuing on the public roadways around the working areas;
- Deliveries of materials will be limited to outside of peak hours on the existing road network and/or likely commuter movement times;
- All trucks entering and exiting the working areas which are carrying materials which could become windborne will be covered with tarpaulin;
- Trucks will not be allowed to park on public roads either outside the working areas or on any of the approach roads leading to the working areas;
- All trucks entering the working areas will be restricted to suitable speed limits and will be directed to the relevant area by the Site Manager. Adherence to posted / legal speed limits will be emphasised to all staff / suppliers and contractors during induction training. Drivers of construction vehicles / HGVs will be advised that vehicular movements in sensitive locations, will be restricted to 60km/h or 30km/h, depending on sensitivities. Such recommended speed limits will only apply to construction traffic and will not apply to general traffic. It is not proposed to signpost such speed limits in the interest of clarity for local road users.
- Trucks required to wait at the working areas will switch off engines to avoid unnecessary fuel usage and noise;
- All trucks exiting the construction compounds will be required to pass through a wheel wash. All water from the wheel wash will be collected, treated to remove silt or other contaminants, and removed from site;
- Roads immediately adjacent to the construction compounds will be visually inspected on a daily basis and power swept and washed as and when required. Roads will be returned to their original condition or better following the works.

- Adequate parking will be provided at the construction compounds to avoid queuing at the site entrances and prevent disruption to neighbouring businesses and residences;

6.1.4 Construction Phases and Occupancy

As mentioned, following the completion of each construction phase and the subsequent occupancy of the residential units, the Contractor will update the CTMP to ensure the segregation of pedestrians/ cyclists/ other road users from construction traffic is maintained at all times. Where required footpaths and additional temporary pedestrian crossing points will be provided within the site.

The movement of traffic within the site will be managed through the use of signage, portable traffic lights or stop/go personnel.

6.2 Air Quality and Climate

Emissions to air during excavation, rock breaking, movement of construction traffic around site and construction will occur. Construction activities are likely to generate dust emissions, particularly during the site clearance, rock breaking and excavation stages.

The extent of the effects from dust emissions will be determined by the prevailing weather, the nature of the works and the distance to sensitive receptors. The focus of the control procedures will therefore be to reduce the generation of airborne material.

Standard environmental control measures will be implemented, as per guidance presented in the TII document *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes* (TII, 2011). These will include the following:

- During dry periods when dust generation is likely or during windy periods, working areas and vehicles delivering material with dust forming potential will also be sprayed with water, as appropriate;
- Wheel-wash facilities will be provided with rumble grids to remove excess mud from wheels. These facilities will be located at the exit from the construction compounds and away from sensitive receptors, where possible.
- Stockpiles will be covered and located as far from sensitive receptors as possible;
- Control of vehicle speeds, speed restrictions and vehicle access; and
- Surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Site roads will be cleaned on a daily basis.

In addition, the following measures will be implemented. These measures are based on best practice as outlined in the British Research Establishment (BRE) document *Controlling particles, vapour and noise pollution from construction sites* (BRE, 2003) and the Institute of Air Quality Management (IAQM) document

Guidance on the assessment of dust from demolition and construction (IAQM, 2016).

- Exhaust emissions from vehicles operating within the working areas, including trucks, excavators, diesel generators or other plant equipment, will be controlled through regular servicing of machinery;
- Areas where materials will be handled and stockpiled will be designed to minimise their exposure to wind – all stockpiles will be kept to the minimum practicable height with gentle slopes;
- There will be no long-term stockpiling within the working areas and storage time will be minimised;
- Material drop heights from plant to plant or from plant to stockpile will be minimised;
- Hoarding c. 2.4m high will be provided around the works to minimise the dispersion of dust from working areas; and
- Truck loads will be covered when carrying material likely to generate dust.

Employee awareness is also an important way that dust may be controlled on any site. Staff training and the management of operations will ensure that all dust suppression methods are implemented and continuously inspected.

6.3 Noise and Vibration

Specific noise abatement measures will be taken, to comply with the recommendations of BS 5228-1 and 2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites: Noise and vibration* (BSI, 2014) and the *European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001* (EC, 2001).

