HALSTON

APPENDIX 6.1

BAT SURVEY REPORT

Eire Ecology

Environmental Consultants

Bat Survey Report

Coolpowra Energy Development

DOCUMENT DETAILS

Client:	Halston Environmental & Planning Limited (Halston) on behalf of Coolpowra FlexGen Limited
Project Title:	Grid connected energy support projects
Document Title:	Bat Survey Report
Address:	Coolpowra, Co. Galway
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1 INTRODUCTION

This report details the findings of a bat survey carried out as part of a planning application for a proposed grid connected energy support project in Coolpowra, Co. Galway (53.131688, 8.263128).

This report aims to;

- Examine the area of works for the presence of bats or their roosts.
- Identify species of bats using the site.

The surveys undertaken are in line with the Bat Conservation Trust 'Good Practice Guidelines, 4th edition, 2023' (BCT Guidelines 2023) and The Irish Wildlife Manual No. 134' (Marnell, F. 2022). The survey was designed and carried out by John Curtin B.Sc. (Env.). John has over ten years' experience of carrying out bat surveys and has completed copious surveys during this time. John has also completed the Bat Conservation Ireland, Bat Detector Workshop and Bat Handling Workshop which are the standard training for the carrying out of bat surveys in Ireland. In addition, John is a longtime active member of Bat Conservation Ireland, which monitor bat populations in Ireland, and facilitate the education of bat communities to the public.

Surveys were assisted by Karolina Illien (MSc) an Eire Ecology ecologist since 2022.

The site of the proposed development primarily consists of improved agricultural grassland directly surrounded by treelines, hedgerows and drains. Improved grassland habitat typically does not support high diversity of bird species. The site also contains a small area of planted immature native trees, as well as several buildings, gravel tracks and roads.

A single occupied dwelling with some bat roosting potential and several sheds can be found on site. All buildings were examined for bat roosts. Trees within the site were also assessed with reference to (Andrews H. , 2018) "Bat Roosts in Trees. In addition, static detector surveys were conducted to establish bat activity levels within the site.

1.1 DEVELOPMENT PROPOSALS

Project 1: Reserve Gas Fired Generator

The CPFL Reserve Gas Fired Generator comprises three open cycle gas-fired generator (OCGT) units positioned within a building (OCGT Hall) along with auxiliary equipment. An OCGT unit consists of a turbine connected to an electric power generator and the three turbines are designed to operate independently of each other. The OCGT units will receive natural gas from the gas network via an underground pipeline to an Above Ground Installation (AGI) compound within the development lands. Gas Networks Ireland (GNI), as the designated competent authority, will separately manage the process of delivering the underground gas transmission pipeline to the proposed AGI.

The proposed OCGT units are dual fuel units as required by system requirements specified by the Commission for Regulation of Utilities (CRU). Natural gas will be the primary and combustion fuel to each of the OCGT units when operating. Secondary fuel (gas oil) will be stored in a bunded structure outside the OCGT building along with ancillary items of electrical plant and machinery such as coolers and transformers. To ensure compliance with the requirements set by the CRU, the Reserve Gas-Fired Generator must be capable of running continuously for 72 hours using secondary fuel. This preparedness is crucial for scenarios involving an outage or interruption to the natural gas supply.

The Reserve Gas-Fired Generator is designed to operate intermittently and provide generation capacity during periods of high demand or when renewable energy generators cannot meet system demand. OCGT units are advantageous due to their operational flexibility and can be turned on quickly to match system demand. The selected turbines are capable of being converted to allow for the combustion of green hydrogen as a fuel in the future, which will allow for carbon free and climate-neutral plant operation.

Project 2: Energy Storage System (ESS)

The CPFL Energy Storage System (ESS) facility comprises (a) a Long Duration Energy Storage (LDES) static battery positioned within a secure outdoor compound, and (b) a Synchronous Condenser which will operate within a building in a separately secured compound. The LDES will provide peaking, active power and back start capability services o the electricity grid.

Battery storage is a technology that enables power system operators and utilities to store energy for later use. A battery energy storage system (BESS) is an electrochemical device that charges (or collects energy) from the grid or a power plant and then discharges that energy at a later time to provide electricity or other grid services when needed. A BESS facility is made up of batteries, a battery management system, a power conditioning system, and an energy management system. Battery storage is one of several technology options that can enhance power system flexibility and enable high levels of renewable energy integration. Studies and real-world experience have demonstrated that interconnected power systems can safely and reliably integrate high levels of renewable energy from variable renewable energy. Sufficient separation distance between enclosures is included within the design to allow for safe access and replacement of modules. Each module will include control equipment, to provide for ventilation, air conditioning and fire suppression equipment. MVPS (or PCS) units and small transformers will also be positioned in self-contained weather-proof enclosures.

At a system level, UL9540A1 is the recognised test method for evaluating thermal runaway in battery storage systems that reduces the risk of a single cell event spreading to the rest of the system. This is a global standard that technology suppliers test their products under to demonstrate compliance. As is the case within the existing BESS facility, the proposed development will comply with the UL9540A standard industry and other recognised best practice and in terms of fire management.

The plant will absorb and inject energy as demanded by the power system numerous times over an annual period over short-duration events. Therefore, it should be distinguished that grid-connected BESS plants do not operate continuously like conventional power fossil fuel power plants. BESS plants are designed to economically and rapidly provide system support services when needed, allowing immediate system recovery.

As storage technologies continue to mature, and their costs continue to fall, they will be increasingly deployed as a flexible asset to support national decarbonisation goals. In June 2021, Baringa published 'Endgame – A zero-carbon electricity plan for Ireland'2, which projects up to 1,700 MW of large-scale battery storage will be needed on an allisland basis to meet 2030 RES-E targets and deliver a zero-carbon power system. According to Energy Storage Ireland, there is currently 700MW of battery storage now operational on the island of Ireland.

Synchronous condenser technology has been around since the mid 1900's and is demonstrated and mature technology having been formerly used by utilities worldwide. The rotating generator is connected to the transmission system via a step-up transformer. The synchronous condenser is started up and stopped by a frequency controlled electric motor (pony motor). When the generator has reached an operating speed that is synchronous to the system frequency, it is synchronised with the transmission network and acts as a motor providing reactive and short circuit power to the electricity network. There is no combustion or emissions from a synchronous condenser. The synchronous condenser will provide short-circuit power, inertia, and reactive power for dynamic loads and stabilise the network through voltage recovery during faults.

The project is designed to complement and support the reserve gas fired generator by providing zero carbon, instantaneous and balancing power to the grid.

Project 3: Gas Insulated Switchgear (GIS) Electricity Substation

The CPFL Gas Insulated Switchgear (GIS) Electricity Substation comprises a two-storey building positioned and secured within a palisade fenced compound. This component of the overall development will enhance and upgrade the existing Oldstreet AIS 400Kv substation and will provide for the connection of Project 1 and Project 2 to the electricity transmission network. The HV lines and electric plant associated with Reserve Gas Fired Generator and ESS facility, and which will connect the projects to the GIS substation, are included with the planning application for Project 3. Following consultations with the Board under Section 182A of the Act it is the opinion of the Board that the project falls with the meaning of Section 182A of the Act. Accordingly, the Board decided that the proposed development would be strategic infrastructure within the meaning of Section 182AA of the act and any application for permission for the project must be made directly to the Board under Section 37E of the Act.

2 DESKTOP STUDY

2.1 Bats in Ireland – Legislative Protection

There are two main pieces of legislation which cover wildlife protection in Ireland – the Wildlife Act and the Habitats Regulations. These are outlined below, with particular reference to the protection afforded to bat species in Ireland.

The Wildlife Acts 1976 and 2000

The primary pieces of national legislation for the protection of wildlife in Ireland are the Wildlife Act (1976) and the Wildlife [Amendment] Act (2000). All species of bats in Ireland are listed on Schedule 5 of the 1976 Act, and are therefore subject to the provisions of Section 23, which make it an offence to:

- Intentionally kill, injure or take a bat
- Possess or control any live or dead specimen or anything derived from a bat
- Willfully interfere with any structure or place used for breeding or resting by a bat
- Willfully interfere with a bat while it is occupying a structure or place which it uses for that purpose

European Communities (Birds and Natural Habitats) Regulations 2011 to 2021

The EC (Birds and Natural Habitats) Regulations 2011-2021 provide strict protection for all of the Irish species listed on Annex IV of the EU's Habitats Directive. It does this by prohibiting certain activities which could impact on the conservation status of those species. Those activities may only be permitted by way of a derogation licence. All bat species found in Ireland are listed under Annex IV of the Directive, while the lesser horseshoe bat is afforded further protection under Annex II.

These regulations makes it an offence to:

- Deliberately capture or kill a bat
- Deliberately disturb a bat
- Damage or destroy a breeding site or resting place of a bat

Provision is made in the Regulations for the environment minister to grant, in strictly specified circumstances set out in that Regulation, a derogation license permitting any of the above activities "where there is no satisfactory alternative and the derogation is not detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range".

2.2 Site Location and Historical Data

The proposed site lies near Coolpowra, Co. Galway (Grid Ref: E582307 N709323).

2.2.1 Designated Sites Surrounding Subject Site

Four SAC's can be found within 6km (the probable max CSZ for an Irish bat species; Leisler's bat); the Ardgraigue Bog SAC, Barroughter Bog SAC, River Shannon Callows SAC, Lough Derg, North-east Shore SAC. None of these sites are designated for bat species. The site synopsis of the two pNHA's found within 6km of the site do not refer to bats.

Table 2-1 Protected habitats with ornithological value in the vicinity of the proposed development

Name of Site	Site Code	Distance	Has the designated site a high value for bats?	Site within designated roost's CSZ?
Special Area of Conservation (SAC)				
Ardgraigue Bog SAC	002356	4.09km	Peatland. Lesser Horseshoe bats are not a Conservation objective. SAC has little value for bats baring potential feeding grounds. No bat roost mentioned in SAC documents	-
Barroughter Bog SAC	000231	5.75km	Peatland. Lesser Horseshoe bats are not a Conservation objective. SAC has little value for bats baring potential feeding grounds. No bat roost mentioned in SAC documents	-
River Shannon Callows SAC	000216	5.82km	Lesser Horseshoe bats are not a Conservation objective. SAC has some riparian zone which could provide roosting habitat for bats. No bat roost mentioned in SAC documents	-
Lough Derg, North-east Shore SAC	002241	5.86km	Contains high quality native woodland with good bat roosting potential trees. Lesser Horseshoe bats are not a Conservation objective. No bat roost mentioned in SAC documents.	-
National Heritage Areas (NHA)				
Capira/Derrew Bog NHA	001240	1.94km	Peatland with little value for bats baring potential feeding grounds. No bat roost mentioned in Site Synopsis documents	-
Cloonoolish Bog NHA	000249	5.56km	Peatland with Peatland with little value for bats baring potential feeding grounds. No bat roost mentioned in Site Synopsis documents	-

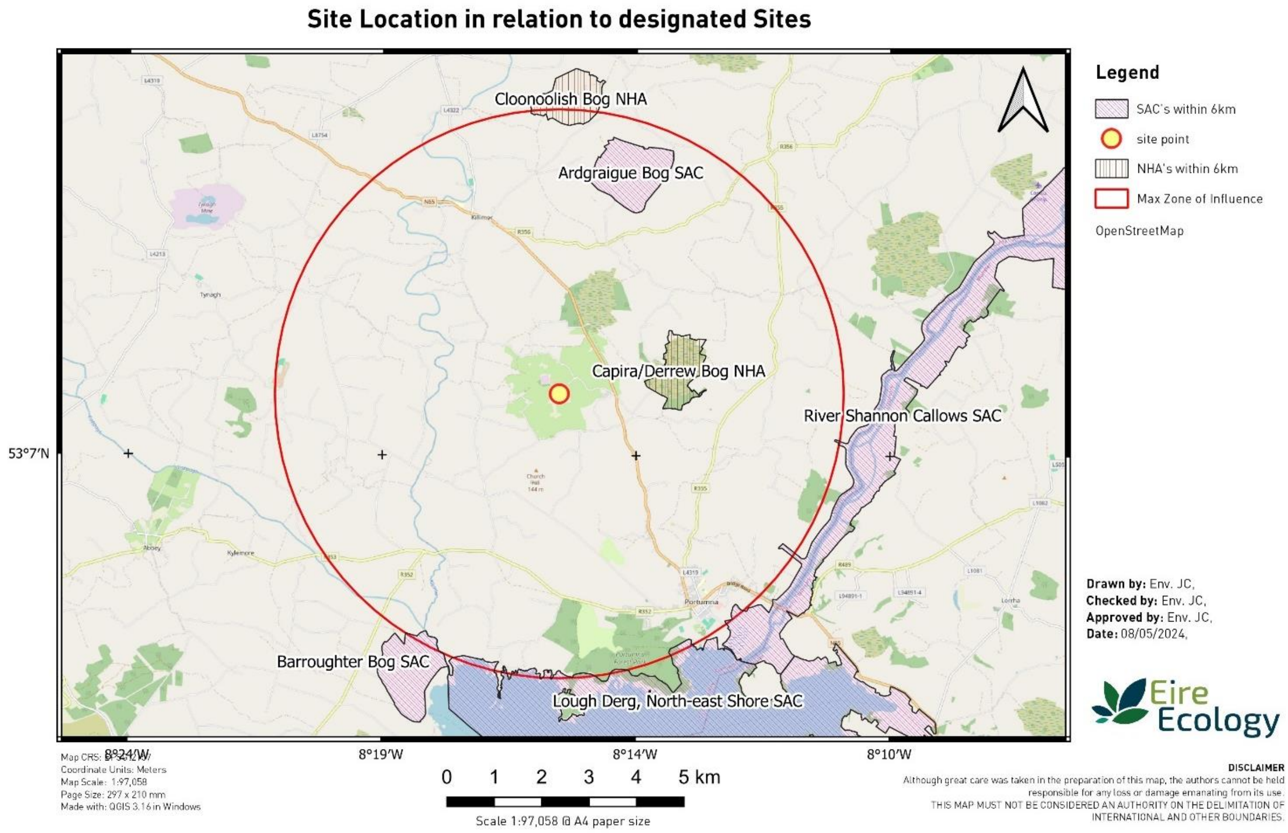

Figure 2-1: Location of proposed development

2.2.2 Bat Landscape

(Lundy, 2011) produced a landscape model by analysing data contained in the Irish National Bat Database, maintained by Bat Conservation Ireland and the National Lesser Horseshoe Bat database maintained by National Parks and Wildlife Service. The maps are a visualisation of the results of the analyses based on a 'habitat suitability' index. The index ranges from 0 to 100 with 0 being least favourable and 100 most favourable for bats.

Table 2-1 shows the BCI bat landscape model for the site. Overall suitability is moderate high with Common and Soprano Pipistrelle, Brown Long-eared Bat, Leisler's Bat, Daubenton's Bat and Natterer's having high favourability.

Table 2-2 Bat favourability

All Bats	Species	Suitability Result
35.33	Soprano Pipistrelle (*Pipistrellus pygmaeus*)	43
	Brown Long-eared Bat (*Plecotus auratus*)	47
	Common Pipistrelle (*Pipistrellus pipistrellus*)	49
	Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	4
	Leisler's Bat (*Nyctalus leisleri*)	46
	Whiskered Myotis (*Myotis mystacinus*)	27

<table>
<tr><th>All Bats</th><th>Species</th><th>Suitability Result</th></tr>
<tr><td rowspan="3"></td><td>Daubenton's Bat (Myotis daubentonii)</td><td>38</td></tr>
<tr><td>Nauthusis' Pipistrelle (Pipistrellus nathusii)</td><td>11</td></tr>
<tr><td>Natterer's Myotis (Myotis Natterii)</td><td>49</td></tr>
</table>

2.2.3 Bat Species Recorded in the Surrounding Area

The NBDC database was consulted for details on bat records held for the site and the surroundings. The database was consulted on the 28/05/2024 for details on historical records from the site and the surrounding 6km given this is the furthest likely zone of influence for Irish bat roosts. Results are outlined in Table 2-2. No bat species were recorded within 2km, however six of the nine confirmed resident bat species known to occur in Ireland have been recorded within 6km of the subject site.

Table 2-3: Irish bat species recorded

<table>
<tr><th>Type of Record</th><th>Species name</th><th>Distance from site</th><th>Last record</th><th>Details</th><th>Designation</th><th>Potential connectivity with subject site</th></tr>
<tr><td rowspan="8">Roost</td><td>Unidentified Bat Species</td><td>4.7km</td><td>2002</td><td>Roost closest to site entrance road. Scattered droppings found.</td><td rowspan="8">EU Habitats Directive Annex IV Protected Species: Wildlife Acts</td><td>Lack of prominent connective features between roost and site location.</td></tr>
<tr><td>Soprano Pipistrelle</td><td>5.0km</td><td>2021</td><td>Roost in Derelict Stone Building inside urban area. Single bat.</td><td>Lies outside the CSZ for this species. Small roost.</td></tr>
<tr><td>Common Pipistrelle</td><td rowspan="6">5.3km</td><td rowspan="6">2005</td><td rowspan="6">Roost on border of broadleaf forest biodiversity area.</td><td rowspan="6">Soprano Pipistrelle maternity roost.
Roost is located within Portumna forest park. The subject site is situated outside the CSZ for Soprano Pipistrelle, the main roost species. The main feeding habitat for the species located in this roost is the woodland.</td></tr>
<tr><td>Soprano Pipistrelle</td></tr>
<tr><td>Leisler's Bat</td></tr>
<tr><td>Daubenton's Myotis</td></tr>
<tr><td>Whiskered Myotis</td></tr>
<tr><td>Natterer's Myotis</td></tr>
</table>

Type of Record	Species name	Distance from site	Last record	Details	Designation	Potential connectivity with subject site
	Unidentified Bat Species	5.4km		Bat Boxes erected on mature deciduous woodland area.		Multiple clusters of bat boxes deployed in Coillte owned forestry. The main feeding habitat for the species located in this roost is the woodland.
	Unidentified Bat Species	5.5km				
	Unidentified Bat Species	6.0km				

2.3 ESB Development North

A planning application by ESB for the Oldstreet kV Substation Extension in 2023. The proposal involves the demolition of a derelict dwelling. Bat surveys conducted in 2022 found Common pipistrelle maternity roost (max of 28 bats observed emerging). As part of the application a purpose-built bat building was proposed. This application was granted, and the bat building has been built however the existing bat roost has yet to be demolished. The dwelling is located 56m to the north of the site while the new bat building is located 180m to the north. Both have good connectivity to the subject site.

3 SURVEY FINDINGS

3.1 SURVEY METHODOLOGIES

3.1.1 Habitats on site

The site of the proposed development primarily consists of improved agricultural grassland directly surrounded by treelines, hedgerows and drains. Improved grassland habitat typically does not support high diversity of bird species. The site also contains a small area of planted immature native trees, as well as several buildings, gravel tracks and roads.

3.1.2 Constraints and limitations

All surveys were conducted at appropriate times of year in good weather conditions.

- All surveys were conducted at appropriate times of year in good weather conditions.
- It is not always possible to identify a bat call to species level due to the recorded call not being clear. Recorded files from automated detectors may contain only fragments of a call, or the bat may be calling from a distance (in relation to the detector) in which case it may not be clear enough to assign the call to a specific species. In these cases, the call has been assigned to genus level.
- Some caution must be taken when comparing activity levels between species, as bias can be shown towards those species with 'louder' or 'lower frequency' echolocation calls. For example, Nyctalus species have louder and low frequency echolocation calls which carry further than the quieter and more broad-band brown long-eared bat echolocation calls;
- A bat contact is defined as a single detector file which contains at least one bat call. Multiple contacts at any given detector location do not necessarily indicate the presence of more than one bat and should therefore be interpreted as a level of activity rather than the number of bats recorded.