The following specific measures will be implemented during the construction phase to ensure noise and vibration effects are minimised:

- The duration of rock-breaking activities will be minimised, with works being concentrated in the early part of each of the three phases of construction. For Phase 1, the duration of this activity will be approximately a month, for Phase 2 it will be approximately three months, with the works in the northern part of the site restricted to a month's duration. It is intended to remove rock identified in the lands of Phase 3 in Phase 2 to complete all these works in a practical manner.
- Noisy works will be restricted to daytime hours;
- Site representatives will be appointed to be responsible for matters relating to noise and vibration;
- Equipment will be switched off when not required and unnecessary revving of machinery will be avoided;
- Rubber linings will be used in chutes and dumpers etc. to reduce noise;
- Drop heights of materials will be minimised;

- Site equipment will be located away from sensitive receivers and will be enclosed;
- Keep internal haul routes well maintained and avoid steep gradients;
- Careful selection of equipment, construction methods and programming with the objective of reducing noise and vibration where possible. Only equipment, including road vehicles, conforming to relevant national or international standards, directives and recommendations on noise and vibration emissions, will be used;
- Plant and vehicles will be started sequentially rather than all together;
- Fitting suitable anti-vibration mountings where practicable, to rotating and/or impacting equipment;
- Using noise-control equipment such as jackets, shrouds, hoods, and doors, and ensuring they are closed;
- Locating plant, as far as is reasonably practicable, away from receptors or as close as possible to noise barriers or hoardings where these are located between the source and receptor;
- Regular and effective maintenance by trained personnel will be carried out to reduce noise and/or vibration from plant and machinery;
- Ensuring that all plant is maintained regularly to comply with relevant national or international standards and operation of plant and equipment that minimises noise emissions;
- Ensuring that air lines are maintained and checked regularly to prevent leaks;
- Designing all audible warning systems and alarms to minimise noise. Non-audible warning systems can be used in preference, i.e. cab-mounted CCTV or the use of banksmen. If required, ensure that audible warning systems are switched to the minimum setting required by the Health and Safety Authority and where practicable use 'white noise' reversing alarms in place of the usual 'siren' style reversing alert
- A c. 2.4m hoarding of density of at least 7kg/m² will be provided around construction works;
- Handling all materials, particularly steelwork, in a manner that minimises noise. For example, storing materials as far as possible away from sensitive receptors and using resilient mats around steel handling areas;
- During construction, regular inspections will be undertaken to ensure that the noise and vibration minimising methods, plant and control measures identified in the specimen design stage are adopted on site and are working effectively. If applicable, it is proposed that construction method inspections be integrated into any health and safety or quality surveillance regime;
- Site representatives will be appointed to be responsible for matters relating to noise and vibration; and

- Monitoring typical levels of noise and vibration during critical periods and at sensitive locations for comparison with limits^{6,7} and background levels e.g. rock-breaking during Phase 2 which is adjacent to Mungret Woods.

From the Standard, applicable daytime noise limits at sensitive receptors are 65dB L_{Aeq} . An exceedance of this limit by more than 10dB is considered to be a significant impact.

In relation to vibration, the Standard identifies that a vibration level of 1.0mm/s can be tolerated if prior warning and explanation is given to residents. Levels of 10mm/s or more is 'likely to be intolerable for any more than a very brief exposure to this level'.

In the absence of additional noise control measures, it is likely that noise levels at the closest sensitive receptors will exceed the 65dB limit for periods of time during the rock breaking activity. To ensure this is properly controlled, the following specific measures will be implemented.

- A programme of noise monitoring will be implemented for the duration of the rock-breaking activities, focussed on the sensitive receptors closest to the most intensive rock-breaking activity.
- The construction contractor will erect acoustic screening local to the rock breaking activity, which will be specified and sized to ensure that off-site noise effects are compliant with the 65dB L_{Aeq} criterion. At a minimum, this will be required for the duration of this activity in the north-eastern part of the site.
- If the noise monitoring records exceedances of the limits, the rock-breaking activity will be suspended until enhanced acoustic screening is installed.

Notwithstanding these measures, the nature of rock-breaking activities means that there is still the potential for negative noise and vibration effects at the closest sensitive receptors while those activities are ongoing.

6.4 Biodiversity

6.4.1 Habitats and Flora

To accommodate construction of the proposed development the removal of three trees is required and approximately 7,523m² of hedgerow. The Contractor will appoint a Project Arborist who will prepare a site-specific Tree Protection Plan. This plan will set out specific measures for the protection of the remaining trees and root protection zones to avoid effects of construction on trees. Environmental control measures to be implemented include:

Pre-Construction Works

⁶ BS 7385-2:1993 *Evaluation and measurement for vibration in buildings. Guide to damage levels from ground borne vibration.*

⁷ BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites –Vibration.*

- Project Arborist will be appointed for the duration of the proposed development and will make regular site visits to ensure that the required protection measures are in place and adhered to.
- All construction personnel will be briefed on the tree and hedge protection measures in place. Environmental buffers and exclusion zones to be easily identifiable.
- Trees and hedgerows identified for removal, including methodologies, will be agreed with the Project Arborist.
- Works will be carried out by appropriately trained personnel taking into account the recommendations of BS 3998 (2012).
- Prior to any construction works on site all trees and hedgerows to be retained will be protected by the use of protective barriers or ground protection. In order for the retained trees and hedgerows to be adequately protected on the site a construction exclusion zone will be identified. Additionally, areas that are designated for new plantings will be similarly protected with barriers being fit for the purpose of excluding construction activity
- Protective fencing will be c. 2.4m high and constructed in accordance with BS 5837 (2012). Alignment of fencing will be agreed with the Project Arborist and once erected will remain in place for the duration of the construction phase of the proposed development and will only be removed when all works are complete and incorporated into the finished landscape.
- Signs will be attached to the protective fences warning people to ‘keep out’.

Construction Works

- During the course of the works special attention will be paid to ensure that the protective fences remain upright, rigid and complete at all times. The fences will be checked daily by the Contractor and any damage noted will be fixed immediately.
- Prior to the installation of any services, these are to be marked out on site for review by the Project Arborist and a detailed method statement is to be prepared by the installation contractor in conjunction with the Project Arborist on how these services are to be installed while providing protection to the vegetation being retained.
- If it becomes necessary to carry out works within the RPA of trees to be retained, such works will be discussed and agreed with the Project Arborist. All works will be carried out manually. Root pruning will be undertaken by an Arborist using proprietary cutting tools such as a secateurs or hand pruning saw. The ground within the RPA of these trees will be protected from damage as per the recommendations of BS 5837 (2012)⁸. The installation of ground protection in the form of a single thickness of scaffold boards on top of a compressible layer laid onto a geotextile may be acceptable.

⁸ British Standard (BS 5837:2012) Trees in Relation to Design, Demolition and Construction-recommendations

- The existing ground level within the RPA of trees to be retained will be incorporated into the finished landscaped development. Where changes in levels occur, these will either be graded into the finished levels starting outside the RPA or alternatively, retaining wall structures will be used differentiating between the different levels.
- The following activities will not be permitted within the RPA, or the vicinity of the trees and hedgerows being retained.
 - Storage of plant/equipment, fuel, construction material, or the stockpiling of soil or rubble;
 - Burning of rubbish;
 - Washing of machinery;
 - Attaching notice boards, cables or other services to any part of the tree;
 - Using neighbouring trees as anchor points; and
 - Care will be taken when using machinery such as Tele-porters, cranes or other equipment close to trees so as not to damage the crown or any other parts.
- Following construction works, all retained trees and hedgerows will be re-examined by the Project Arborist and remedial works, where identified, completed.
- The Wildlife Amendment Act 2000 (S.46.1) provides that it is an offence to cut, grub, burn or destroy any vegetation on uncultivated land or such growing in any hedge or ditch from the 01 March to the 31 August. Exemptions include the clearance of vegetation in the course of road or other construction works or in the development or preparation of sites on which any building or other structure is intended to be provided. Where possible, vegetation will be removed outside of the breeding season and in particular, removal during the peak-breeding season (April-June inclusive) will be avoided. This will also minimise the potential disturbance of breeding birds outside of the proposed development site boundary.