3.1.3 Assessment of Potential Roost Habitats

Buildings and trees within the site were examined. The aim of the surveys was to compile information on actual and potential access points and roosting locations. This was done by searching for evidence of bats including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

Potential building roosts

An occupied dwelling (53.1302585, -8.2655434) with sheds can be found within the site. The house and two sheds have some roosting potential. A large metal shed to the rear (53.1305135 , -8.2647968) has low potential. In addition, a small derelict mobile home (53.1319012, -8.2657650) was examined and noted as having low bat roosting potential.

Potential tree roosts

Trees are a highly important feature of landscapes in that they provide roost sites throughout the year as well as being essential sources of insect prey. Therefore, the removal of such trees reduces the availability of shelter and feeding sites for bats (NRA 2005). The use of trees as roost sites is well established. Discovery of such roosts may be established by a variety of means including the use of a bat detector survey or alternatively by examination of all suitable crevices and cavities; commonly referred as Potential Roost Features (PRF's). Trees most likely to serve as bat roosts should be identified by a bat specialist from a walk-through of the route, from aerial photography or from a tree survey report.

Tree Category	Description
1	Trees with multiple, highly suitable features capable of supporting larger roosts
2	Trees with definite bat potential but supporting features suitable for use by singleton bats;
3	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats;
4	Trees have no potential.

Trees were examined for potential to host bat roosts on the 25th of January and the 23rd of February 2024 following guidelines set out in the Bat Tree Habitat Key (Andrews, 2016) and BCT Guidelines for professional ecologists ed 2 and 3. All trees were assessed from ground level using binoculars.

Examples of crevice features include:

- Natural holes;
- Cracks/splits in major limbs;
- Loose bark; and
- Hollows/cavities.

Each tree was assessed and ranked from category 1 – 4. A table of results can be found in Appendix A while a map is presented below as Figure 3-2.

Table 3-1 Categorize each tree according to Bat Conservation Trust 2 ed. (Hundt *et al*, 2012):

3.1.4 Night time bat detector surveys.

Dusk emergence and transects surveys were carried out within the site. These surveys used aspects from chapter 7 of (Collins, 2023) and (Marnell, 2022). Each contact with a bat was recorded. Where possible, a positive identification to species level was made. Information on the behavior was also recorded where available.

The bat detectors used during the surveys were Wildlife Acoustics Inc. (Massachusetts, USA) EM3 touch pro 2s which are triggered to record when a bat call is emitted louder than 18dB for 1sec. These detectors uses full spectrum sampling; detecting all frequencies simultaneously, meaning that multiple bat calls can be recorded at the same time. In addition NVA's were used to aid spot emerging bats;

- Cannon XA10 with two IR Nightfox torches
- Guidetrack Pro 19mm thermal scope
- Guidetrack Pro TK612 thermal scope

A contact as shown below describes a bat observed by the surveyor. This contact can range from a commuter passing quickly to a foraging bat circling a feature lasting for several minutes. Some observations contain multiple bats. When several bats of the same species are encountered together they are recorded under the one contact. A separate contact is recorded for each species. A contact finishes when the recorder assumes the bat is no longer present. It is likely that the same bat is recorded in several contacts throughout the night. This survey type cannot estimate abundance of bats, rather activity; the amount of use bats make of an area / feature

3.1.5 Static bat detector surveys

Song Meter Mini full spectrum bat recorders were deployed within the study area during May 2024. Five detectors were placed within the site;

- D1; along an East to West hedge line adjacent to the Oldstreet 400kV Station,
- D2; placed on a tree to the South of the site,
- D3; placed on a powerline pole in the center of the site,
- D4; located in open, actively-grazed grassland,
- D5; placed on the northern most hedge line with connectivity to a historical roost on the site.

The aim of this survey was to examine how bats utilize the various habitats within the site. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats. Per SNH (2019) guidance, static units (SM-Mini) were programmed to commence half an hour before sunset and finish half an hour after sunrise to ensure that bat species that emerge early in the evening and return to roosts late are recorded. Detectors were left out for 10 nights in May 2024.

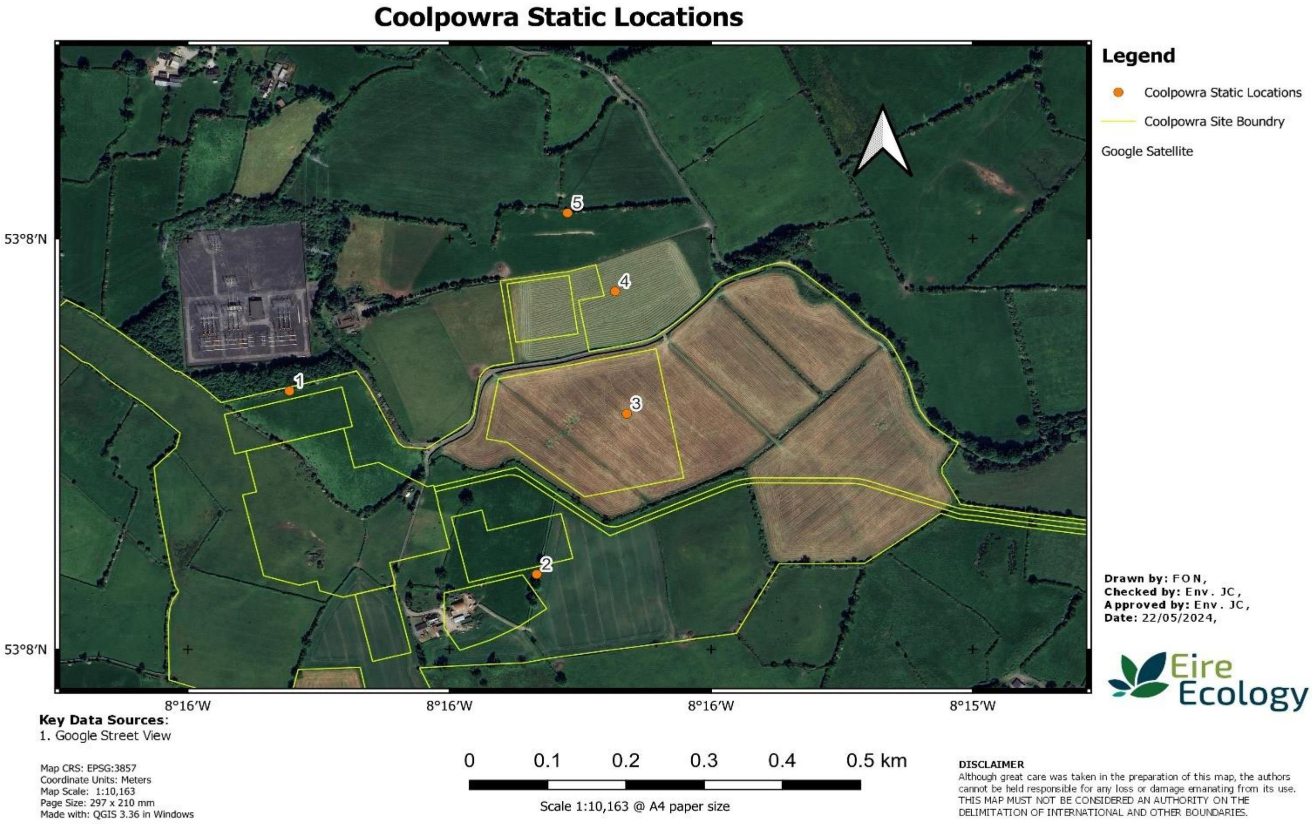

Figure 3-1: Static detector locations

3.2 Survey Results

3.2.1 Potential tree roosts

Each tree was assessed and ranked from category 1 – 4. In total 37 category 1 and 2 trees were recorded (See Appendix B for details). Very few trees of these most suitable categories for bat interaction are located to the West of the site, with highest concentrations of potential roost trees to the south and center of the site.

The majority of these trees will not be impacted by the proposed development.

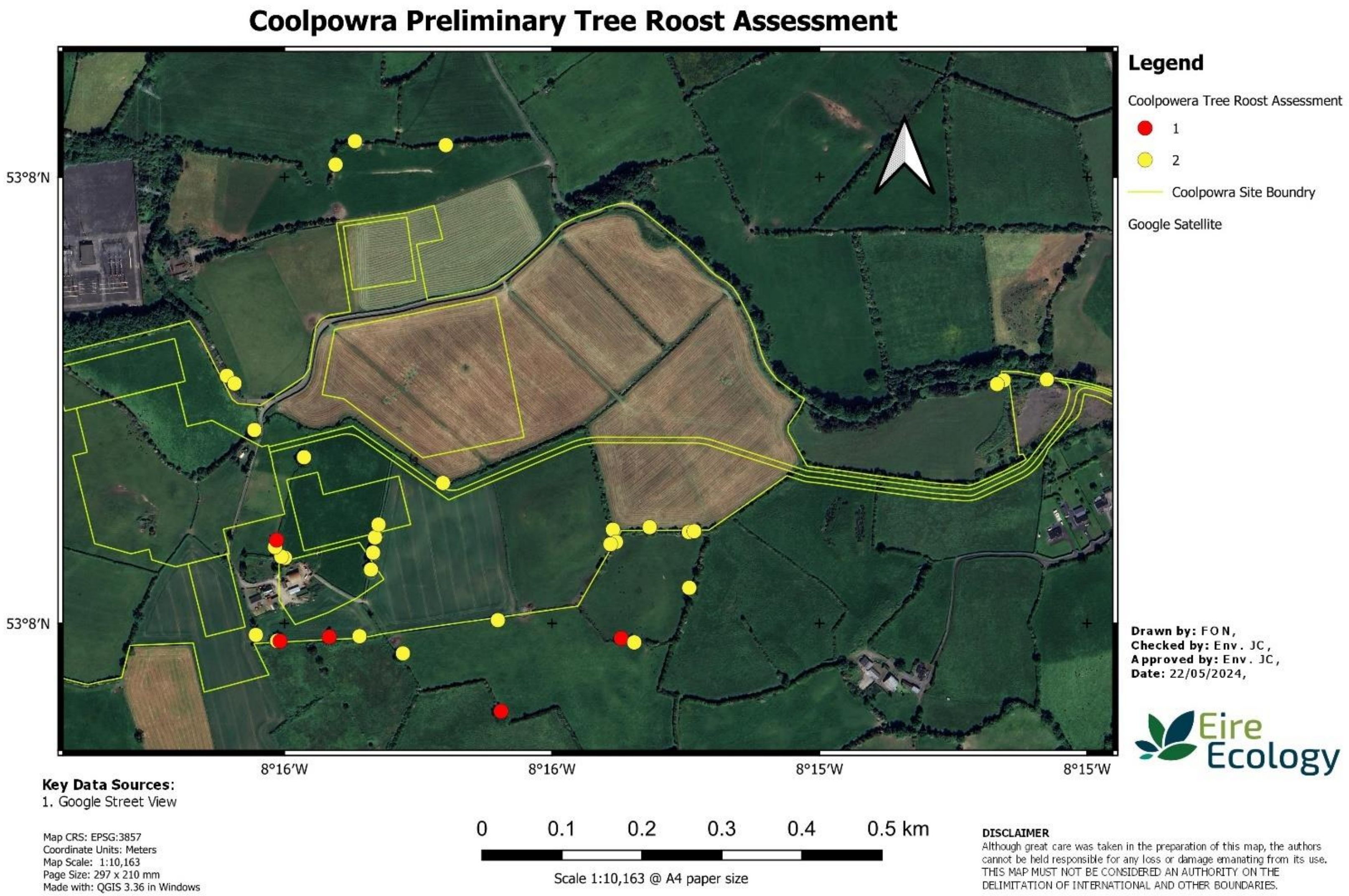

Figure 3-2: Location of category 2 and 3 trees

3.2.2 1st May 2024 Results

Survey was conducted on the dwelling house and adjoining sheds to the south of the site on 1st of May 2024. Emergence Survey was conducted with a surveyor using a Thermal Scope (guide track pro 19mm) facing the Northen face of the dwelling and an accompanying Ultrasonic Bat Detector, while another surveyor was positioned by the sheds to the rear to evaluate any roost potential in the four shed structures (using a Canon xa10). When the survey commenced at 20:30pm, temperature was 13.7 degrees with negligible wind conditions. Sunset fell at 21:04pm.

Location 1

Common and Soprano Pipistrelle, Leisler's bat and unknown Myotis bat were recorded.

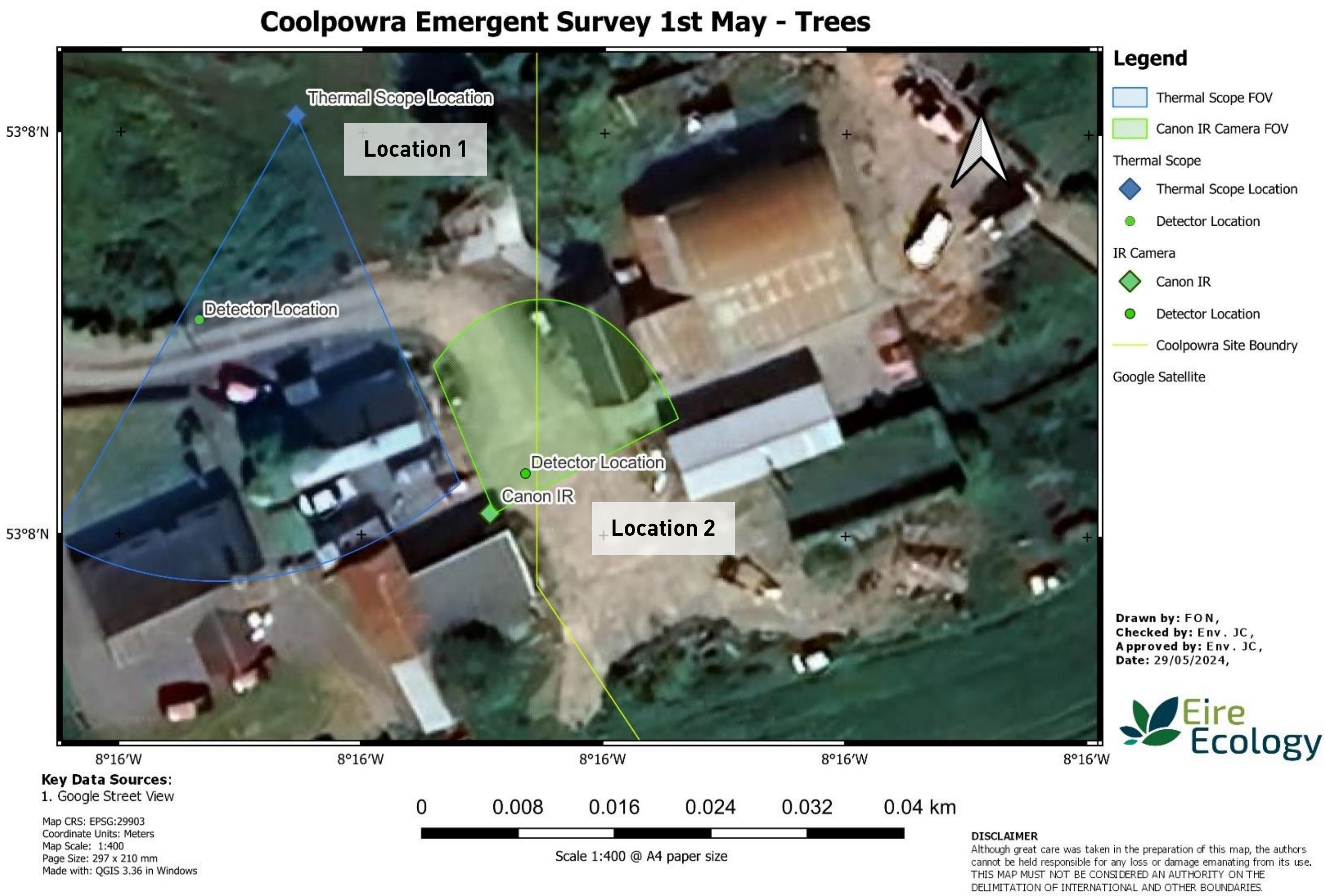

Figure 3-3: Location of surveyors 1st of May.

The first recording of a bat from location 1 (dwelling) occurred 33 minutes after sunset at 21:37pm when an unseen brief Soprano Pipistrelle was recorded. The first observed bat was noted at 21:43 (49 minutes after sunset). A number of Pipistrelle species were recorded from this point hunting above the house for a considerable amount of time before the survey was concluded. **No bats were found emerging from the dwelling.**

Location 2

The first recorded bat from the rear of the dwelling, by the sheds (location 2) coincided with location 1 and was probably the same bat; a Soprano Pipistrelle recorded at 21:35. This bat was noted flying from the south heading north past the sheds. This bat did not emerge from any buildings within the survey area.

The next recording did not occur until 21:58, 54 minutes after sunset when a Soprano Pipistrelle was recorded. No bat was found to emerge from the sheds or rear of the dwelling.

Overall activity was low until 22:35 when Common Pipistrelle were noted flying around the site hunting. In addition, occasional Soprano Pipistrelle and Leisler's bat were noted. Common Pipistrelle was the most frequently recorded bat.

Transect

A transect was walked in the tilled fields to the back of the survey area and occasional Common Pipistrelle were observed hunting on the tree line.

3.2.3 23rd May 2024 Results

Emergence surveys on the 23rd focused on trees with high roosting potential that have the potential to be impacted by the proposed development.

Location 3a and b focused on trees to the north of the farmstead (figure 3-4) while a second location by the eastern entrance was also surveyed (figure 3-5). Sunset was at 21:42. Temperature during this survey 9°.

Locations 3a and b.

A Canon IR Camera was deployed at 21:03 facing East towards the tree of highest potential, while Thermal Scope 1 was positioned facing northeast towards a category 2 Ash tree found to the northeast of the occupied dwelling.

No bat was found emerging from either tree. Common and Soprano Pipistrelle were recorded overflying however activity was low.

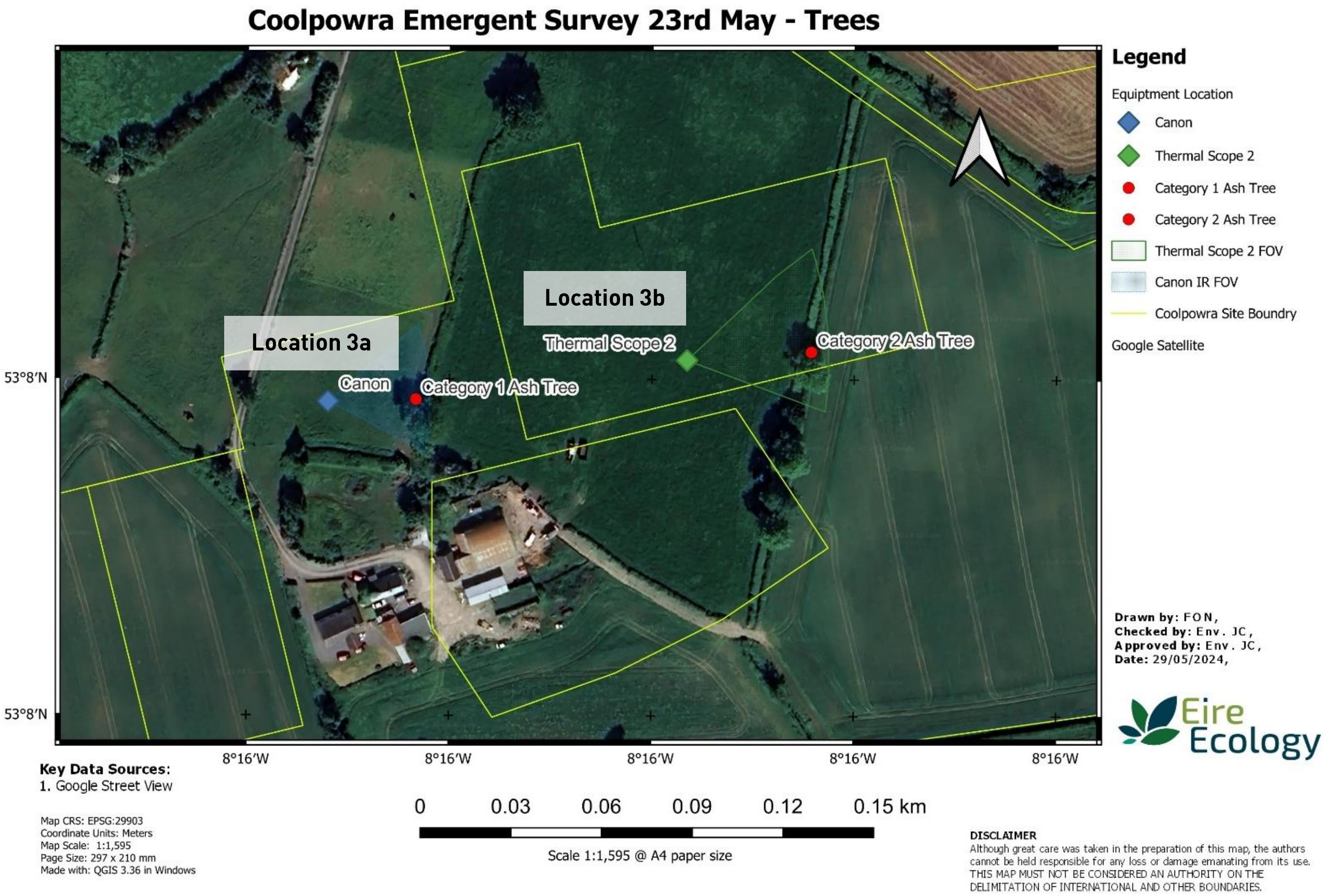

Figure 3-4: Location 3a and b.

Locations 4.

Location 4 was based to the east of the site by the entranceway and examined a Category 2 ash tree (PRF-I). **No emerging bat was found**. The first recorded bat was a Leisler's bat 40 minutes after sunset. Common Pipistrelle and Unidentified Myotis were recorded.

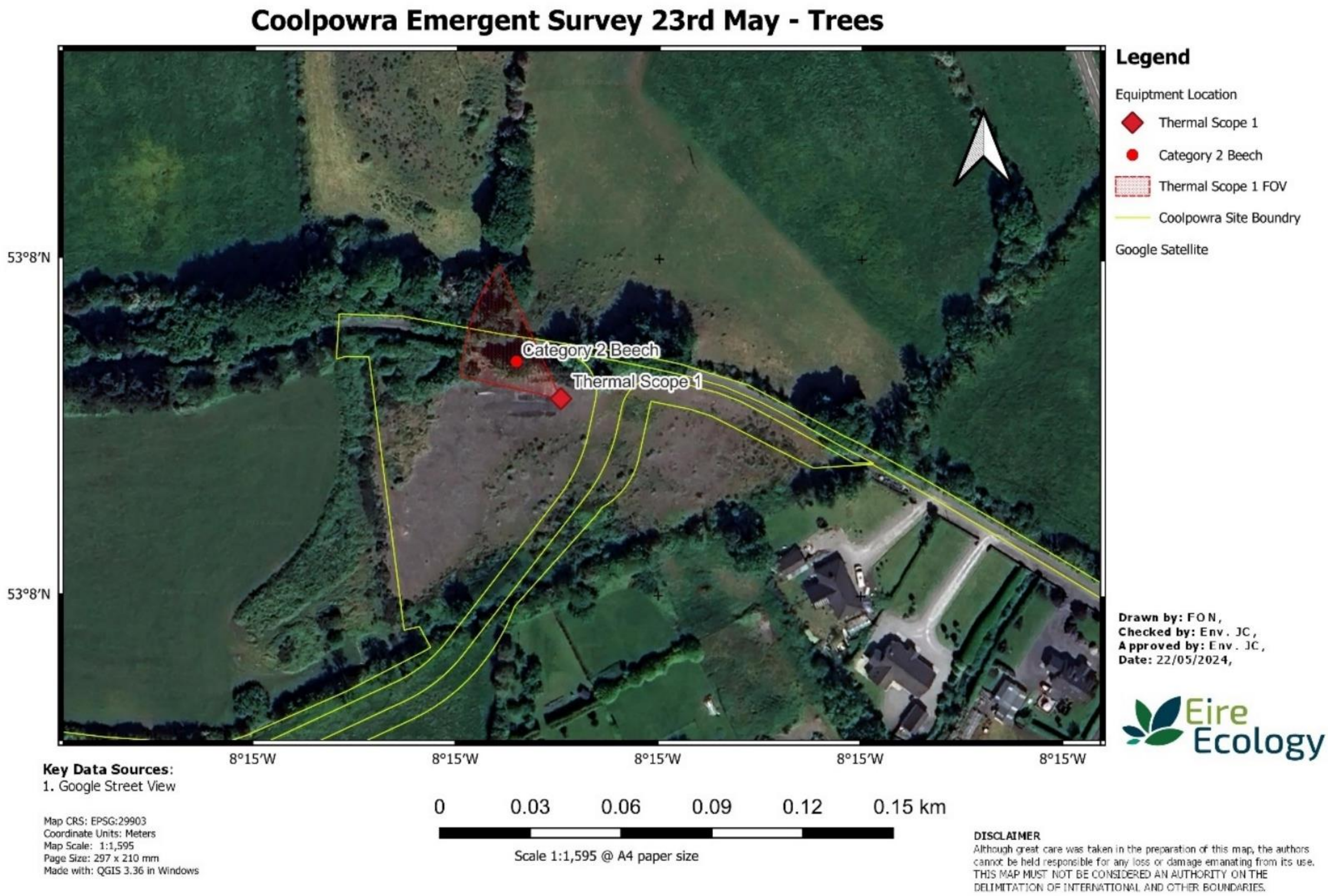

Figure 3-5: Location 4.

3.3 Results of Static Detector Survey

Analysis of recorded registrations was made using Wildlife Acoustic's Kaleidoscope Pro; version 2.1.0. This software identifies many of the calls made by Irish bats. All calls were manually verified.

The results of the static detector survey are summarised in **Table 3-3** and displayed in graph form in **Figure 3-3** below. Over the course of the 10 nights a total of 739 registrations were recorded from detector 1, 106 from detector 2, 120 from detector 3, 185 for detector 4 and 2257 from detector 5. The most active location is at detector 5, which accounts for 66% of all bat registrations on the site.

The most common species recorded from detector 1 (Hedge line) was Common Pipistrelle with 287 registrations (8%*), followed by Leisler's Bat, Soprano Pipistrelle, and Natterer's Bat with 156 (35%), 121 (23%), and 24 (72%) respectively. Brown long-eared bat were also recorded. Unspecified Myotis Bats were mostly located at this detector with 116 (90%) calls registered.

Detector 5 had a total of 2757 registrations, with Common Pipistrelle most frequently recorded: 1702 (77%). Leisler's bat and Soprano Pipistrelle were recorded in lower numbers; 136 (31%) and 353 (67%) respectively. 35 registrations of 40 kHz (51%) were also recorded. Other species, particularly woodland species such as Brown Long-eared bats and Myotis were recorded in low numbers 16 (55%) and 7 (5%) despite the more suitable static location.

Detectors 2,3 and 4 represented only 12% of total bat activity recorded during the survey period, the majority of which are Common Pipistrelle and Soprano Pipistrelle calls. It should be noted that a single bat continuously circling a small stand of trees will produce numerous recordings, thus the number of registrations cannot quantify abundance, rather activity.

* Represents the percentage of bat registrations compared to the total population of each species. i.e. 8% of total Common Pipistrelle calls recorded.

Table 3-2: Summary of results

Detector	Leisler's Bat	Common Pipistrelle	Soprano Pipistrelle	Pipistrelle 40 kHz	Brown Long-eared	Natterer's Bat	Unidentified Myotis	Total	Minutes recorded	Bat passes per hour
1	156	287	121	27	8	24	116	739	5,716	7.8
2	1	99	5	0	0	0	1	106	5,716	1.1
3	55	39	22	3	0	0	1	120	5,716	1.3
4	86	67	20	3	5	1	3	185	5,716	1.9
5	136	1702	353	35	16	8	7	2,257	5,716	23.7
Total	**434**	**2194**	**521**	**68**	**29**	**33**	**128**	**3,407**	**28,580**	7.2

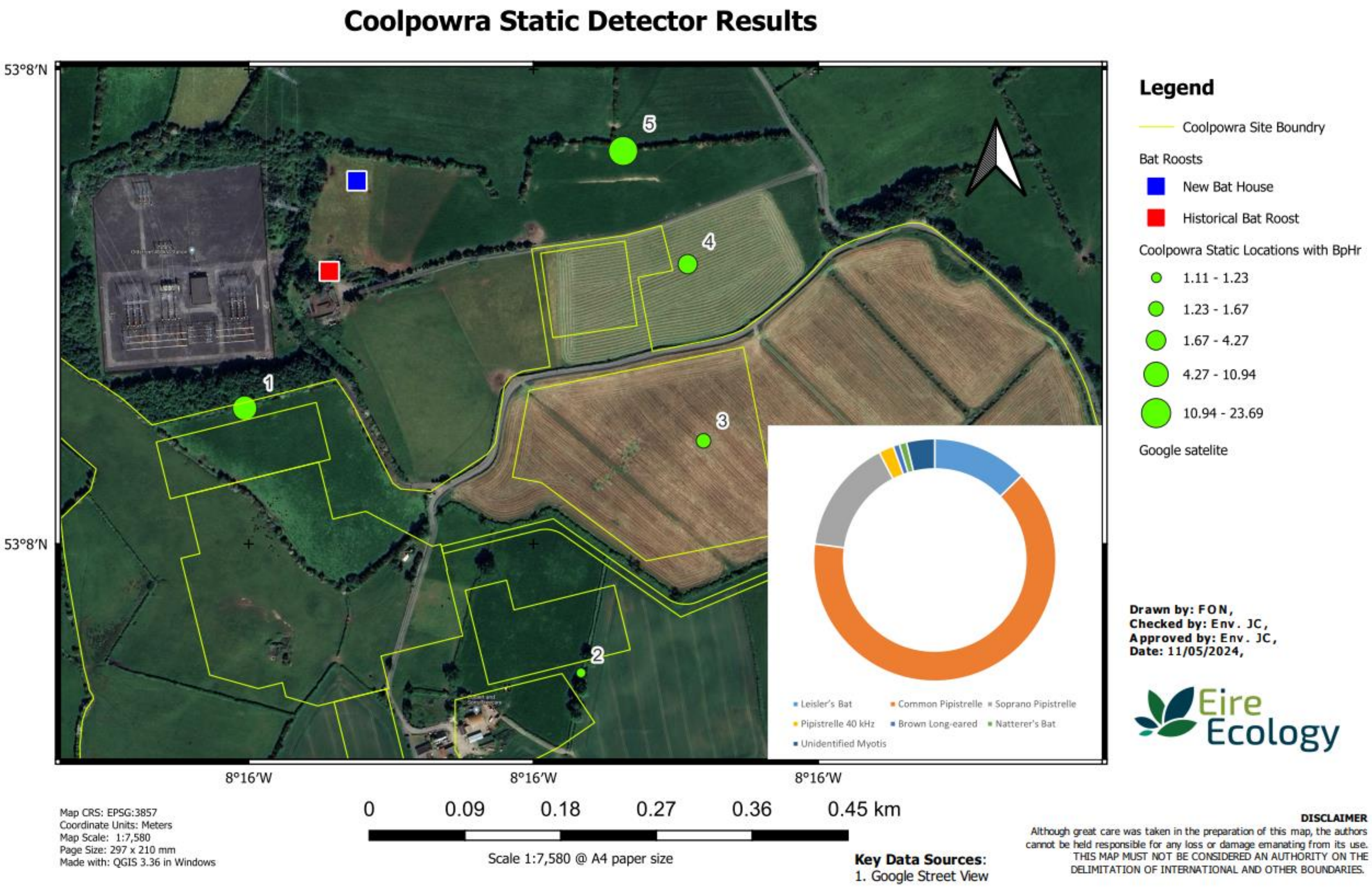

Figure 3-6: Static Detector Results with location of neighboring bat roosts.

4 Discussion

Five species of bat were positively identified during the various bat surveys: Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Natterer's Bat (*Myotis nattereri*), Leisler's bat (*Nyctalus leisleri*) and Brown Long-eared Bat (*Plecotus auritus*).

A number of contacts or recordings of Myotis sp. bats were also made. It can be very difficult to separate the three species of Myotis bat that are regularly found in Ireland and it was not possible in these instances. 68 registrations have been labeled as '40kHz Pipistrelle'. These bats will have been either Common or Nathusius's Pipistrelle and were not identified to species level because the recorded frequency of the CF tail was at about 40 kHz (the typical frequency for Common Pipistrelle is 45 kHz, whilst a Nathusius typical peak frequency is 39.3 kHz.

Over the 10 nights, each static detector was set recording for a total of 95 hours and 15.6 minutes or 5716 minutes (28580 minutes total), with a combined total of 3407 registrations logged. This equates to 7.2 bat passes per hour (Bp/Hr). This is a relatively low number from a lowland habitat.

Detectors 5 and 1 have marked higher activity levels with significantly more Common Pipistrelle activity than other locations. These locations have connectivity (via treelines and conifer edge) to the existing bat roost. Southern sections of the site have a marked lower activity level. Surprisingly, detector 2 located by the treeline to the south had lowest activity. Typically edge habitats have far higher activity than open areas (locations 3 and 4).

5 Impacts Pre-Mitigation

The survey above provides a preliminary study of bat usage of an agricultural site located in Coolpowra, Co. Galway.

Disturbance

Works associated with development or building work are likely to lead to an increase in human presence at the site, extra noise and changes in the site layout and local environment. Of these, the most impactful is lighting, particularly in the operational phase.

Without appropriate design, there is a high likelihood of long term moderate impacts on commuting and foraging bats by illumination.

Loss of foraging and commuting habitat

The redevelopment of this site involves the removal of small sections of treelines and hedgerows that represent landscape features used primarily by Leisler's and Pipistrelle bats species. Activity by Myotis and brown long-eared bat was low. Given the amount of hedgerow and treeline features located in the surroundings the loss of the internal treelines and hedgerows will result in a low level permanent reduction of this habitat for local bat populations. It should be noted that activity within the site was low (baring norther treelines which won't be impacted by the development).

The proposed works will have a Low effect on receptors of Local Importance (Low Value). The loss of feeding habitat within the site is not significant at a county, national or international scale.

Loss of potential roosting habitats in trees.

Although no bats were found within buildings or trees on the site it is possible bats will occupy trees prior to feeling. The preliminary assessment of trees noted category 2 category 1 tree within the site. An at height survey will be required at each of these trees prior to felling.

The proposed works will have a Moderate effect on receptors of Local Importance (Low Value). The loss of trees within the site is not significant at a county, national or international scale.

Loss of potential roosting habitats within structures.

The only structure capable of hosting a bat roost found within the site is an occupied dwelling with associated sheds. A daylight inspection and night time survey shows no evidence of bats.

The proposed works will have a Moderate effect on receptors of Local Importance (Low Value). The loss of these structures within the site is not significant at a county, national or international scale.

6 MITIGATION AND COMPENSATION

6.1.1 Landscaping

A landscape plan has been produced by Macro works that will result in a net benefit for wildlife including bats.

The current bat usage within the site is low probably as much of the site is open pasture and tillage (see static results above). The landscape plan will see a large quantity of woodland and tree planting providing more landscape features usable by bats. Treelines and woodlands to the north where an existing bat roost is located (outside the site) will be protected and enhanced, linking up other areas of the site. The addition of two ponds will allow for higher amounts of invertebrate prey for bats.

6.1.2 Feling of trees

Trees will be felled in October to November or January to February. Any tree ranked category 1 or 2 will be examined 'at height' in order to ensure no bats are present.

Category 3 trees are defined as 'trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats'. Also included within this category are trees with thick ivy however the ivy root is not thick enough to form mats, thus it is possible but unlikely a single bat may be roosting here. Following the precautionary approach all category 3 trees to be felled within the site the following procedure will be undertaken:

Tree-felling to be undertaken using heavy plant and chainsaw equipment. Normally trees are pushed over, with a need to excavate and sever roots in some cases. In order to ensure the optimum warning for any roosting bats that may still be present, the tree should be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly. A period of at least 24 hours, and preferably 48 hours, should elapse prior to such operations to allow bats to escape. Felling works should be overseen by an ecological clerk of works.

All trees ranked category 4 can be felled and removed immediately.

6.1.3 Demolition of Building

A dwelling house and sheds located within the site were examined for bat roosts. None were found. As bats are a mobile species and can avail of roosting structure a pre-demolition survey will be conducted on these structures. Should bats or their roosts be found a derogation license will be required before construction works begin.

6.1.4 Construction of wildlife tower.

The accompanying bird survey report requests the creation of a barn owl tower within the site. This structure can also serve as a bat roost with a lower floor dedicated to roosting bats. Bat boxes will be installed within this lower section with a slot opening providing access into this room (15mm high by 40mm wide) positioned at a height of 2m.

Figure 6-1 Sample roost house

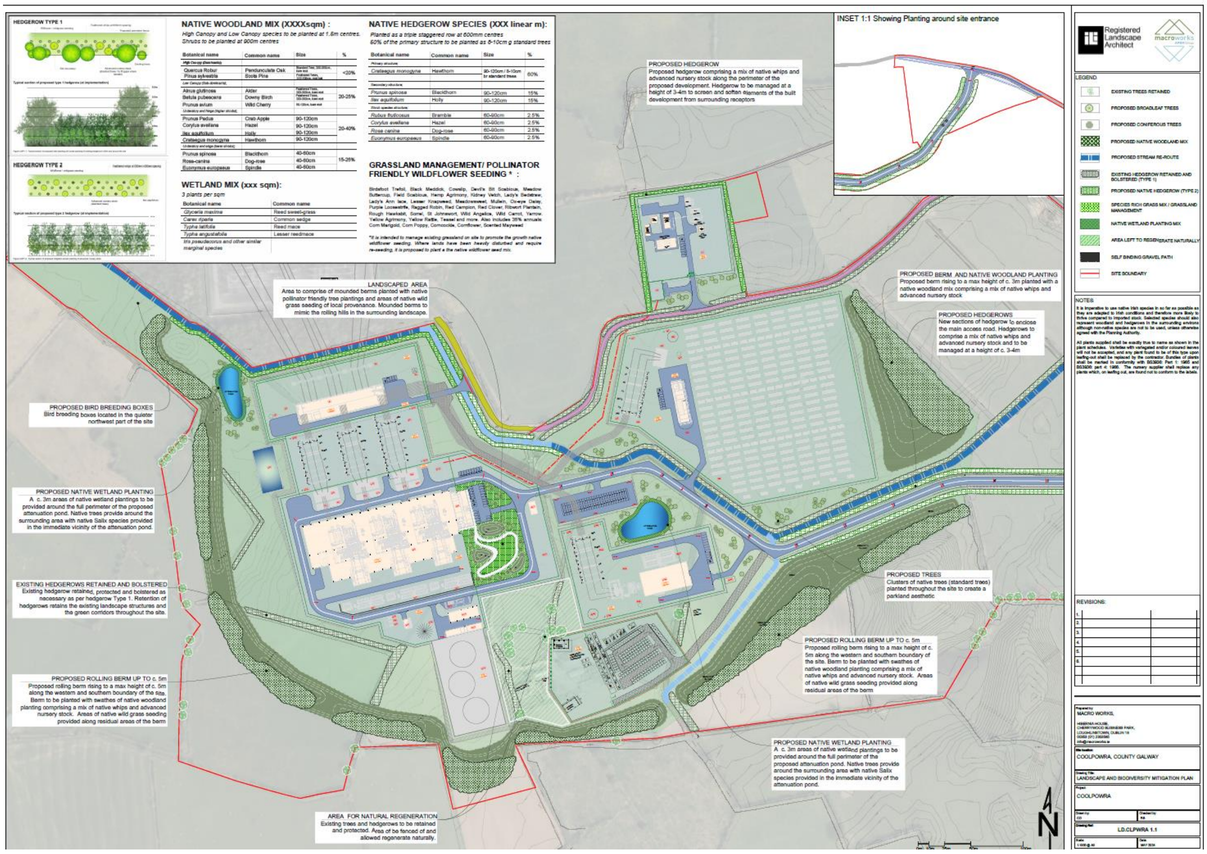

Figure 6-2 Purposed location of roost house

6.1.5 Lighting.

A lighting plan has been designed by Darkmack exterior lighting design. Lighting will be confined to entrance roads and built habitats. The battery storage area will not be lit. Similarly lights have been designed so that treelines are not illuminated. Lux diagrams submitted as part of the application show lux levels of below 0.1 on treelines and hedgerows baring where access roads require entrance. Similarly, the attenuation wildlife ponds will remain unlit. The following measures will also be adhered to;

- Lux levels no greater than 3000k
- luminaires have been proposed with integral rear shields and a mounting tilt of 0° to reduce back spill lighting and upward light.
- photocell control to switch lights on and off at dusk and dawn and programmed off during the months May to September inclusive.