6.4.2 Fauna

There are no species-specific control measures included for the proposed works, however, to facilitate the continued movement of mammals across the construction site mammal gates will be located wherever external hedgerows intersect the site hoarding.

Potential indirect effects on faunal species could arise from water quality issues, environmental controls in relation to water quality are described in **Section 6.7**.

6.5 Archaeology, Architectural and Cultural Heritage

As part of the proposed development minor upgrade works to the observatory and existing site walls are to be carried out. Works to the observatory include the

installation of a new steel frame and vertical bar gate at the entrance and the construction of a sweeping path. Additionally, the fabric of the observatory is also intended for some repair and stabilisation works. Conservation and retention work to the existing site walls include the removal of vegetation, cleaning of joints and repointing.

The following specific measures will be implemented during the construction phase to ensure effects to the observatory and existing site walls are minimised:

- Protective fencing will be erected around the observatory and existing site walls to protect the structures from accidental damage. The fencing will remain in place for the duration of the construction phase and will only be removed when all works are complete and incorporated into the finished landscape.
- Prior to the commencement of works an assessment on the stability of the existing site walls will be carried out by a structural engineer. Based on the findings a comprehensive cleaning and conservation strategy will be prepared and undertaken by a specialist in this area. All vegetation will be removed, and care taken to the surrounding stone and mortar joints. Where mortar joints have deteriorated and decayed, a process for the repointing will be undertaken with regards to, raking out, washing, brushing, mortar mix and curing. The joints will be cleaned, and loose debris removed prior to repointing. A Natural Hydraulic Lime (NHL) mortar, to the appropriate specification, will be used for repointing, thereby adhering to good conservation practise of replacing like with like materials.
- All ground disturbances associated with the proposed development will be monitored by a suitably qualified archaeologist. If any features of archaeological potential are discovered during the course of the works archaeological measures may be required, such as preservation in-situ or by record. The archaeologist will secure an excavation licence for monitoring in the event of an archaeological discovery. Any further measures will require approval from the National Monuments Service.
- Vibration monitoring will be implemented to ensure that the construction does not exceed the vibration limits^{6, 7} for protected structures.
- Financial support and sufficient time within the construction programme will be provided at the outset of the proposed development to facilitate any excavation or recording of archaeological material that may be uncovered during the works. The construction programme will be developed and implemented to reflect this provision, to ensure the preservation of such archaeological material.

6.6 Land and Soils and Hydrogeology

The following standard best practice measures and construction techniques will be implemented to prevent soil contamination, sedimentation, run-off and pollutants from entering adjacent watercourses and contamination:

- Good housekeeping (daily site clean-ups, use of disposal bins, etc.) will be carried out on site during construction, and the proper use, storage and disposal of all substances and their containers will help prevent soil contamination. For all activities involving the use of potential pollutants or hazardous materials, there will be a requirement to ensure that the material such as concrete, fuels, lubricants and hydraulic fluids will be carefully handled and stored to avoid spillages. Potential pollutants will also be adequately secured against vandalism and will be provided with proper containment. Any spillages will be immediately contained, and contaminated soil removed from site and disposed of in a licenced waste facility.
- Chemicals will be stored in sealed containers and applied in such a way as to avoid any spillage or leakage
- Excavations in made ground will be monitored by an appropriately qualified person to ensure that any hotspots of contamination encountered are identified, segregated and disposed of appropriately. Care will be taken to ensure that the hotspot does not cross contaminate clean soils elsewhere throughout the sites.
- Best practice measures to prevent potential soil and water pollution incidents include adequate bunding for oil containers, wheel washers and dust suppression on site roads, and regular plant maintenance. A contingency plan for pollution emergencies will also be developed prior to the commencement of works and regularly updated, which will identify the actions to be taken in the event of a pollution incident. The CIRIA document recommends that a contingency plan for pollution emergencies will address the following:
 - Containment measures;
 - Emergency discharge routes;
 - List of appropriate equipment and clean-up materials;
 - Maintenance schedule for equipment;
 - Details of trained staff, location and provision for 24-hour cover;
 - Details of staff responsibilities;
 - Notification procedures to inform the relevant environmental protection authority;
 - Audit and review schedule;
 - Telephone numbers of statutory water undertakers and local water company; and
 - List of specialist pollution clean-up companies and their telephone numbers.
- Where at all possible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together. Monitoring of excavation during site clearance to ensure that the soils excavated for disposal are consistent with the relevant descriptions and classifications according to the relevant legislation.

- Ground settlement, horizontal movement and vibration monitoring will be implemented during the construction activities where required to ensure that the construction does not exceed the design limitations.
- Ground settlements will be controlled through the selection of a foundation type and method of construction which are suitable for the particular ground conditions.
- Earthwork operations will be carried out such that surfaces will be designed with adequate falls, profiling and drainage to promote safe run-off and prevent ponding which could lead to percolation to ground.

Section 6.7 provides further erosion and sediment control measures to be implemented.

6.7 Surface Water Management Plan

Best practice construction measures, which are in accordance with CIRIA (C532) – *Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (2001)* will be implemented during construction of the proposed development.

6.7.1 Concrete Control Measures

Concrete will be used for foundations, wall forming structures and grouting of precast concrete. Wet concrete and cement are very alkaline and corrosive and can cause serious pollution to watercourses. The following measures will be implemented:

- Concreting works will be carried out in dry conditions where possible and concrete works will be strictly controlled and monitored;
- No concrete washout will be allowed to discharge to watercourses. Wash out of concrete trucks will not be permitted on site;
- Batch loads of concrete will be delivered, on an as needed basis, to pre-prepared hardstand areas to the roadside boundary of the site.
- A hardstand area of the site will be prepared as a temporary storage compound and construction preparation area.
- All concrete mixing and batching activities will be located in areas away from watercourses and drains;
- Small batch concrete loads will be delivered to specific construction locations by mini dumper or other enclosed contained system of transfer.
- Trucks that deliver concrete to site will be washed out at the supplier's facilities and not on site.
- A designated trained operator experienced in working with concrete will be employed during concrete pours.
- Disposal of raw or uncured waste concrete will be controlled to ensure no watercourses are impacted.

- Best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / formwork, adequate curing times will be implemented.
- Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline, therefore, washing will not be permitted on site.

6.7.2 Fuel and Oil Management Plan

- A detailed spillage procedure will be put in place and all personnel will be trained with respect to the relevant procedures to be undertaken in the event of the release of any sediment, hydrocarbons into a watercourse. Spill kits will be maintained on site and relevant staff will be trained in their effective usage. All site personnel will be trained and aware of the appropriate action in the event of an emergency, such as the spillage of potentially polluting substances. In the event of spillage of any polluting substance and/or pollution of a watercourse, Limerick City & County Council and the NPWS will be notified.
- At the construction compounds, all fuels, oils and lubricants will be stored in a bunded area (110% capacity) protected from flood damage and inundation. In addition, a designated bunded refuelling area on an impermeable surface will be provided at the construction compounds.
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.
- Refuelling of vehicles and mobile plant will take place at designated locations on an impermeable surface and from any drains or watercourses. A spill kit, including an oil containment boom and absorbent pads, will be on site at all time;
- Generators, diesel pumps and similar equipment will be placed in drip trays to collect minor spillages. These will be checked regularly, and accumulated oil removed;
- No vehicles will be left unattended when refuelling;
- Hoses and valves will be checked regularly for signs of wear and turned off when not in use;
- All vehicles will be regularly maintained, washed and checked for fuel and oil leaks;
- Leaking oil drums will be removed from site immediately and disposed of via a licensed waste disposal contractor;
- Any tanks or drums will be stored in a secure container or compound, which is to be kept locked when not in use. The contents of the tanks will be clearly marked on the tank, and a notice displayed requiring that valves and hoses to be locked when not in use.

- Oily water associated with construction activities will pass through an oil separator before discharging into the surface water drainage system.

6.7.3 Erosion and Sediment Control Measures

Construction works have the potential to generate sediment within the work area.