7 Conclusion.

The surveys above shows baseline bat surveys conducted on a site where Grid connected energy support projects are proposed.

The site is situated within the core sustenance zone of a known Common Pipistrelle maternity roost, located to the north of the site.

Static bat detector surveys demonstrate highest activity to the north, closest to the roost. Activity to the south is substantially lower.

No bat roost was found within the site. The report concluded that post mitigation the proposed development will have no negative impacts on the local bat populations.

Appendix A: Preliminary Tree Roost Assessment

Tree Number	Category	Species	PR details	Lat	Lon
1	3	7 whitethorns	Ivy growth	53.131	-8.267
2	4	Hedgerow	No potential - cut to 2m	53.131	-8.268
3	4	Hawthorn hedgerow with bramble	Cut short	53.131	-8.270
4	3	Hawthorn	Ivy cover	53.132	-8.270
5	3	Elder	Ivy cover	53.133	-8.270
6	4	Hawthorn	Immature hedgerow	53.133	-8.270
7	3	Hawthorn	Mature with ivy	53.133	-8.271
8	2	Sally	Mature with ivy and broken branches	53.133	-8.271
9	2	Sally	Crack in trunk	53.133	-8.271
10	3	Hawthorn	Section of hedge with 11 trees with ivy	53.133	-8.272
11	4	Ivy		53.133	-8.272
12	3	Sally	Ivy growth	53.134	-8.273
13	3	Beech	Ivy growth	53.134	-8.272
14	3	Hawthorn	Ivy	53.134	-8.272
15	4	Beech		53.134	-8.272
16	3	Hawthorn	Ivy cover	53.134	-8.272
17	3	Hawthorn	Ivy cover	53.134	-8.272
18	3	Hawthorn		53.134	-8.272
19	3	Hawthorn	Ivy	53.134	-8.272
20	4	Sally		53.134	-8.271
21	3	Mixed	Semimature wooded area outside of site	53.134	-8.271
22	3	Sally, hawthorn, birch	Hedgerow on far side of stream to site	53.134	-8.271
23	3	Hawthorn	Mature hedge with ivy across stream with mixed woodland behind it	53.133	-8.270
24	3	Sally	Mature with ivy	53.133	-8.268
25	3	Sally	Mature with ivy and broken bits	53.133	-8.268
26	3	Damson	Mature with ivy	53.132	-8.268
27	3	Hawthorn several mature with ivy		53.132	-8.268
28	3	Hawthorn	Mature with ivy	53.132	-8.268
29	3	Hawthorn	Mature with ivy	53.132	-8.267
30	3	Hawthorn	Mature with ivy	53.132	-8.267
31	3	Hawthorn	Mature with ivy	53.132	-8.267
32	3	Hawthorn	Mature with ivy	53.132	-8.267
33	3	Hawthorn	Mature with ivy	53.132	-8.267
34	3	Hawthorn	Mature with ivy	53.132	-8.267
35	4	Blackthorn		53.132	-8.267
36	3	Hawthorn	Mature with ivy	53.132	-8.267

Tree Number	Category	Species	PR details	Lat	Lon
37	4	Hawthorn	Mainly hawthorn hedgerow cut short	53.131	-8.267
38	4	Hawthorn	Hawthorn hedge cut short with bramble	53.131	-8.266
39	4	Birch		53.131	-8.266
40	4	Holly		53.132	-8.267
41	4	Sally		53.132	-8.267
42	3	Hawthorn	Mature hawthorn hedge with ivy	53.132	-8.266
43	4	Leylandii	No holes seen	53.132	-8.266
44	4	Leylandii	Hedge with bark stripped at bottom but no holes	53.132	-8.266
45	3	Hawthorn	Several hawthorns with ivy growth	53.132	-8.266
46	3	Spruce	Mature with ivy	53.132	-8.266
47	2	Ash	Mature with ivy, several broken branches with potential crevices	53.132	-8.266
48	3	Hawthorn	Mature with ivy	53.132	-8.266
49	3	Ash	Thick ivy	53.135	-8.264
50	3	Ash	Dead tree with ivy	53.135	-8.264
51	2	Ash	Mature trees with thick ivy and appear to have crevices	53.135	-8.264
52	3	Hawthorn	Mature hawthorn hedge with thick ivy	53.135	-8.263
53	4	Hazel		53.135	-8.263
54	4	Elder		53.135	-8.263
55	3	Hawthorn	Mature trees with thick ivy	53.135	-8.263
56	2	Elder	Elder in hawthorn tree line with thick ivy & crevices	53.135	-8.262
57	3	Hawthorn	Mature with ivy	53.135	-8.262
58	3	Hawthorn	Tree line with mature hawthorn and thick ivy	53.135	-8.261
59	3	Ash	Mature with ivy	53.135	-8.260
60	4	Snowberry	Hedge cut short. Snowberry, as, hawthorn	53.135	-8.260
61	4	Scots pine	Group of trees, no gaps and very little ivy	53.135	-8.260
62	4	Hawthorn	Hedges clipped short	53.134	-8.260
63	3	Beech	Mature tree with ivy cover	53.135	-8.260
64	4	Hawthorn	Hedge cut short	53.135	-8.259
65	3	Hawthorn	Mature with ivy	53.132	-8.255
66	3	Sally	Mature with ivy	53.132	-8.255
67	3	Sally	Ivy cover	53.132	-8.256
68	3	Hawthorn	Ivy cover	53.132	-8.256
69	3	Hawthorn	Ivy cover	53.131	-8.256
70	3	Sally	Ivy	53.131	-8.256
71	3	Hawthorn	Mature with ivy. Hawthorn and sally	53.131	-8.257
72	3	Hazel	Mature with ivy	53.131	-8.257

Tree Number	Category	Species	PR details	Lat	Lon
73	4	Ash		53.131	-8.257
74	3	Hawthorn	Thick ivy cover	53.131	-8.257
75	2	Hazel	Mature with crevices	53.131	-8.257
76	2	Sally	Large trunk crevice	53.131	-8.257
77	3	Hawthorn	Ivy cover	53.131	-8.258
78	3	Hawthorn	Ivy	53.131	-8.258
79	3	Hazel	Ivy	53.131	-8.258
80	3	Hazel	Ivy	53.131	-8.258
81	2	Ash	Mature tree with thick ivy	53.131	-8.258
82	3	Elder	Mature tree with ivy	53.131	-8.258
83	3	Hazel		53.131	-8.259
84	3	Elder	Mixed hedgerow, cut in past. Elder, hawthorn, hazel, blackthorn	53.132	-8.259
85	4	Blackthorn	Overall low cat 4 in this hedge row, as small trees and scrub with little ivy	53.132	-8.259
86	4	Hazel		53.132	-8.259
87	3	Hazel	Semi mature hedgerow cut low in the past. Some ivy growth. Mix of hazel, sally, whitethorn	53.132	-8.261
88	4	Hawthorn	Cut hedge	53.134	-8.261
89	4	Snowberry	Cut hedge	53.134	-8.261
90	3	Hawthorn	Mature	53.133	-8.266
91	2	Hawthorn	Crevices	53.133	-8.266
92	2	Hawthorn	Crevices	53.133	-8.266
93	3	Hawthorn	Whole tree line of mature hawthorn with potential crevices and some ivy	53.133	-8.266
94	3	Ash	Several mature ash with ivy	53.133	-8.266
95	4	Hazel	Hedgerow cut short	53.132	-8.264
96	3	Ash	Single ash in hedgerow. Ivy cover	53.132	-8.265
97	3	Ash	Mature ash with ivy	53.132	-8.265
98	2	Ash	Very mature tree with thick ivy. Holes from branches	53.132	-8.265
99	4	Hazel	Hedgerow of mainly hazel	53.132	-8.264
100	2	Yew	Very mature tree with crevices	53.131	-8.263
101	2	Ash	Very mature with crevices and ivy	53.131	-8.263
102	3	Ash	Mature with ivy	53.131	-8.263
103	2	Ash	Mature with ivy	53.131	-8.263
104	3	Ash	Mature with ivy	53.132	-8.263
105	2	Ash	Mature with ivy and crevices	53.132	-8.262
106	3	Ash	Ivy cover	53.130	-8.263
107	4	Whitethorn	Hedgerow with mainly whitethorn	53.130	-8.262
108	2	Ash	Mature with thick ivy and branch holes	53.130	-8.263

Tree Number	Category	Species	PR details	Lat	Lon
109	4	Hawthorn		53.129	-8.262
110	1	Ash	Very mature tree with thick ivy and cut branches with potential deep crevices	53.129	-8.261
111	3	Hawthorn	Mature hawthorn hedge with ivy	53.129	-8.261
112	3	Hawthorn	Mature hedge with ivy	53.129	-8.260
113	3	Hazel	Mature hedge with mainly hazel and ivy growth	53.128	-8.258
114	3	Whitethorn	Mature hedgerow with ivy	53.129	-8.258
115	4	Blackthorn		53.130	-8.258
116	2	Ash	Mature with branch holes	53.130	-8.258
117	1	Sally	Mature with thick ivy and crevices	53.130	-8.259
118	2	Sally	Mature sally with holes	53.131	-8.259
119	3	Sally	Shallow crevices	53.131	-8.259
120	2	Hawthorn	Crevices	53.131	-8.259
121	3	Fallen tree	Crevices	53.131	-8.259
122	2	Hazel	Deep crevices	53.131	-8.259
123	3	Holly	Mature with thick ivy	53.130	-8.259
124	2	Ash	Branch holes and ivy	53.130	-8.261
125	2	Ash	Mature tree with branch holes	53.130	-8.264
126	1	Ash	Appears to have large crevices from broken off branches	53.130	-8.264
127	1	Ash	Numerous crevices high up and ivy	53.130	-8.265
128	2	Ash	Mature with thick ivy and broken branches	53.130	-8.265
129	3	Hawthorn	Mature with ivy	53.130	-8.266
130	3	Spruce	Mature with ivy cover	53.130	-8.266
131	2	Leylandii	Mature with peeling bark and ivy	53.130	-8.266
132	3	Hawthorn	Ivy	53.130	-8.266
133	4	Willow		53.131	-8.266
134	4	Willow		53.131	-8.266
135	3	Leylandii	Loose bark	53.131	-8.266
136	3	Leylandii	Loose bark and ivy	53.131	-8.266
137	1	Ash	Very mature with branch holes	53.131	-8.265
138	2	Ash	Appears dead. With holes	53.131	-8.265
139	3	Elder		53.131	-8.265
140	2	Whitethorn	Crevices	53.131	-8.265
141	2	Whitethorn	Crevices	53.131	-8.265
142	3	Elder	Mature	53.131	-8.265
143	4	Beech		53.134	-8.258
144	3	Ash	Ivy cover	53.134	-8.258
145	4	Beech		53.134	-8.257
146	4	Beech		53.133	-8.256
147	4	Hawthorn	Hedge with mainly wispy hawthorn	53.131	-8.267

Tree Number	Category	Species	PR details	Lat	Lon
148	3	Blackthorn	Thick ivy	53.130	-8.268
149	3	Hawthorn	Ivy	53.130	-8.268
150	4	Elder	Hedge with elder, hawthorn. Cut short	53.130	-8.267
151	4	Hawthorn	Immature planted hedgerow	53.129	-8.267
152	2	Hazel	Very mature hazel with ivy cover	53.128	-8.265
153	3	Hazel	Mature hedgerow, cut to 3m height with ivy cover	53.128	-8.266
154	4	Sally		53.128	-8.267
155	3	Hawthorn	Mature with ivy	53.128	-8.267
156	3	Hawthorn	Mature with ivy	53.128	-8.267
157	4	Beech	Planted woodland of immature hardwood. Rowan, beech	53.127	-8.267
158	3	Hawthorn	Hedgerow surrounding planted wood consists mainly of mature hawthorn, with ivy	53.127	-8.267
159	3	Hawthorn	Mature hedge with ivy7	53.127	-8.267
160	3	Hawthorn	Mature hedge with ivy	53.127	-8.266
161	2	Ash	Mature with ivy, possible crevice	53.127	-8.265
162	3	Hawthorn	Mature hawthorn hedge with ivy	53.127	-8.265
163	4	Holly		53.128	-8.264
164	3	Hazel	Mature with ivy	53.128	-8.264
165	3	Hawthorn	Mature hawthorn cut into hedge. Ivy cover	53.128	-8.264
166	0			53.132	-8.269
167	3	Hawthorn	Ivy cover & broken branches	53.133	-8.270
168	4	Holly		53.132	-8.268
169	0		Point where stream crosses sides	53.132	-8.268
170	3	Hawthorn	Mature with ivy	53.132	-8.268
171	0	Hawthorn	Mature with ivy	53.132	-8.267
172	4	Birch		53.131	-8.266
173	3	Ash	Ivy cover	53.132	-8.266
174	3	Hawthorn	Ivy covered	53.135	-8.264
175	3	Hawthorn	Hedgerow of mature ivy-covered trees	53.135	-8.264
176	2	Hawthorn	Thick ivy & crevices	53.135	-8.264
177	3	Ash	Thick ivy and possible crevices	53.135	-8.264
178	4	Ash	Hedge clipped short	53.135	-8.260
179	4	Beech		53.135	-8.260
180	4	No trees		53.135	-8.262
181	3	Hawthorn	Ivy cover	53.132	-8.256
182	3	Elder	Little crevices	53.131	-8.258
183	4	Blackthorn	Blackthorn hedgerow	53.132	-8.265
184	2	Ash	Mature ash with branch holes and ivy	53.131	-8.263
185	2	Ash	Mature ash with thick ivy	53.130	-8.257

Tree Number	Category	Species	PR details	Lat	Lon
186	3	Ash	Stumps with thick ivy	53.130	-8.263
187	3	Leylandii	Thick ivy cover	53.130	-8.266
188	3	Leylandii	Mature with ivy	53.130	-8.266
189	4	No trees	Cut hedgerow	53.133	-8.256
190	4	Beech		53.133	-8.256
191	4	Beech		53.133	-8.255
192	3	Ash	Thick ivy	53.130	-8.268
193	3	Ash	Semi-mature with ivy cover	53.132	-8.251
194	3	Ash	Semi-mature with ivy	53.133	-8.250
195	2	Beech	Several branch holes	53.133	-8.251
196	4	Hazel		53.133	-8.251
197	2	Scots pine	Mature with thick ivy	53.133	-8.252
198	2	Scots pine	Mature with thick ivy	53.133	-8.252
199	3	Whitethorn	Ivy	53.131	-8.270
200	3	Whitethorn	Ivy	53.130	-8.270
201	3	Ash	Mature with thick ivy	53.130	-8.270
202	3	Ash	Mature, thick ivy	53.130	-8.270
203	3	Whitethorn	Mature, ivy	53.131	-8.270
204	3	Elder	Mature	53.132	-8.271
205	3	Whitethorn	Mature, ivy	53.132	-8.271
206	3	Whitethorn	Mature, ivy	53.132	-8.271
207	3	Whitethorn	Mature ivy	53.131	-8.271
208	3	Whitethorn	Tree line of mature whitethorn with ivy cover	53.132	-8.271
209	3	Whitethorn	Tree line of semi mature whitethorn with ivy	53.133	-8.266

Table 7-1: Emergence Survey: Location 1. 01st May 2024

Contact number	Date	Time	Species	Details
1	01/05/2024	21:37	Common Pipistrelle	First Recording; no Visual. (33 minutes after Sunset)
2	01/05/2024	21:43	Unknown, no audio	Initial pass, first Visual
3	01/05/2024	21:45	Soprano Pipistrelle	Passing by Gable end of House
4	01/05/2024	21:52	Common Pipistrelle	Hunting above opposite side of the house
5	01/05/2024	21:53	Soprano Pipistrelle	Same bats continue to display hunting behaviour
6	01/05/2024	21:53	Common Pipistrelle	
7	01/05/2024	22:19	Myotis Species	Recording without visual on thermal
8	01/05/2024	22:23	Leisler's Bat	Recording without any visual on thermal

Plate 7-1: Location1

Table 7-2: Emergence Survey: Location 2. 01st May 2024

Contact number	Time	Species	Details
1	21:35	Soprano Pipistrelle	First bat recorded flying N along yard
2	21:58	Soprano Pipistrelle	-
3	22:01	Leisler's	Unseen
4	22:03	Common Pipistrelle	-
5	22:05	Soprano Pipistrelle	-
6	22:06	Common Pipistrelle	-
7	22:11	Soprano Pipistrelle	-
8	22:15	Soprano Pipistrelle	-
9	22:22	Soprano Pipistrelle	-
10	22:23	Leisler's	-
11	22:28	Soprano Pipistrelle	-
12	22:31	Common Pipistrelle	-
13	22:35	Common Pipistrelle	hunting over yard
14	22:39	Common & Soprano Pipistrelle	both hunting

Plate 7-2: Location 2

Table 7-1: Location 3 23rd May

Contact number	Date	Time	Species	Details
1	23/05/2024	22:09:29	Soprano Pipistrelle	Heard and seen flying from SE to NW
2	23/05/2024	22:15:16	Common Pipistrelle	2 Pipistrelles flying around tree
3	23/05/2024	22:18:22	Common Pipistrelle	Flying around tree

Plate 7-3: Location 3a

Plate 7-4: Location 3b

Table 7-2: Location 4 23rd May

Contact number	Date	Time	Species	Details
1	23/05/2024	22:12:48	Leisler's Bat	Audio recording with no Visual (40 Minutes after Sunset)
2	23/05/2024	22:27:55	Common Pipistrelle	Common Pipistrelle calls heard but not observed.
6	23/05/2024	23:00:04	Unspecified Myotis	Myotis calls heard but not observed

Plate 7-5: Location 4

APPENDIX 6.2

BIRD SURVEY REPORT

Eire Ecology

Environmental Consultants

Bird Survey Report

Coolpowra, Co. Galway

DOCUMENT DETAILS

Client:	Halston Environmental & Planning Limited (Halston) on behalf of Coolpowra FlexGen Limited
Project Title:	Grid connected energy support projects
Address:	Coolpowra, Co. Galway
Document Title:	Bird Survey Report
Prepared By:	Karolina Illien – Ecologist
Reviewed By:	John Curtin – Consultant Ecologist
Date:	May 2024

EXECUTIVE SUMMARY

This document reports on the findings of bird surveys undertaken within and surrounding a proposed development at Coolpowra, Co. Galway. The surveys took place between January 2024 and May 2024. The objective of the surveys was to establish a baseline dataset of birds utilising the site and the surrounds.

A robust survey roster was followed in order to understand all aspects of breeding, wintering and migratory bird species within and surrounding the site.

Results show habitats on the site to be mainly agricultural land with built lands with low significance for rare and protected birds.

Robust mitigation and enhancement measures such as the creation of ponds, woods and a dedicated barn owl tower should result in a net benefit for birds overall.

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1 INTRODUCTION

1.1 Purpose of this report

Eire Ecology were commissioned to complete wintering and breeding bird surveys for a proposed grid connected energy support project. This report presents the results of these surveys, comprising of vantage point, transects (wintering and breeding) and hinterland surveys within and surrounding the proposed development in Coolpowra, Co. Galway (Grid Ref: E582307 N709323).

The report aims to:

- Identify species of birds using the site.
- Examine feeding and commuting routes.
- Identify breeding bird species on and adjacent to the site.
- Identify how bird species in the surroundings utilise the site.
- Potential impacts of birds by the proposed development.

Surveys were conducted from January to May 2024. The survey types were determined most appropriate to establish a baseline species assemblage, along with spatial and temporal distribution of species activity within the proposed planning boundary.

1.2 Landscape context

The site is situated within mixed habitats consisting of agricultural with associated hedgerows, treelines and built land. The majority of the site consists of improved grassland; which is highly managed with fertiliser and herbicides. Some fields are used as tillage fields. The site has mature hedgerows throughout.

1.3 Development proposals

Project 1: Reserve Gas Fired Generator

The CPFL Reserve Gas Fired Generator comprises three open cycle gas-fired generator (OCGT) units positioned within a building (OCGT Hall) along with auxiliary equipment. An OCGT unit consists of a turbine connected to an electric power generator and the three turbines are designed to operate independently of each other. The OCGT units will receive natural gas from the gas network via an underground pipeline to an Above Ground Installation (AGI) compound within the development lands. Gas Networks Ireland (GNI), as the designated competent authority, will separately manage the process of delivering the underground gas transmission pipeline to the proposed AGI.

The proposed OCGT units are dual fuel units as required by system requirements specified by the Commission for Regulation of Utilities (CRU). Natural gas will be the primary and combustion fuel to each of the OCGT units when operating. Secondary fuel (gas oil) will be stored in a bunded structure outside the OCGT building along with ancillary items of electrical plant and machinery such as coolers and transformers. To ensure compliance with the requirements set by the CRU, the Reserve Gas-Fired Generator must be capable of running continuously for 72 hours using secondary fuel. This preparedness is crucial for scenarios involving an outage or interruption to the natural gas supply.

The Reserve Gas-Fired Generator is designed to operate intermittently and provide generation capacity during periods of high demand or when renewable energy generators cannot meet system demand. OCGT units are advantageous due to their operational flexibility and can be turned on quickly to match system demand. The selected turbines are capable of being converted to allow for the combustion of green hydrogen as a fuel in the future, which will allow for carbon free and climate-neutral plant operation.

Project 2: Energy Storage System (ESS)
The CPFL Energy Storage System (ESS) facility comprises (a) a Long Duration Energy Storage (LDES) static battery positioned within a secure outdoor compound, and (b) a Synchronous Condenser which will operate within a building in a separately secured compound. The LDES will provide peaking, active power and back start capability services o the electricity grid.

Battery storage is a technology that enables power system operators and utilities to store energy for later use. A battery energy storage system (BESS) is an electrochemical device that charges (or collects energy) from the grid or a power plant and then discharges that energy at a later time to provide electricity or other grid services when needed. A BESS facility is made up of batteries, a battery management system, a power conditioning system, and an energy management system. Battery storage is one of several technology options that can enhance power system flexibility and enable high levels of renewable energy integration. Studies and real-world experience have demonstrated that interconnected power systems can safely and reliably integrate high levels of renewable energy from variable renewable energy. Sufficient separation distance between enclosures is included within the design to allow for safe access and replacement of modules. Each module will include control equipment, to provide for ventilation, air conditioning and fire suppression equipment. MVPS (or PCS) units and small transformers will also be positioned in self-contained weather-proof enclosures.

At a system level, UL9540A1 is the recognised test method for evaluating thermal runaway in battery storage systems that reduces the risk of a single cell event spreading to the rest of the system. This is a global standard that technology suppliers test their products under to demonstrate compliance. As is the case within the existing BESS facility, the proposed development will comply with the UL9540A standard industry and other recognised best practice and in terms of fire management.

The plant will absorb and inject energy as demanded by the power system numerous times over an annual period over short-duration events. Therefore, it should be distinguished that grid-connected BESS plants do not operate continuously like conventional power fossil fuel power plants. BESS plants are designed to economically and rapidly provide system support services when needed, allowing immediate system recovery.

As storage technologies continue to mature, and their costs continue to fall, they will be increasingly deployed as a flexible asset to support national decarbonisation goals. In June 2021, Baringa published 'Endgame – A zero-carbon electricity plan for Ireland'2, which projects up to 1,700 MW of large-scale battery storage will be needed on an allisland basis to meet 2030 RES-E targets and deliver a zero-carbon power system. According to Energy Storage Ireland, there is currently 700MW of battery storage now operational on the island of Ireland.

Synchronous condenser technology has been around since the mid 1900's and is demonstrated and mature technology having been formerly used by utilities worldwide. The rotating generator is connected to the transmission system via a step-up transformer. The synchronous condenser is started up and stopped by a frequency controlled electric motor (pony motor). When the generator has reached an operating speed that is synchronous to the system frequency, it is synchronised with the transmission network and acts as a motor providing reactive and short circuit power to the electricity network. There is no combustion or emissions from a synchronous condenser. The synchronous condenser will provide short-circuit power, inertia, and reactive power for dynamic loads and stabilise the network through voltage recovery during faults.

The project is designed to complement and support the reserve gas fired generator by providing zero carbon, instantaneous and balancing power to the grid.

Project 3: Gas Insulated Switchgear (GIS) Electricity Substation

The CPFL Gas Insulated Switchgear (GIS) Electricity Substation comprises a two-storey building positioned and secured within a palisade fenced compound. This component of the overall development will enhance and upgrade the existing Oldstreet AIS 400Kv substation and will provide for the connection of Project 1 and Project 2 to the electricity transmission network. The HV lines and electric plant associated with Reserve Gas Fired Generator and ESS facility, and which will connect the projects to the GIS substation, are included with the planning application for Project 3. Following consultations with the Board under Section 182A of the Act it is the opinion of the Board that the project falls with the meaning of Section 182A of the Act. Accordingly, the Board decided that the proposed development would be strategic infrastructure within the meaning of Section 182AA of the act and any application for permission for the project must be made directly to the Board under Section 37E of the Act.

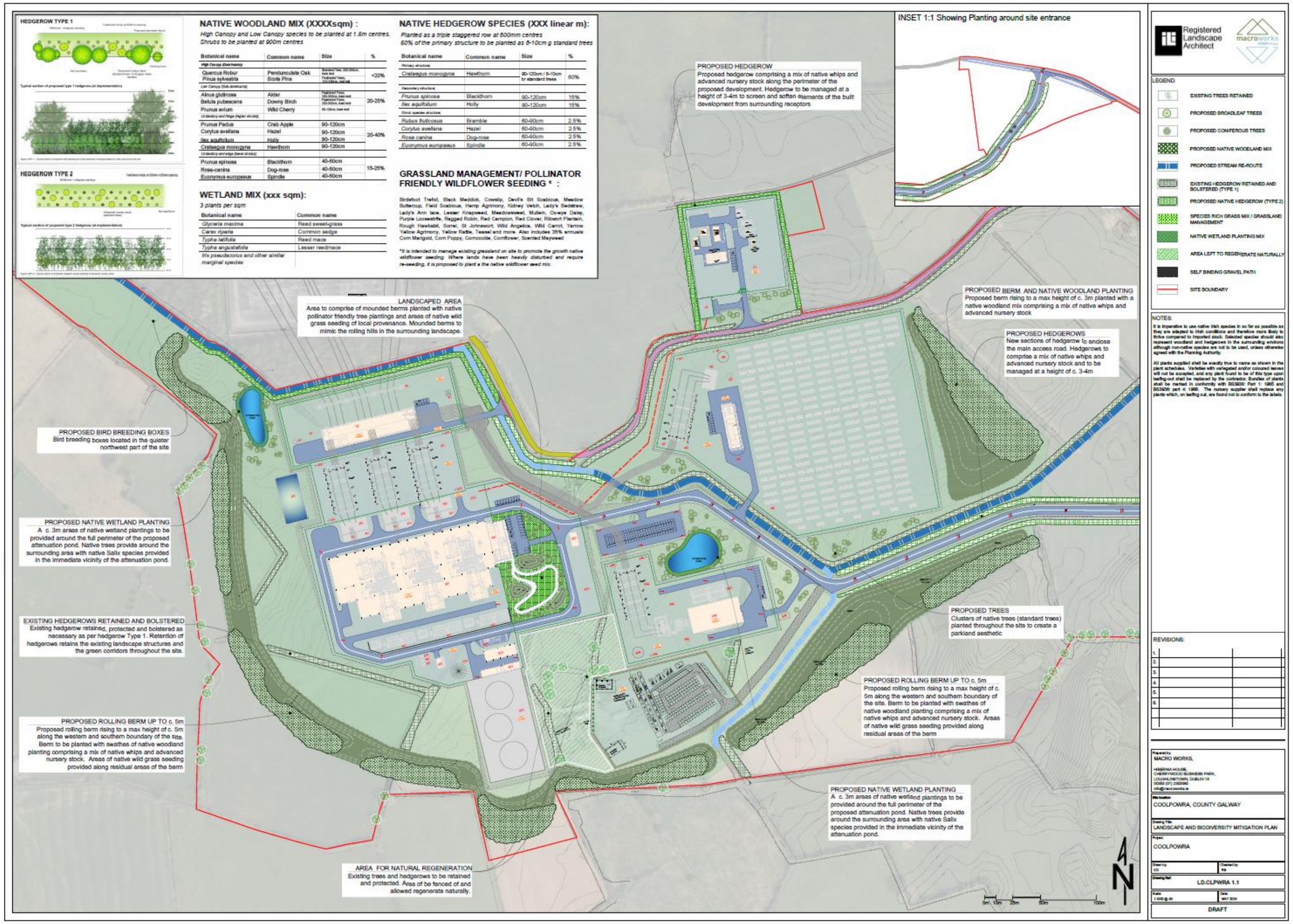


Figure 1-1: Proposed development

1.4 Survey and Assessment

A desk study which includes a review of the literature relevant to the avian ecology of the site is provided in section 2 of this report. The following sources of information are included: the most recent Bird Atlas 2007-2011 (the breeding and wintering birds of Britain and Ireland) (Balmer *et al* 2013). IWeBS survey data and NDBC data within 10km of the site.

Field surveys of the site were conducted from January to May 2024 and the findings of those surveys are presented in section 3 of this report. Walkover surveys (wintering and breeding) were undertaken during the survey visits which included the area within the site of the proposed development. All bird species observed or heard within the site and the surrounding area were recorded during the walkover survey.

Two vantage point surveys were conducted at site in January and May. Each VP was undertaken for 6 hours. All species were noted and target species were sketched onto field maps.

In order to better understand the relationship between the site and the surrounding areas, hinterland surveys were conducted from January to May. As there are no formal Irish guidance document on required bird surveys for powerplant developments, guidance on survey techniques was derived from windfarm developments (SNH, 2017). Hinterland surveys comprised of point counts around surrounding lands and encompassed waterbird distribution. In addition, vantage point surveys, dedicated Barn Owl survey and breeding bird transect surveys were conducted on site.

Target species for the surveys included designated species for the nearby SPA's, in addition to wintering swans and geese given the close proximity to peatland (roosting site) the site has the potential to be used as feeding ground given these species graze on grass. In addition, birds of prey, ducks, plovers, lapwings, sandpipers, gulls and terns. For the purposes of the survey raptors were also considered to be target species. In line with I-WeBS methodology, Cormorant, Shag, Little Egret, Grey Heron, and Kingfisher were also included (Lewis L. J., 2017)

1.5 Limitations of Survey

All of the surveys were carried out in weather conditions which were acceptable for bird survey. Winter bird surveys would normally start in October, however due to the late appointment of Eire Ecology, these surveys were not carried out.

The location of the VPs were chosen as they provided the optimum visibility of the study site (i.e. site of the proposed development and its immediate surrounds). The Vantage point surveys were conducted on the site itself, which could be considered a limitation as a possible source of disturbance to birds. It was, however considered that observer presence would not cause undue disturbance given the level of background disturbance on the site.

2 DESK STUDY

2.1 POLICY & GUIDANCE

2.1.1 EU Birds Directive

The "Birds Directive" (Council Directive 79/409/EEC as codified by 2009/147/EC) provides for a network of sites in all member states to protect birds at their breeding, feeding, roosting and wintering areas. This directive identifies species that are rare, in danger of extinction or vulnerable to changes in habitat and which need protection (Annex I species). Appendix I indicates Annex I bird species as listed on the Birds Directive. A "Special Protection Area" or SPA, is a designation under The Birds Directive.

SACs and SPAs form a pan-European network of protected sites known as Natura 2000 sites and any plan or project that has the potential to impact upon a Natura 2000 site requires Appropriate Assessment (AA). As outlined previously, an AA Screening Report was prepared for this project and is presented as a separate report to the planning application.

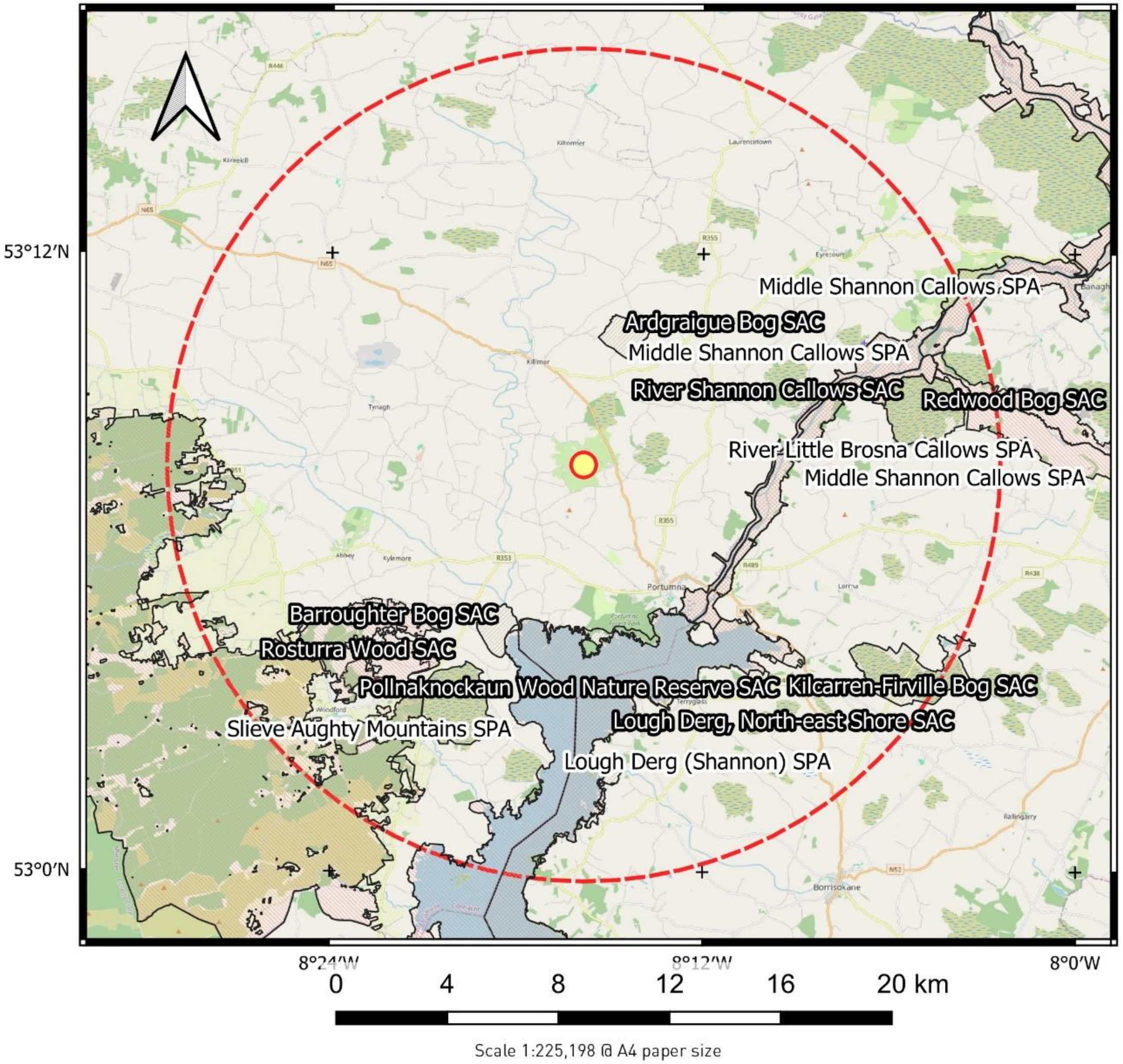
2.1.2 Wildlife Acts 1976 – 2012

The primary domestic legislation providing for the protection of wildlife in general, and the control of some activities adversely impacting upon wildlife is the Wildlife Act of 1976, as amended. The aims of the wildlife act according to the National Parks and Wildlife Service are "... to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims." All bird species are protected under the act. The Wildlife (Amendment) Act of 2000 amended the original Act to improve the effectiveness of the Act to achieve its aims.

2.2 Site Location in Relation to Protected sites with Ornithological Value

The proposed site lies near Coolpowra, Co. Galway (Grid Ref: E582307 N709323). The site for the proposed development lies approximately 5.84km from the Middle Shannon Callows SPA (Site Code: 004096) and approximately 5.90km from the Lough Derg (Shannon) SPA (site code: 004058) which are the closest protected sites for birds. The Slieve Aughty Mountains SPA (004168), the River Little Brosna Callows SPA & NHA (004086), and numerous other protected sites all lie within 15km of the site. These sites contain habitats which may support bird populations (see **Figure 2-1** and **table 2-1** below).

Designated Sites within 15km Buffer



Legend

- SPAs within 15km
- SAC's within 15km
- 15km Site Buffer
- site point

OpenStreetMap

Drawn by: Env. JC,
Checked by: Env. JC,
Approved by: Env. JC,
Date: 08/05/2024,

Map CRS: EPSG:2157
Coordinate Units: Meters
Map Scale: 1:225,198
Page Size: 297 x 210 mm
Made with: QGIS 3.16 in Windows

DISCLAIMER
Although great care was taken in the preparation of this map, the authors cannot be held responsible for any loss or damage emanating from its use.
THIS MAP MUST NOT BE CONSIDERED AN AUTHORITY ON THE DELIMITATION OF INTERNATIONAL AND OTHER BOUNDARIES.