To prevent silt and sediment from entering the watercourses the following standard best practice measures and construction techniques will be implemented and monitored:

- All works undertaken will be fully consolidated to prevent run-off of silt;
- To minimise the potential for elevated silt levels in surface water run-off, the working area used during construction will be clearly outlined prior to the commencement of works and will be kept to the minimum area necessary to effectively complete the works.
- To reduce the risk of erosion vegetation will be retained where possible. Where deemed necessary, areas where vegetation has been removed, will be stabilised using hardstand materials (road base, bitumen seal, concrete, or similar).
- Sediment fences/silt traps will be provided at locations where surface water run-off may enter/leave the working areas. Where a sediment fence cannot be adequately installed due to presence of rock, alternative controls capable of ponding site runoff will be installed (e.g. sediment sock filled with sand).
- Excavations: Water will be prevented from entering local excavations by way of cut-off drains. Personnel and/or plant will not disturb water in a local excavation. If required, the means of dewatering excavations in the event there is ingress will include sediment filtration tanks, to ensure that any dewaterings do not increase background suspended solids levels in the environment.
- Dewatering, where required, will be passed through sediment filtration tanks. There will be no direct pumping of contaminated water from the works at any time;
- Spoil heaps: Small (<100m³) topsoil/subsoil heaps will be located, protected and stabilised at the temporary construction compounds in a way that will avoid the risk of contamination of drainage systems and local watercourses. Stockpiles and adjacent drainage infrastructure will be monitored and maintained appropriately.
- Self-contained wheel wash facilities will be provided to protect watercourses from the carriage of silt on vehicles. Waste liquid will be contained and subsequently removed off-site for disposal at an appropriately permitted facility.

6.7.4 Foul Drainage

At the construction compounds, mobile welfare facilities such as vans, towed units or self-contained units will be provided for construction personnel with foul sewage disposed of by removal off-site to a licensed facility at regular intervals.

6.8 Construction Waste Management

The following measures will be implemented throughout the proposed development:

- Site clearance which includes the removal of trees and vegetation will be restricted to the winter months.
- Organic waste, such as trees and vegetation, will be removed from site by a waste collection permit holder and delivered to an authorised composting or organic waste facility.
- All spoil and excavated materials will be temporarily stored at designated areas.
- Possibilities for re-use of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use. Where excavation material cannot be re-used within the proposed works, every effort will be made to send material for re-use as a by-product, recovery or recycling so far as is reasonably practicable. Re-use as a by-product can be done under an Article 27 notification once the established EPA criteria for such re-use are met;
- Where excavation material may not be re-used within the proposed development or as a by-product the Contractor will endeavour to send material to a suitable waste permit facility or licensed soil recovery facility in accordance with relevant waste legislation.
- The Contractor will ensure that any off-site interim storage facilities for excavated material have the appropriate waste licences or waste facility permits in place.
- Waste disposal will be minimised so far as is reasonably practicable;
- Waste from the proposed development will be transported by authorised waste collectors in accordance with the relevant Irish waste legislation;
- Storage of materials which are vulnerable to damage by rain are covered and carefully handled to avoid undue damage;
- Waste from the proposed development will be delivered to authorised waste facilities in accordance with the relevant Irish waste legislation;
- Source segregation: Where possible, metal, timber, glass and other recyclable material will be segregated during construction works and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding, and photographs of wastes to be placed in each container as required, will be used to facilitate segregation. Where waste generation cannot be avoided this will

maximise the quantity and quality of waste delivered for recycling and facilitate its movement up the waste hierarchy away from landfill disposal and reduce its environmental effect;

- Material management: ‘Just-in-time’ delivery will be used so far as is reasonably practicable to minimise material wastage;
- Supply chain partners: The Contractor will engage with the supply chain to supply products and materials that use minimal packaging, and segregate packaging for reuse;
- Waste Auditing: The quantity in tonnes and types of waste and materials leaving site will be recorded during the construction phase;
- Waste fuels/oils will be generated from equipment used on-site during construction and will be classified as hazardous waste. Such wastes will be stored in a secure, bunded area on-site prior to collection by a contractor who holds the appropriate waste collection permit;
- The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material, which is recovered, and which is disposed of.
- The site will be maintained to prevent litter and regular litter picking will take place throughout the site.
- The Contractor will record the quantity in tonnes and types of waste and materials leaving the site during the demolition works. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity of waste in tonnes delivered to each facility. Records will show material which is recovered and disposed of.
- Waste generated on site will be removed as soon as practicable following generation for delivery to an authorised waste facility.