Figure 2-1 **Site Location in Relation to designated sites**

Table 2-1 Protected habitats with ornithological value in the vicinity of the proposed development

Name of Site	Site Code	Distance	Has the designated site a high ornithological value?	Has the site ornithological connectivity to the subject site?
Special Protection Areas (SPA's)				
Middle Shannon Callows SPA	004096	5.84km	Internationally important site that supports an assemblage of over 20,000 wintering waterbirds. It holds internationally important populations of two species - Whooper Swan and Black-tailed Godwit. In addition, there are four species that have wintering populations of national importance. The site also supports a nationally important breeding population of Corncrake. Of particular note is that several of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Corncrake and Golden Plover. Golden Plover, Lapwing, Black-tailed Godwit and Black-Headed Gull	Possibly. SPA lies to the east of site. River system provides an ecological corridor.
Lough Derg (Shannon) SPA	004058	5.90km	Lough Derg (Shannon) SPA is of high ornithological importance as it supports nationally important breeding populations of Cormorant and Common Tern. In winter, it has nationally important populations of Tufted Duck and Goldeneye, as well as a range of other species including Whooper Swan. The presence of Whooper Swan, Greenland White-fronted Goose, Hen Harrier and Common Tern is of particular note as these are listed on Annex I of the E.U. Birds Directive. Parts of Lough Derg (Shannon) SPA are a Wildfowl Sanctuary.	Possibly. SPA lies to the south of site. River system provides an ecological corridor
Slieve Aughty Mountains SPA	004168	7.86km	The Slieve Aughty Mountains SPA is of ornithological significance, as it provides excellent nesting and foraging habitat for nationally important breeding populations of Hen Harrier and Merlin, two species that are listed on Annex I of the E.U. Birds Directive. Some	No. SPA lies to the west and SW of site. Lack of relevant connectivity to the site
River Little Brosna Callows SPA & NHA	004086 000564	13.11km	The River Little Brosna Callows SPA is one of the top sites in the country for wintering waterfowl and part of the site is a Wildfowl Sanctuary. It is of international importance on account of the total numbers of birds that use it, as well as for its Greenland White-fronted Goose, Golden Plover and Black-tailed Godwit populations. In addition, there are a further seven species with nationally important populations, several of which are the largest in the country. Also of note is that three of the species which occur regularly, i.e. Whooper Swan, Greenland White-fronted Goose and Golden Plover, are listed on Annex I of the E.U. Birds Directive.	Unlikely. SPA lies to the NE of site. While river system provides an ecological corridor, this SPA lies a considerable distance from the site

Name of Site	Site Code	Distance	Has the designated site a high ornithological value?	Has the site ornithological connectivity to the subject site?
Special Area of Conservation (SAC)				
Ardgraigue Bog SAC	002356	4.09km	Peatland with wet pools with potential for wintering birds.	SAC lies to the north of the site. Possible connectivity to the site
Barroughter Bog SAC	000231	5.75km	Peatland with wet pools with potential for wintering birds.	Close proximity to the shores of Lough Derg, with its succession from open water through extensive reed beds and marginal scrub, to raised bog. River system provides ecological corridor
River Shannon Callows SAC	000216	5.82km	In winter the site is internationally important for numbers and species of waterfowl. In spring it feeds large numbers of birds on migration, and in summer it holds very large numbers of breeding waders, rare breeding birds and the endangered Corncrake, as well as a very wide variety of more common grassland and wetland birds.	SAC to the east of the site. River network provides ecological corridor
Lough Derg, North-east Shore SAC	002241	5.86km	Lough Derg (Shannon) is of high ornithological importance as it supports nationally important breeding populations of Cormorant and Common Tern. In winter, it has nationally important populations of Tufted Duck and Goldeneye, as well as a range of other species including Whooper Swan. Records of Whooper Swan, Greenland White-fronted Goose, Hen Harrier and Common Tern.	SAC to the south of the site. River network provides ecological corridor
Cloonmoylan Bog SAC	000248	8.24km	Peatland with wet pools with potential for wintering birds.	SAC located to the SW of the site. No connectivity
Rosturra Wood SAC	001313	8.74km	Almost half of Rosturra Wood is designated as a Statutory Nature Reserve.	SAC located to the SW of the site. No relevant connectivity to the site

Name of Site	Site Code	Distance	Has the designated site a high ornithological value?	Has the site ornithological connectivity to the subject site?
Pollnaknockaun Wood Nature Reserve SAC	000319	10.30km	Pollnaknockaun Wood represents an opportunity to recreate an oakwood with its associated fauna and a diverse ground flora. The wet woodland, stream and wet grassland add further interest to this site	SAC located to the SW of the site. No relevant connectivity to the site
Redwood Bog SAC	002353	11.09km	Peatland with wet pools with potential for wintering birds.	SAC located to the east of site. River system provides
Derrycrag Wood Nature Reserve SAC	00261	11.81km	Most of the site is also designated as a Nature Reserve. Kestrel, Sparrowhawk and Jay are a few of the more notable bird species present in the site	SAC located to the SW of the site. No relevant connectivity to the site
Kilcarren-Firville Bog SAC	000647	11.82km	Peatland with wet pools with potential for wintering birds.	SAC located to the SE of the site. Possible connectivity
National Heritage Areas (NHA)				
Capira/Derrew Bog NHA	001240	1.94km	Peatland with wet pools with potential for wintering birds.	Capira/Derrew bog located to the east of east. Connected by close proximity
Cloonoolish Bog NHA	000249	5.56km	Peatland with wet pools with potential for wintering birds.	NHA located to the north of the site. River network provides possible ecological corridor
Meeneen Bog NHA	000310	7.21km	Peatland with wet pools with potential for wintering birds.	NHA located to the NE of the site. Distance lowers potential.
Moorfield Bog NHA	001303	7.33km	Peatland with wet pools with potential for wintering birds.	NHA located to the NE of the site. Low connectivity to the site

Name of Site	Site Code	Distance	Has the designated site a high ornithological value?	Has the site ornithological connectivity to the subject site?
Eskerboy Bog NHA	001264	8.28km	Peatland with wet pools with potential for wintering birds.	NHA located to the NW of the site. Distance lowers potential.
Friar's Lough pNHA	000933	8.99km	Friars Lough is a small lake with adjacent woodland, situated near the village of Lorrah in north Tipperary, which may be used by wintering birds.	NHA located to the SE of the site. Distance lowers potential.
Ballymacegan Bog NHA	000642	9.33km	Peatland with wet pools with potential for wintering birds.	NHA located to the NE of the site. Distance lowers potential.
Lorrha Bog NHA	001684	10.97km	Peatland with wet pools with potential for wintering birds.	NHA located to the SE of the site. Low connectivity to the site
Derryoober Bog NHA	002379	14.52km	Peatland with wet pools with potential for wintering birds.	NHA located to the south of the site. Distance lowers potential.
Proposed National Heritage Areas (pNHA's)				
Spring Park Wetlands pNHA	000941	13.36km	Wetlands with potential for wintering birds	NHA located to the SE of the site. Low connectivity to the site
Lough Avan pNHA	001995	14.50km	Lake with potential for wintering birds	NHA located to the SE of the site. Low connectivity to the site

2.3 Historical Review of Data

2.3.1 National Biodiversity Data Centre (NBDC) information

A search was made of the NDBC for records of bird species recorded within the area of the site of the proposed development. There was only one bird species recorded within the two 2km squares (M80E and M80J), therefore a search in the 10km square was conducted (M80). Datasets used in compiling the list below include The Atlas of Breeding and Wintering Birds 2007-2011) (*Balmer et al 2013*) and the Irish Wetland Birds Survey (*I-WeBS*). A total of sixteen records for designated bird species was noted. It should be noted that I-WeBS records from the surrounding wetlands will have also been uploaded to the NBDC.

Table 2-2 Designated species recorded within the 10km squares; M80

Name	Last recorded	Designation
Arctic Tern (Sterna paradisaea)	31/07/1972	Wildlife Acts | EU Birds Directive > Annex I Birds of Conservation Concern - Amber List
Barn Owl (Tyto alba)	31/12/2011	Wildlife Acts > Birds of Conservation Concern - Red List
Barn Swallow (Hirundo rustica)	12/04/2018	Wildlife Acts |Birds of Conservation Concern - Amber List
Black-headed Gull (Larus ridibundus)	18/02/2020	Wildlife Acts > Birds of Conservation Concern - Red List
Common Coot (Fulica atra)	23/03/2022	Wildlife Acts |EU Birds Directive > Annex II, Annex III > Birds of Conservation Concern - Amber List
Common Goldeneye (Bucephala clangula)	31/12/2011	Wildlife Acts |EU Birds Directive > Annex II > Birds of Conservation Concern - Amber List
Common Grasshopper Warbler (Locustella naevia)	31/12/2011	Wildlife Acts > Birds of Conservation Concern - Amber List
Common Kestrel (Falco tinnunculus)	31/12/2011	Wildlife Acts > Birds of Conservation Concern - Amber List
Common Kingfisher (Alcedo atthis)	15/09/2020	Wildlife Acts |EU Birds Directive > Annex I > Birds of Conservation Concern - Amber List
Common Linnet (Carduelis cannabina)	31/12/2011	Wildlife Acts > Birds of Conservation Concern - Amber List
Common Pheasant (Phasianus colchicus)	31/12/2011	Wildlife Acts | EU Birds Directive > Annex II, Annex III
Common Pochard (Aythya ferina)	31/12/2011	Wildlife Acts | EU Birds Directive > Annex II, Annex III, > Birds of Conservation Concern - Amber List
Common Redshank (Tringa totanus)	31/12/2011	Wildlife Acts || > Birds of Conservation Concern - Red List
Common Sandpiper (Actitis hypoleucos)	31/12/2011	Wildlife Acts |> Birds of Conservation Concern - Amber List
Common Snipe (Gallinago gallinago)	30/01/2019	Wildlife Acts | EU Birds Directive > Annex II, Annex III > Birds of Conservation Concern - Amber List
Common Starling (Sturnus vulgaris)	31/12/2011	Wildlife Acts |> Birds of Conservation Concern - Amber List
Common Swift (Apus apus)	31/12/2011	Wildlife Acts || Threatened Species: Birds of Conservation Concern - Amber List
Common Tern (Sterna hirundo)	15/09/2020	Wildlife Acts | EU Birds Directive > Annex I > Birds of Conservation Concern - Amber List

Name	Last recorded	Designation
Common Wood Pigeon (Columba palumbus)	20/03/2022	Wildlife Acts |EU Birds Directive >> Annex II, Annex III
Corn Crake (Crex crex)	31/07/1972	Wildlife Acts || EU Birds Directive >> Annex I > Birds of Conservation Concern - Red List
Eurasian Curlew (Numenius arquata)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex II > Birds of Conservation Concern - Red List
Eurasian Teal (Anas crecca)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex II, Annex III, > Birds of Conservation Concern - Amber List
Eurasian Wigeon (Anas penelope)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex III, > Birds of Conservation Concern - Amber List
Eurasian Woodcock (Scolopax rusticola)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex II, Annex III, > Birds of Conservation Concern - Amber List
European Golden Plover (Pluvialis apricaria)	29/02/1984	Wildlife Acts || EU Birds Directive >> Annex I, Annex II, Annex III > Birds of Conservation Concern - Red List
Gadwall (Anas strepera)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex II Birds of Conservation Concern - Amber List
Great Black-backed Gull (Larus marinus)	29/02/1984	Wildlife Acts || Threatened Species: Birds of Conservation Concern - Amber List
Great Cormorant (Phalacrocorax carbo)	23/03/2022	Wildlife Acts || >> Birds of Conservation Concern - Amber List
Great Crested Grebe (Podiceps cristatus)	23/03/2022	Wildlife Acts || >> Birds of Conservation Concern - Amber List
Greater Scaup (Aythya marila)	31/12/2011	Wildlife Acts || >> Annex II, Annex III >> Birds of Conservation Concern - Amber List
Greater White-fronted Goose (Anser albifrons)	29/02/1984	Wildlife Acts || EU Birds Directive > Annex I, Annex II, Annex III. Birds of Conservation Concern - Amber List
Grey Partridge (Perdix perdix)	31/07/1972	Wildlife Acts || EU Birds Directive >> Annex II, Annex III, Birds of Conservation Concern - Red List
Greylag Goose (Anser anser)	31/12/2011	Invasive Species. EU Birds Directive || Annex II, Annex III. Birds of Conservation Concern - Amber List
Hen Harrier (Circus cyaneus)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex I Birds of Conservation Concern - Amber List
Herring Gull (Larus argentatus)	29/02/1984	Wildlife Acts || Birds of Conservation Concern >> Birds of Conservation Concern - Red List
House Martin (Delichon urbicum)	31/12/2011	Wildlife Acts || Birds of Conservation Concern - Amber List
House Sparrow (Passer domesticus)	31/12/2011	Wildlife Acts || Birds of Conservation Concern - Amber List
Lesser Black-backed Gull (Larus fuscus)	31/12/2011	Wildlife Acts || Birds of Conservation Concern - Amber List
Little Egret (Egretta garzetta)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex I Bird Species
Little Grebe (Tachybaptus ruficollis)	20/03/2022	Wildlife Acts || >> Birds of Conservation Concern - Amber List
Mallard (Anas platyrhynchos)	20/03/2022	Wildlife Acts || EU Birds Directive >> Annex II, Annex III
Mew Gull (Larus canus)	31/12/2011	Wildlife Acts || Birds of Conservation Concern - Amber List
Mute Swan (Cygnus olor)	20/03/2022	Wildlife Acts || Birds of Conservation Concern - Amber List

Name	Last recorded	Designation
Northern Lapwing (Vanellus vanellus)	04/02/2018	Wildlife Acts || Annex II. Birds of Conservation Concern - Red List
Northern Pintail (Anas acuta)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex III >> Birds of Conservation Concern - Red List
Northern Shoveler (Anas clypeata)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex II, Annex III, >> Birds of Conservation Concern - Red List
Northern Wheatear (Oenanthe oenanthe)	31/07/1972	Wildlife Acts || Birds of Conservation Concern - Amber List
Red-breasted Merganser (Mergus serrator)	18/04/2019	Wildlife Acts || EU Birds Directive >> Annex II
Rock Pigeon (Columba livia)	31/07/1972	Wildlife Acts || EU Birds Directive >> Annex II
Sand Martin (Riparia riparia)	31/07/1991	Wildlife Acts || Birds of Conservation Concern - Amber List
Sky Lark (Alauda arvensis)	31/07/1991	Wildlife Acts || Birds of Conservation Concern - Amber List
Spotted Flycatcher (Muscicapa striata)	31/12/2011	Wildlife Acts || Birds of Conservation Concern - Amber List
Stock Pigeon (Columba oenas)	31/07/1991	Wildlife Acts || Birds of Conservation Concern - Amber List
Tufted Duck (Aythya fuligula)	31/12/2011	Wildlife Acts || EU Birds Directive >> Annex II, Annex III, >> Birds of Conservation Concern - Amber List
Water Rail (Rallus aquaticus)	21/03/2022	Wildlife Acts || >> Birds of Conservation Concern - Amber List
Whinchat (Saxicola rubetra)	31/07/1972	Wildlife Acts || Birds of Conservation Concern - Amber List
White-tailed Eagle (Haliaeetus albicilla)	29/03/2018	Wildlife Acts
Whooper Swan (Cygnus cygnus)	29/02/1984	Wildlife Acts || EU Birds Directive >> Annex I Birds of Conservation Concern - Amber List
Yellowhammer (Emberiza citrinella)	04/07/2020	Wildlife Acts || Birds of Conservation Concern - Red List

2.3.2 I-WeBS

The closest I-WeBS point to the proposed development is listed as 0G397 Portumna Bridge – Big Isle (Shannon Callows), located c. 5km to the east of the subject site. These counts were conducted using aerial overpasses with data from 2011/12 and 2012/13 only.

Table 2-3: I-WeBS peak counts – Shannon Aerial

Species	1% national	2011/12	2012/13	Peak Months	BoCCI4	Annex
Black-headed Gull	Unknown	745	145	Feb, Nov	Amber	-
Coot	190	760	1107	Feb, Nov	Amber	II & III
Cormorant	110	11	50	Feb, Nov	Green	-
Curlew	350	11	-	Feb	Red	II
Goldeneye	40	134	137	Feb, Dec	Red	II
Great Black-backed Gull	Unknown	-	5	Nov	Green	-

Species	1% national	2011/12	2012/13	Peak Months	BoCCI4	Annex
Great Crested Grebe	30	-	4*	Feb, Dec	Amber	-
Grey Heron	25	8	1	Feb, Nov	Green	-
Greylag Goose	35	96	149*	Feb	Amber	II & III
Herring Gull	Unknown	-	8	Nov	Green	-
Lapwing	850	215	20	Feb, Dec	Red	II
Little Egret	20	-	2	Nov	Green	I
Mallard	280	263	219	Feb, Dec	Amber	II & III
Mute Swan	90	177	390	Feb, Dec	Amber	-
Pochard	110	30	24	Feb, Nov	Red	II & III
Scaup	25	42	--	Feb	Red	II & III
Shoveler	20	2		Feb	Red	II & III
Teal	360	445	448	Feb, Dec	Amber	II & III
Tufted Duck	270	962	1039	Feb, Dec	Amber	II & III
Whooper Swan	150	107	78	Feb, Dec	Amber	I
Wigeon	560	461	662	Feb, Dec	Amber	II & III

2.3.3 Ad-hoc records

Barn owl have been breeding within a derelict ruin to the south of the site. The site is managed by the Barn Owl Project. Surveys and impact assessment has been conducted for barn owls as part of the project.

3 Field Survey

3.1 Survey Personal

Bird surveys were conducted by Karolina Illien (MSc) and John Curtin (B.Sc.). John Curtin is an experienced ecologist having conducted plant, habitats, birds, bats and mammal surveys since 2010 including at windfarm and solar sites, while surveyor Karolina Illien has a range of ecological experience including conducting voluntary bird surveys since 2015 including Shannon estuary wintering wader surveys and commercial ornithology since 2022.

3.2 Birds in the ecological survey area

3.2.1 Habitats within the site

The site of the proposed development primarily consists of improved agricultural grassland directly surrounded by treelines, hedgerows and drains. Improved grassland habitat typically does not support high diversity of bird species. The site also contains a small area of planted immature native trees, as well as several buildings, gravel tracks and roads.

3.2.2 Birds within the site of the proposed development and undesignated surrounds

Species of note found within the site include Buzzard, Kestrel, Snipe, as well as red listed Redwing and Meadow pipit. Several amber listed passerines were present on-site including Goldcrest, Willow warbler, Skylark, Linnet, House martin and Barn swallow. Mallard, Black-headed Gull, Grey Heron and Whimbrel were observed flying over the site in small numbers. A White-tailed eagle was observed on one occasion flying adjacent to the site. The site was found to contain breeding Barn swallow, Starling, Linnet and possible breeding Willow Warbler.

Species of note found within the hinterland included; Barn Owl, Northern Lapwing, Black-headed gull, Teal and Mallard.

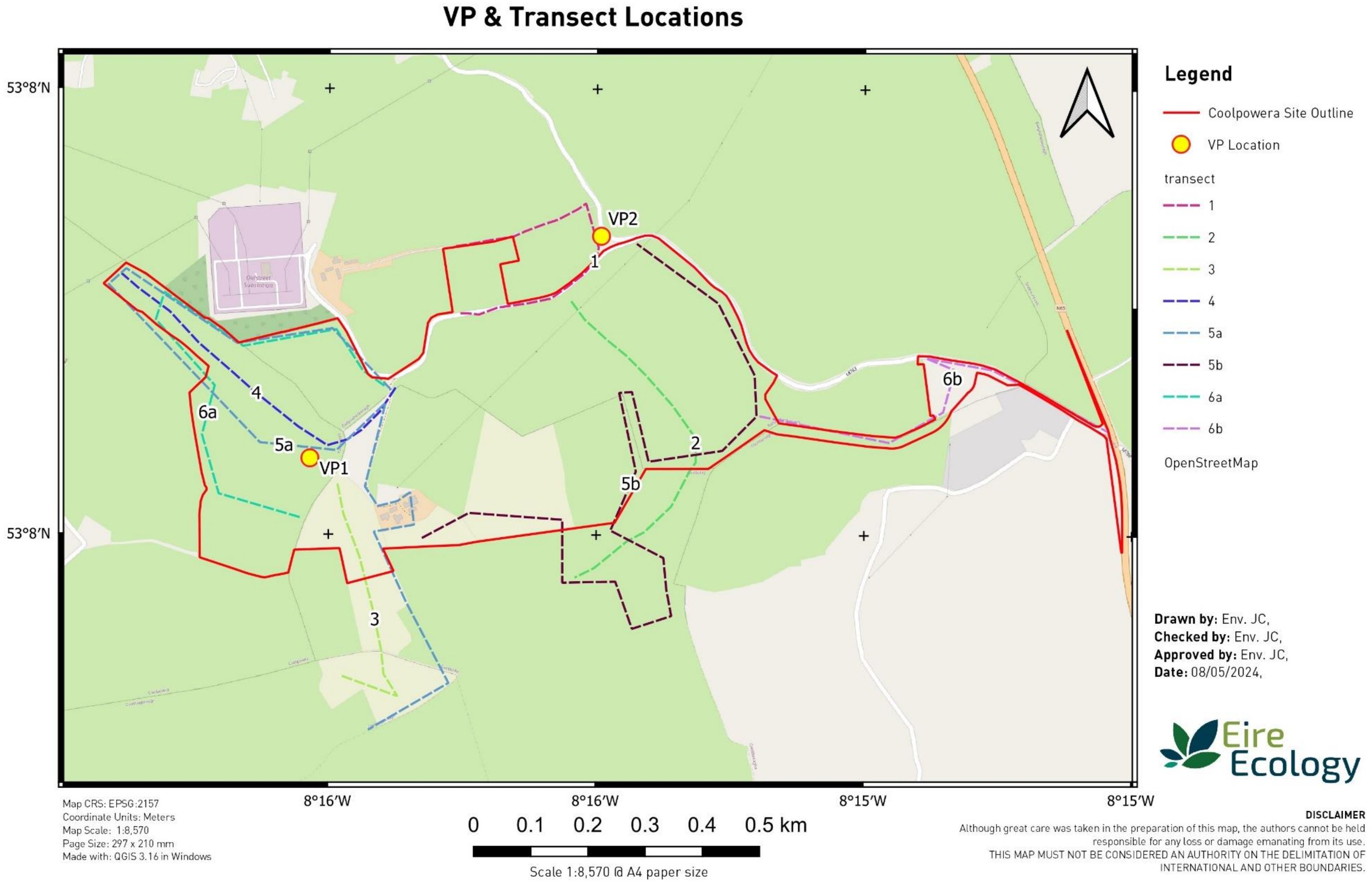


Figure 3-1: Vantage point & transect locations.