6.8.1 Hazardous Waste

All hazardous waste such as paints, sealants and chemicals will be separately stored in a bunded location in an appropriate lockable container, prior to removal from site by an appropriate waste collection holder.

Even though the quantity of hazardous waste generated during the construction phase are expected to be small and not of significance, the following steps must be taken where hazardous waste is being transported from the proposed development to a hazardous waste recovery or disposal facility within the State:

- Waste transfer forms will be obtained by the waste producer from Limerick City & County Council’s website and completed on-line before the waste is collected.
- A copy will be downloaded, printed and signed, accompanying the consignment of hazardous waste when it is in transit.

- On the load's arrival, the operator of the recipient disposal or recovery facility will log-in and complete the relevant details documenting the receipt of the waste.
- Export of hazardous waste from the proposed development outside of the State is subject to a Europe-wide control system founded on EU Regulation 1013/2006 on the Shipments of Waste (known as the Transfrontier Shipment Regulations), as amended. This legislation is supplemented by the Waste Management (Shipments of Waste) Regulations 2007, as amended, which makes Dublin City Council responsible for the enforcement of this regulatory system throughout Ireland. Export of hazardous waste from site outside the state should comply with the procedures set out in this legislation.

6.9 Population and Human Health

Measures which will be implemented to minimise effects on the general amenity of residents and businesses will include:

- The erection of directional and information signage where paths are temporarily closed;
- The provision of information to local residents and businesses during the construction phase;
- The provision of community liaison and nomination of personnel to manage community relations; and
- The preparation of an emergency response plan to cover foreseeable risks.

Industry-standard traffic management measures will be put in place to alleviate construction-related traffic disruptions. Refer to **Section 6.1** for further details.

Dust emissions will be controlled throughout the construction phase. Refer to **Section 6.2** for details of dust control measures.

Noise and vibration disturbance will also be minimised. Environmental controls are described in **Section 6.3** will be adhered to during the construction phase.

As required by regulation and legislation, a Health and Safety Plan will be prepared to address health and safety issues during the construction phase. This plan will be reviewed and updated as required, as the development progresses. The Project Supervisor Construction Stage will assemble the Safety File as the project progresses. Further details are provided in **Section 5.8**.

6.10 Material Assets

The Contractor will be responsible for putting measures in place to ensure that there are no interruptions to existing services and that all services and utilities are maintained unless this has been agreed in advance with the relevant service provider. All works near existing services and utilities will be carried out in ongoing consultation with the relevant utility company and will follow any requirements or guidelines they may have.

Further methods to be implemented by the Contractor to minimise the risk of damage to existing services will be as follows.

- Undertake their own surveys to establish full extent of underground services prior to the commencement of construction to support any surveys already undertaken as part of early design work and statutory consent applications
- The use of Ground Penetration Radar (GPR) and CAT (cable avoidance tool), to provide greater confirmation of the locations of existing assets;
- The use of trial holes, where required, again to provide greater knowledge on the exact location of existing assets;
- The implemented of environmental controls will minimise the risk of pollution of storm water run-off or groundwater. Refer to **Section 6.7** for further details.

7 Concluding Statement

It is intended that this CEMP will be expanded and further developed prior to the commencement of any construction activities on site. The CEMP is a dynamic document and will remain up to date for the duration of the construction period. The CEMP may need to be altered during the lifecycle of the construction period to take account of monitoring results, legislative changes, outcomes of third-party consultations etc.

Following appointment, the Contractor will be required to develop more specific Method Statements that are cognisant of the proposed construction activities, equipment and plant usage and environmental monitoring plan for the proposed development. This CEMP should not be considered a detailed Construction Method Statement as it will be the responsibility of the Contractor, appointed to undertake the individual works, in association with Limerick City & County Council, to implement appropriate procedures and progress this documentation prior to commencement of construction.