3.2.3 Onsite Results

Six hour vantage point surveys were conducted in January 2024 and May 2024. The location of vantage point surveys are shown in figure 3-1 below. During the surveys, the presence of target species and their flight lines were recorded. Data from flight lines observed during onsite walkover surveys are also included here. VP 1 (53.131208, 8.267513) is located on a hill overlooking the site with the surveyor looking NE. VP 2 (53.134671, -8.259881) is located by the north-eastern road.

Table 3-1: Summary of VP 'Species of interest'

Species	No. of obs.	Max no. observed	1% National Population	BoCCI4	Season for BOCCI4 designation
Buzzard	1	1	Unknown	Green	-
Grey Heron	3	2	25	Green	-
Kestrel	1	1	Unknown	Red	Breeding
Redwing	185	50	Unknown	Red	Wintering
Mallard	1	1	280	Amber	Breeding / Wintering

Table 3-2: Species list of non-target species recorded from VPs.

Species	No. of obs.	Max no. observed	BoCCI4	Species	No. of obs.	Max no. observed	BoCCI4
Barn Swallow	5	5	Green	Mistle thrush	2	1	Green
Blackbird	7	4	Green	Pheasant	3	1	Green
Blackcap	1	1	Green	Pied Wagtail	1	1	Green
Chaffinch	14	8	Green	Raven	4	2	Green
Chiffchaff	1	1	Green	Robin	4	1	Green
Dunnock	2	1	Green	Rook	19	15	Green
Goldcrest	1	1	Amber	Sky Lark	14	14	Green
Great Tit	1	1	Green	Song Thrush	3	1	Green
Hooded Crow	4	3	Green	Starling	52	30	Amber
Jackdaw	16	8	Green	Willow Warbler	2	1	Amber
Long-tailed Tit	5	5	Green	Winter Wren	3	1	Green
Magpie	7	4	Green	Wood Pigeon	10	5	Green

The aim of the wintering VP survey was to examine if the site is a feeding ground or on a regular flightpath for wintering waterbirds such as Whooper Swans or Curlew. The survey results shows the site is not used by these species.

Table 3-3 below summarises results from walked transects conducted during the wintering and breeding seasons. Breeding Barn Swallow, Linnet, Chaffinch, Song Thrush, Jackdaw, Starling and Wood pigeon were recorded. The only species of interest (red listed or Annex I) found probably breeding on site is Meadow pipit.

Table 3-3 Summary of Transect 'Species of interest' results

Species	No. of obs.	Max no. observed	Breeding Assessment	1% National Population	BoCCI4	Season for BOCCI4 designation
Black-headed Gull	3	6	Wintering	Unknown	Amber	Breeding/Wintering
Buzzard	7	2	Wintering	Unknown	Green	-
Grey Heron	1	1	Wintering	25	Green	-
Kestrel	2	1	Wintering	Unknown	Red	Breeding
Mallard	1	1	Wintering / Non-Breeding	280	Amber	Breeding/Wintering
Meadow Pipit	11	6	Probably Breeding	Unknown	Red	Breeding
Redwing	7	20	Wintering	Unknown	Red	Wintering
Snipe	7	3	Wintering	Unknown	Red	Breeding/Wintering
Whimbrel	1	10	Non-Breeding	Unknown	Green	-
White-tailed Eagle	1	1	Non-Breeding	Unknown	Red	Breeding

Table 3-4: Species list of non-target species recorded from Transects.

Species	No. of obs.	Max no. obs.	Breeding Assessment	No. of Breeding pairs	BoCCI4	Season for BOCCI4 designation
Barn Swallow	16	10	**Breeding Occupied nest**	9	Amber	Breeding
Blackbird	58	4	PRB Agitated behaviour	-	Green	-
Blue Tit	7	2	PRB Agitated behaviour	-	Green	-
Bullfinch	2	1	PSB Suitable Habitat	-	Green	-
Chaffinch	26	30	**Breeding Food / faecal sac**	1	Green	-
Chiffchaff	9	1	PSB Suitable Habitat	-	Green	-
Dunnock	5	1	PSB Suitable Habitat	-	Green	-
Fieldfare	9	43	Wintering	-	Green	-
Goldcrest	5	1	PRB Agitated behaviour	-	Amber	Breeding
Goldfinch	7	20	PRB Pair	-	Green	-
Great Tit	8	2	PSB Suitable Habitat	-	Green	-
Greenfinch	2	1	PSB Suitable Habitat	-	Amber	Breeding
Hooded Crow	8	7	PSB Suitable Habitat	-	Green	-
House Martin	3	3	PSB Suitable Habitat	-	Amber	Breeding
House Sparrow	15	20	PRB Pair	-	Amber	Breeding
Jackdaw	25	9	**Breeding Occupied nest**	1	Green	-
Linnet	7	15	**Breeding Food / faecal sac**	1	Amber	Breeding
Long-tailed Tit	6	4	PRB Pair	-	Green	-
Magpie	13	3	PSB Suitable Habitat	-	Green	-
Mistle Thrush	2	2	PSB Suitable Habitat	-	Green	-
Pheasant	7	3	PSB Suitable Habitat	-	Green	-
Pied Wagtail	2	3	Wintering	-	Green	-
Raven	3	5	PSB Suitable Habitat	-	Green	-
Reed Bunting	2	1	PSB Suitable Habitat	-	Green	-
Robin	24	1	PSB Suitable Habitat	-	Green	-

Species	No. of obs.	Max no. obs.	Breeding Assessment	No. of Breeding pairs	BoCCI4	Season for BOCCI4 designation
Rook	5	2	PRB Pair	-	Green	-
Siskin	1	2	Wintering	-	Green	-
Sky Lark	2	27	Wintering	-	Green	-
Song Thrush	6	2	**Breeding Food / faecal sac**	1	Green	-
Starling	12	30	**Breeding Occupied nest**	6	Amber	Breeding
Willow Warbler	9	1	PSB Singing male	-	Amber	Breeding
Winter Wren	48	2	PRB Agitated behaviour	-	Green	-
Wood Pigeon	28	4	**Breeding Food / faecal sac**	-	Green	-

3.2.4 Hinterland Results

Table 3-5 provides a summary of results from the hinterland surveys. Very low numbers of birds of interest were found during hinterland surveys. Lapwing were observed in a field beside the town of Portumna in January but were not there on subsequent visits. Teal and Mallard were at one location south of the site in a ponding area of a field, but these were also only seen once at this location.

No Nationally Important flocks of birds were recorded from the hinterland surveys.

Table 3-5 Summary of Hinterland 'Species of interest' results

Species	No. of obs.	Max no. obs.	1% National Population	BoCCI4	Season for BOCCI4 designation
Black-headed Gull	2	2	Unknown	Amber	Breeding/Wintering
Buzzard	1	1	Unknown	Green	Green
Kestrel	1	1	Unknown	Red	Breeding
Mallard	10	10	280	Amber	Breeding/Wintering
Northern Lapwing	30	30	Unknown	Green	Green
Teal	22	20	360	Amber	Breeding/Wintering
Water Rail	1	1	Unknown	Green	Green

Hinterland Results

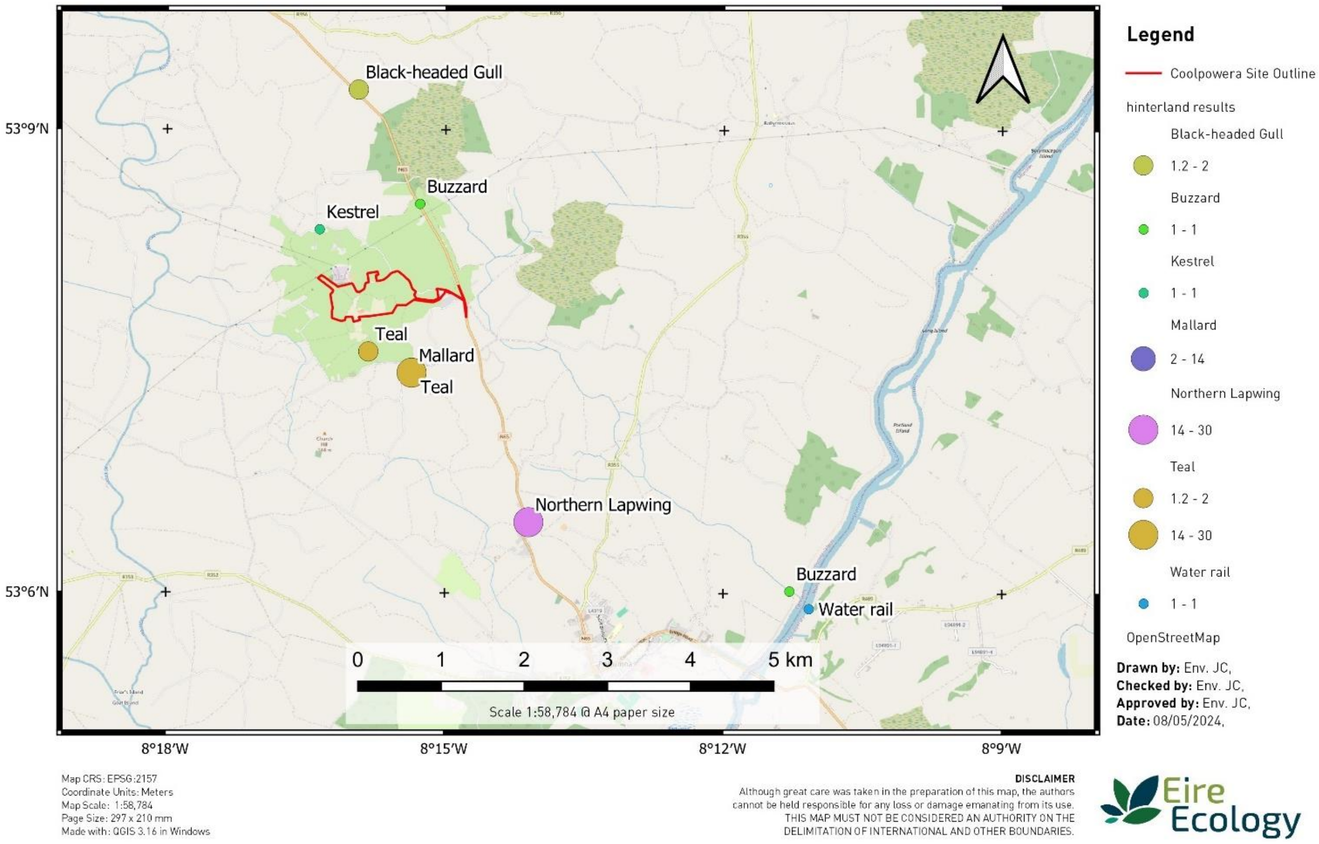


Figure 3-2: Hinterland map

3.2.5 Barn Owl

A scarce resident mainly in central and southern Ireland. No longer breeds in large patches of northern, western and eastern Ireland. Red-listed in Ireland due to a significant decline in the breeding population. The European population is currently evaluated as Declining. Due to a reported barn owl nest site close to the site, a survey was conducted on the 01st May 2024 to establish Barn owl presence at given location. A dusk watch was conducted from a distance in order to avoid disturbance. The survey was aided using Zeist binoculars and a Guide track 19mm thermal scope. (Shawyer, 2011). One barn owl was observed in the area, however a Nest site Verification Survey was not conducted as this would cause unnecessary disturbance to the species. No Barn owls were seen on site.

The barn owl nest location is withheld from this report as releasing locations of nest sites is not advisable. This information will be submitted separately and should not be available for public viewing.

3.3 Summary per species

The following sections provides a summary of sightings from species of note observed within the site. Further details can be found in Appendix 1.

3.3.1.1 Buzzard

Buzzard is a widespread bird of prey best adapted to hunt over lowland pasture. Multiple records were noted from this species throughout the site. The species typically breeds within treelines and hedgerows thus retention of these features will be important for Buzzards continued usage of the site. Buzzard are green listed with a secure Irish population. Multiple observations were noted during all survey periods. Buzzards were observed over the site on several occasions with a max of three soaring over the farm house on the 19th of April. While there is suitable breeding habitat for this species within the site, no evidence of breeding was found.

3.3.1.2 Kestrel

Similar to Buzzard, multiple observations of Kestrel were made during vantage point and walkover surveys. Birdwatch Irelands publication; *''Countryside Bird Survey: Status and Trends of Common and Widespread Breeding Birds 1998-2016"* states the kestrel population was estimated at 13,500, a decrease of 44.9% over the 18-year period, 1998-2016 and a 22.1% decrease in distribution over the 25-year period 1991-2016. Kestrel are a BoCCI red listed species. Both male and female Kestrel were recorded during surveys with records from both the breeding and wintering season. No breeding sites were found although there are suitable treelines for them within the site.

3.3.1.3 Snipe

Common snipe is a small cryptic wader mostly found in bog, marshy wetland, and rough ground in both upland, lowland regions, and lakeshores. Breeding takes place between April - June. Courtship ritual most often involves a male producing a drumming effect by filtering air over feathers ((RSPB)., 2021). There may be an aerial display to ward off competitors. As snipe is a crepuscular species, these behaviors are most likely observed in twilight. The lifespan of a snipe is typically 3 years, with breeding commencing at 2 years. The average clutch size is 4, which the female incubates 18-20 days. The fledgling period is 19/20 days ((BTO), 2021). Small invertebrates and seedlings form part of the diet.

Surveys conducted on site appropriate to Snipe include wintering transects, and breeding bird transects following O'Brien and Smith (1992) / Common Bird Census. Breeding transects included areas most likely used by snipe including along drains and wet areas. Snipe were seen numerous times on site from January until April 2024. The maximum number were four Snipe seen flying out of wet area in field to the east of farmhouse. No drumming or chirping were heard thus these birds were remnants of the winter flock. During Mays surveys, the surveyors checked fields with thermal scope and no Snipe were seen or heard. No Snipe were found during dawn breeding bird transect conducted in May.

3.3.1.4 Redwing

Widespread winter visitor to Ireland from October to March from Iceland and Scandinavia. A thrush which favours open fields in lowland areas, but tends to avoid urban areas. A red listed species for wintering (Bird watch Ireland,2023). Redwing were (up to 50) were seen flying over site in flocks along with Fieldfare. Redwing were also observed perched in hedgerows and mature trees in the centre of site.

3.3.1.5 Meadow pipit

This species is Red-listed according to Birds of Conservation Concern in Ireland 2020-2026 and is of high conservation value as a result. The Meadow Pipit is amongst the most abundant bird species in the country and can be found in a plethora of habitat types such as rough pasture, upland scrub, bogs, saltmarshes, agricultural land and even parks and dune systems. This species was noticed within the site in both the winter and breeding season. This species is probably breeding as habitats are suitable.

3.3.2 Amber list observations

Several amber listed species were recorded on site during the breeding season:

3.3.2.1 Barn Swallow

Common summer visitor throughout Ireland from mid-March to late-September. Birdwatch Ireland's Countryside Bird Survey shows that the breeding population trend of Swallow in Ireland has remained relatively stable since 1998, however the numbers that breed here from one year to the next can fluctuate greatly. Despite these annual fluctuations the long-term trend shows a marginal decline of 1.4% since 1998. Barn swallows were confirmed breeding in farm sheds towards the centre of the site. A max of 10 barn swallow were noted breeding within sheds.

3.3.2.2 House sparrow

One of Ireland's Top 20 most widespread garden birds. BirdWatch Ireland's Countryside Bird Survey which monitors breeding birds shows that the breeding population of House Sparrow in Ireland has experienced a 39.6% increase over the 10 years between 2006 and 2016, and an ever larger 82.2% increase since 1998. House sparrow are probably breeding within sheds on site.

3.3.2.3 House Martin

Common and widespread summer visitor, mid-March to late September. House martins were seen along with barn swallows in low numbers around the farmhouse and sheds and are probably breeding within the sheds.

3.3.2.4 Starling

Birdwatch Ireland's Countryside Bird Survey show that the breeding population of Starling has remain stable since 1998. Starling have been confirmed breeding within sheds on the site.

3.3.2.5 Goldcrest

Goldcrests breed in a wide variety of habitats, including broadleaf forests, hedgerows and suburban gardens. It is also one of the few species that will breed in dense coniferous woodlands. There is suitable habitat within the site for this species.

3.3.2.6 Greenfinch

Widespread resident. One of Ireland's top-20 most widespread garden birds. Regularly visiting peanut feeders with other finches in suburban and rural areas. Resident birds most likely joined by wintering Greenfinches from continental Europe. This species was observed flying within the site.

3.3.2.7 Linnet

Widespread resident throughout Ireland. Bird noted carry food, confirming breeding.

3.3.2.8 Willow warbler

One of the commonest breeding birds in Ireland (about 1 million pairs), with the highest densities in stands of willows along the edges of bogs and marshes. Less frequently in hedgerows, forests and well-vegetated gardens.

3.3.2.9 Skylark

Common resident throughout Ireland in uplands and areas of farmland, especially cereal. Breeds in a variety of habitats including cultivated areas, ungrazed grasslands and upland heaths. Usually moves out of breeding areas to winter in flocks on stubble fields, grasslands and coastal areas. Birds from continental Europe arrive in variable numbers from September and depart March/April.

3.3.3 Other species of note observed outside site:

3.3.3.1 Barn Owl

This species is Red-listed according to Birds of Conservation Concern in Ireland 2020-2026 and is of high conservation value as a result. Scarce resident mainly in central and southern Ireland. No longer breeds in large patches of northern, western and eastern Ireland. Red-listed in Ireland due to a significant decline in the breeding population. The European population is currently evaluated as Declining (Bird watch Ireland,2023). Not observed on site, however seen at derelict house where there is a reported nest site. The species was not observed within the site.

3.3.3.2 White-tailed Eagle

This species is Red-listed according to Birds of Conservation Concern in Ireland 2020-2026 and is of high conservation value as a result. White tailed eagle is a reintroduced species in Ireland. Killarney National Park facilitated their reintroduction in 2007. This reintroduction programme saw 100 young eagles released in the National Park which were then free to disperse as they pleased. This programme produced mixed results in terms of establishing a strong breeding population (NPWS, 2021). As of July 2020, a small breeding population has successfully fledged chicks across Cork, Kerry, Clare, Galway and Tipperary (NPWS, 2021). Building on the original phase of this reintroduction programme (2007-2011), phase 2 saw the release of more young individuals from multiple sites across Ireland. Each individual was tagged for ease of tracking (NPWS, 2021). These individuals were shown to spread across Munster and northwards along the Shannon River (NPWS, 2021). There was one sighting of a juvenile White-tailed eagle flying over a neighbouring farm before flying out of sight behind trees to the NE of the site. The species did not associate with the site.

3.3.4 Teal

This species is amber-listed according to Birds of Conservation Concern in Ireland 2020-2026. Teal are resident and a winter migrant duck in Ireland and numbers have increased over the long-term although a recent short-term decline is now evident. Teal are very widespread in Ireland, occurring in a wide range of inland and coastal wetland habitats, including small lakes and ponds, bogs, drainage ditches and rivers, all of which are under-represented during I-WeBS. (Lewis L. J., Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16, 2019). Twenty Teal were seen in February in a field with a flooded area to the south of site. The area was checked on subsequent surveys but no Teal present. The species did not associate with the site.

3.3.5 Mallard

Mallard are the most widespread species, although not quite as numerous as Wigeon or Teal. They occur in almost all available wetland habitats in Ireland. Mallard that occur in Ireland belong to the population that breed across northern Europe and these have a non-breeding range that extends across north-west Europe, east to the Baltic. This population is stable (Wetlands International, 2018). Irish-breeding birds are resident, and are augmented each winter by migrants, possibly some from the Icelandic breeding population (Wernham et al., 2002). Numbers of Mallard have declined throughout I-WeBS, as well as in Northern Ireland and Britain. Frost et al. (2018) suggest that the declines in wintering Mallard could be related to fewer releases by shooting estates and/or perhaps short-stopping by Russian birds. (Lewis L. J., Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16, 2019). Ten Mallard were seen in February in a field with a flooded area to the south of site. The area was checked on subsequent surveys but no Mallard present. One Mallard was seen flying over site in April. The species did not associate with the site.

3.3.6 Black-headed gull

The Black-headed Gull is our most widespread and numerous wintering gull, being found regularly on inland and coastal wetlands throughout the winter. Based on colour-ring resightings, the Irish wintering population is likely comprised of a mix of Irish-breeding birds as well as individuals from the UK, Scandinavia and Baltic states (Wernham et al., 2002). Most Irish-breeding Black-headed Gull remain here throughout the year but a small proportion of predominantly juvenile birds move south to Europe or north Africa (Wernham et al., 2002; McGreal, 2014). (Lewis L. J., Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16., 2019). Three Black headed gull flew over site in February, one in April and six in May. The species did not associate with the site.

3.3.7 Whimbrel

The Whimbrel is a close relative of the Curlew, both being from the Numenius genus which contains nine 'Curlew/Whimbrel' species, two of which are extinct. The genus name 'Numenius' is derived from the words for 'new' and 'moon' – a reference to the crescent shape of the bill of this group of birds. Whimbrel look very similar to a Curlew – they're large as waders go, long legs and have a long, curved bill, and they put these to good use in the same way as our Curlew, by probing in soft sands and soils in wetlands to feed on invertebrates. Whimbrel fall into the category of 'passage migrant' however – none breed here, and they don't winter here either, but rather they stop off in Ireland in spring and autumn when making their journey between their Arctic breeding grounds and West African wintering areas. Their sudden and noticeable appearance at this time of year earned them the name of "May Bird" in years gone by.

Whimberel were heard during the bat survey in May. The fields on-site were checked with a thermal scope and no birds were seen. Ten Whimberel flew over the site in May, however they did not associate with the site any further.

3.3.8 Water rail

Resident at wetlands throughout Ireland. A secretive and skulking species which is more often heard than seen. One Water rail was observed during hinterland surveys.

3.4 Significance of Birds

The significance of potential ecological effects on birds was determined using Percival (2003) together with professional judgement. The effects were further described with reference to EPA (2017) and CIEEM (2019) criteria for characterising ecological impacts.

Table 3-6: Criteria for assessing impacts based on CIEEM (2019) and (EPA, 2017)

<table>
<tr><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">Quality</td><td colspan="2">Positive effect: 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).</td></tr>
<tr><td colspan="2">Neutral effect: No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.</td></tr>
<tr><td colspan="2">Negative effect: 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).</td></tr>
<tr><td>Extent</td><td colspan="2">The area over which an impact occurs</td></tr>
<tr><td>Duration</td><td colspan="2">• Momentary – effects lasting from seconds to minutes
• Brief – effects lasting less than a day
• Temporary – effects lasting less than a year
• Short-term – effects lasting 1 to 7 years
• Medium term – effects lasting 7 to 15 years
• Long term – effects lasting 15 to 60 years
• Permanent – effects lasting over 60 years
• Reversible</td></tr>
<tr><td>Reversibility</td><td colspan="2">Irreversible impacts: permanent changes from which recovery is not possible within a reasonable time scale or for which there is no reasonable chance of action being taken to reverse it.
Reversible impact: temporary changes in which spontaneous recovery is possible or for which effective mitigation (avoidance/cancellation/reduction of effect) or compensation (offset/recompense/offer benefit) is possible.</td></tr>
<tr><td>Frequency and Timing</td><td colspan="2">Frequency –How often the effect will occur. (once, rarely, occasionally, frequently, constantly –or hourly, daily, weekly, monthly, annually)
Timing –the timing of an activity or change may result in an impact if it coincides with critical life-stages or seasons e.g. bird nesting season.</td></tr>
<tr><td rowspan="4">Describing the significance of effects (EPA, 2017)</td><td>Imperceptible</td><td>An effect capable of measurement but without significant consequences.</td></tr>
<tr><td>Not significant</td><td>An effect which causes noticeable changes in the character of the environment but without significant consequences.</td></tr>
<tr><td>Slight</td><td>An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.</td></tr>
<tr><td>Moderate</td><td>An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.</td></tr>
</table>

Parameter	Description	
	Significant	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	An effect which obliterates sensitive characteristics

The desk study and the field study reveal that some species of high ecological importance are present in low numbers in the local environment. Wintering water bird species of interest were recorded utilising the fields in the surrounds. The threshold for inclusion of a bird species as a qualifying interest for an SPA is 1% of Irelands population. However, no such flock was recorded from within the site or during hinterland surveys.

3.4.1 Significance values for birds

Table 3-9 evaluates the importance of species of interest found within and surrounding the site. The table provides a sensitivity value based on (Percivel 2003) although this was designed to examine impacts on birds by wind energy.

Table 3-7 Determination of Sensitivity in study area

Sensitivity	Determining factor
Very High	Species that form the cited interest of SPAs and other statutorily protected nature conservation areas. Cited means mentioned in the citation text for the site as a species for which the site is designated.
High	Species that contribute to the integrity of an SPA but which are not cited as species for which the site is designated. Ecologically sensitive species including the following: divers, common scoter, hen harrier, golden eagle, red-necked phalarope, roseate tern and chough. Species present in nationally important numbers (>1% Irish population)
Medium	Species on Annex 1 of the EC Birds Directive Species present in regionally important numbers (>1% regional (county) population) Other species on BirdWatch Ireland's red list of Birds of Conservation Concern
Low	Any other species of conservation interest, including species on BirdWatch Ireland's amber list of Birds of Conservation Concern not covered above.

Table 3-8 Evaluation of importance for species of interest from within site and hinterland

Species	Species information	Found within site?	Found in Hinterland surveys?	Designation	Sensitivity (Percivel 2003)	Value of hinterland study area	Value of subject site
Barn Owl	Scarce resident mainly in central and southern Ireland. No longer breeds in large patches of northern, western and eastern Ireland. Red-listed in Ireland due to a significant decline in the breeding population. The European population is currently evaluated as Declining.	No	Yes, one nest site within1km from site boundary	Red	Medium	Local	Local Medium
Black headed Gull	Qualifying interest of the Middle Shannon Callows SPA. Amber listed in BoCCI 2020-2026 (breeding and wintering). Highest numbers recorded flying over was 6. Not observed associating (feeding or roosting) within the site. No impacts expected.	No, a total of seven flew over site	Yes, in low numbers	Amber	Very high	Local	Local Low
Buzzard	Green listed in BoCCI 2020-2026 Found both within and surrounding the site.	Yes, observed once feeding on site and occasionally soaring above the site	Yes. recorded perched and feeding in field	Green	Low	Local	Local Low
Grey Heron	Green listed in BoCCI 2020-2026. Observed flying over on three occasions. Not observed associating with the site. No impacts expected.	No, but flew over site	Yes, one sighting	Green	Low	Local	Local Low
Kestrel	Red listed (breeding) in BoCCI 2020-2026. Countryside bird survey shows an overall downward trend since 1998 however the index has trended up since a 2014 low (https://c0cre470.caspio.com/dp/4bae3000b62efcaae08e4f4da8bd). The 2011-2016 population was estimated at 13,500 (Lewis 2019). This species was found to hunt within the site on one occasion and twice hunting to the north of the site, which appears to be their preferred territory.	Yes	Yes	Red	Medium	Local	Local Medium
Northern Lapwing	Red listed in BoCC 2020-2026.Qualifying interest of the Middle Shannon Callows SPA. The SPA supports nationally important populations of Lapwing (13,240). No sighting of Lapwing was recorded from within the site during any survey. One recording was noted from hinterland survey, when 30 Lapwing were observed in field 2.6km to the south/SE of the site. Not observed associating with the site. No impacts expected.	No	Yes, one observation of 30 Lapwing during hinterland surveys	Red	Very High	Local	Local low

Species	Species information	Found within site?	Found in Hinterland surveys?	Designation	Sensitivity (Percivel 2003)	Value of hinterland study area	Value of subject site
Meadow Pipit	Red listed (breeding) in BoCC 2020-2026. The listing of this species as of high conservation concern is due to a large decline in population following the unusually cold winters of 2009/2010. According to BirdWatch Ireland, the species has undergone a significant recovery since that period (Countryside bird survey data trend showed 2019 with highest peak since index started in 1998. Slight decline occurred from this peak in 2020 and 2021; https://c0cre470.caspio.com/dp/4bae3000b62efcaae08e4f4da8bd). Low numbers of birds observed during winter and breeding season however one sighting conducted during breeding season suggests this species is probably breeding within the site.	Yes	No	Red	Medium	Local	Local Medium
Redwing	Red listed in BoCC 2020-2026. The species was observed on several occasions during the winter surveys using the treelines and flying over.	Yes, max number observed 50	Yes	Red	Medium	Local	Local Medium
Snipe	Red listed in BoCC 2020-2026 (breeding and wintering). The population trend for Snipe in Ireland remains uncertain as they are very difficult to monitor and are almost certainly undercounted (Lewis 2019). Ireland provides vital wintering grounds for the Icelandic population that numbers around 5,700 individuals. The subject site was found to host wintering snipe however all records were during the wintering period. No breeding Snipe were found.	Yes. 9 recordings from transects. Last records was on the 18th of April (crossover month). Not found breeding on site.	No	Red	Medium	Local	Local Medium
Mallard	Amber listed in BoCC 2020-2026 (breeding and wintering). And has shown a decline in population of 11.8% in the 5 years from 2015/20016 to 2009/2010 (Lewis 2019). The Irish population is estimated at 28,230. Not observed associating with the site. No impacts expected.	No, just flew over	Yes	Amber	Low	Local	Local Low
Whimbrel	Green listed in BoCC 2020-2026. Passage migrant in autumn (August/September) and spring (April/May).	No, just flew over	No	Green	Low	Local	Local Low
White-tailed Eagle	Red listed in BoCC 2020-2026 (breeding). Mixed success in terms of breeding in Ireland since the recent reintroduction at Mountshannon and Portumna. Historically a widespread breeding species, and formerly the last wild pair bred in County Mayo in 1912. One sighting during surveys when a juvenile flew over adjacent farm to the east of the site. Did not associate with the site, no impacts expected.	No	Yes, one observation flying over the neighbouring farm	Red	High	Local	Local low

4 ASSESSMENT OF IMPACTS

Determination of impacts is derived with guidance from (Percival, 2003). Table 4-1 provides definitions for magnitude of effect. This data alongside the previously assigned significance value is imputed into Table 4-2; significance matrix to provide a final significance impact of the development per species.

Table 4-1 Determination of Magnitude of Effects.

Magnitude	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. Guide: < 20% of population / habitat remains
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed. Guide: 20-80% of population/ habitat lost
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. Guide: 5-20% of population/ habitat lost
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1-5% of population/ habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. Guide: < 1% population/ habitat lost

Table 4-2 Significance matrix

Significance		Sensitivity			
		Very high	**High**	**Medium**	**Low**
Magnitude	**Very High**	Very high	Very high	High	Medium
	High	Very high	Very high	Medium	Low
	Medium	Very high	High	Low	Very Low
	Low	Medium	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low

Table 4-3 Impacts on species of interest

Species	Potential Impacts		Duration and Magnitude of potential impact	Frequency and reversibility	Magnitude and Significance of effect
Barn Owl	Direct Habitat Loss	Barn owl were not found to roost within the site. Although some lands will be converted from improved pasture to built lands the landscaping plan will create a multitude of semi natural habitats which will provide good hunting habitat. The proposed development will also create a breeding tower allowing for the expansion of the species within the site. (TII, 2017) states Barn owl are not strongly territorial, with home ranges regularly overlapping. Barn owl nest sites have been recorded less than 350m apart. See mitigation section below for further details.	Permanent, positive	Occurs once, irreversible	The magnitude of the impact is assessed as Very Low. moderate sensitivity species + Negligible Impact = Very Low effect significance. No likely significant effects at a local level are predicted
	Displacement and barrier effect	A breeding site was found during hinterland surveys. (Goodship, 2022) states Barn owl have a low sensitivity to disturbance and suggests a 50 to 100m buffer zone during the breeding season. (Shawyer, 2011) suggests a disturbance risk of 175 for heavy construction works noting. The subject site lies over 500m from the nest site thus disturbance from the development will not impact this species. There were no sightings of barn owl during night time bat surveys within the site. Given the lack of observations of this species interacting with the site, in addition to the distance between the site and the breeding location, no displacement or barrier effects are anticipated.	Temporary and of negligible magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of the impact is assessed as Very Low. Moderate sensitivity species + Negligible Impact = Very Low effect significance. No likely significant effects at a local level are predicted
Black headed gull	Direct Habitat Loss	This species did not associate itself with the site throughout the survey period with occasional observations noted. Based on baseline data the proposed development will have a negligible impact on the local Black-headed gull population	Long-term Imperceptible neutral	Occurs once, irreversible	The magnitude of the impact is assessed as Low. Very high sensitivity species + Negligible Impact = Low effect significance. No likely significant effects at a local level are predicted
	Displacement and barrier effect	Given the lack of observations of this species interacting with the site, no displacement or barrier effects are anticipated.	Temporary and of negligible magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of the impact is assessed as Low. Very High sensitivity species + Negligible Impact = Low effect significance. No likely significant effects at a local level are predicted
Buzzard	Direct Habitat Loss	The development footprint is dominated by improved grassland and tillage with associated hedgerows and treelines, providing suitable breeding and foraging habitat for the species. The final site outline will result in the creation of woodland and planted berm with scattered trees and wildflower mix providing habitat for prey species. The total area of proposed woodland / treeline creation of 1.4km substantially mitigates the cumulative loss of 540m of treelines and hedges.	Permanent, slight negative	Occurs once, irreversible	The magnitude of impact is assessed as Very Low. Low sensitivity species + Medium Impact = Very Low effect significance. No likely significant effects at a local level are predicted
	Displacement and barrier effect	There is the potential of disturbance to breeding Buzzard because the construction activities will disturb the birds and displace them from the area. Foraging and commuting birds may temporarily avoid construction areas owing to the noise and increased activity. Based on continued bird surveys through the construction phase it is proposed to identify breeding sites and	Temporary and of low magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Very Low. Low sensitivity species + Medium Impact = Very Low effect significance. No likely significant effects at a local level are predicted

Species	Potential Impacts		Duration and Magnitude of potential impact	Frequency and reversibility	Magnitude and Significance of effect
		create a 150m buffer surrounding the zone (Goodship, 2022). Construction will be avoided here until fledging has occurred.			
Grey Heron	Direct Habitat Loss	3 sightings of heron were made of an overflying bird, not interacting with the site. This species utilises rivers and wetlands for feeding, none of which can be found on the site. The creation of two ponds and wetland will increase the favourability of the site for this species.	Permanent, positive	Occurs once, irreversible	The magnitude of impact is assessed as Low. Low sensitivity species + Low Impact = Very Low effect significance. No likely significant negative effects at a local level are predicted
	Displacement and barrier effect	There is the potential of disturbance to breeding Heron through construction phase activities. Foraging and commuting birds may temporarily avoid construction areas owing to the noise and increased activity. Based on continued bird surveys through the construction phase it is proposed to identify breeding sites and create a 200m buffer surrounding the nest. Construction will be avoided here until fledging has occurred.	Temporary and of low magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Low. Low sensitivity species + Low Impact = Very Low effect significance. No likely significant effects at a local level are predicted
Kestrel	Direct Habitat Loss	The development footprint is dominated by improved grassland and tillage with associated hedgerows and treelines, providing suitable foraging habitat for the species. Kestrel can nest in a variety of substrates such as rock ledges, old corvid stick nests, bird boxes, buildings etc. Some breeding and foraging habitat will be removed from the site however a landscape plan is in place for woodland, wildflowers and scattered trees minimising long term impacts. The total area of proposed woodland / treeline creation of 1.4km substantially mitigates the cumulative loss of 540m of treelines and hedges.	Permanent, slight negative	Occurs once, irreversible	The magnitude of impact is assessed as Low. Medium sensitivity species + Low Impact = Low effect significance. No likely significant effects at a local level are predicted
	Displacement and barrier effect	There is the potential of disturbance to breeding Buzzard because the construction activities will disturb the birds and displace them from the area. Foraging and commuting birds may temporarily avoid construction areas owing to the noise and increased activity. Based on continued bird surveys through the construction phase it is proposed to identify breeding sites and create a 150m buffer surrounding the zone (Goodship, 2022) state the species has a Low/Medium sensitivity to disturbance and recommend a breeding zone of 100 – 200m. Construction will be avoided here until fledging has occurred.	Temporary and of low magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Low. Medium sensitivity species + Low Impact = Low effect significance. No likely significant effects at a local level are predicted
Lapwing	Direct Habitat Loss	This species was not found within the site during any survey with a single sighting found during hinterland surveys 2.6km from the site. Given the lack of interaction, impacts on habitat loss are not expected.	Long-term Imperceptible neutral	Occurs once, irreversible	The magnitude of the impact is assessed as Low. Very High sensitivity species + Negligible Impact = Low effect significance. No likely significant effects at a local level are predicted

Species	Potential Impacts		Duration and Magnitude of potential impact	Frequency and reversibility	Magnitude and Significance of effect
	Displacement and barrier effect	The IECS Toolkit26 (EU, 2010) suggests that lapwing is of moderate sensitivity to disturbance. There is the potential of disturbance to wintering Lapwing located in the hinterland through construction phase disturbance. Based on continued bird surveys through the construction phase it is proposed to identify wintering sites and create a 200m buffer surrounding the zone (200m buffer is based on IECS Toolkit26.)	Temporary and of low to negligible magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Low. Very high sensitivity species + Low Impact = Low effect significance. No likely significant effects at a local level are predicted
Mallard	Direct Habitat Loss	Amber listed Mallard were observed once overflying the site and once just outside. This species utilises rivers and wetlands for feeding and roosting, none of which will be impacted by the development. The creation of two ponds and wetland will increase the favourability of the site for this species.	Permanent, positive	Occurs once, irreversible	The magnitude of impact is assessed as Low. Low sensitivity species + Low Impact = Very Low effect significance. No likely significant negative effects at a local level are predicted
Mallard	Displacement and barrier effect	There is the potential of disturbance to breeding Mallard through construction phase solar panel arrays, or because the construction activities will disturb the birds and displace them from the area. Foraging and commuting birds may temporarily avoid construction areas owing to the noise and increased activity. Based on continued bird surveys through the construction phase it is proposed to identify breeding sites and create a 200m buffer (200m buffer is based on IECS Toolkit26.) Construction will be avoided here until fledging has occurred.	Temporary and of low magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Low. Low sensitivity species + Low Impact = Very Low effect significance. No likely significant effects at a local level are predicted
Meadow Pipit	Direct Habitat Loss	The development footprint is dominated by improved grass and tillage, which provides some suitable nesting, roosting and foraging habitat for the species. 7 sightings occurred over the winter period (max 4 birds) while 4 sightings were made during the breeding season. Probably breeding on site. The proposed development will result in an approx. loss of 30% of onsite breeding grounds for this species. It should be noted that numbers of these birds are low within the site and the locality has an abundance of similar habitats.	Permanent and of medium magnitude	Occurs once, irreversible	The magnitude of the impact is assessed as Low. Medium sensitivity species + medium Impact = Low effect significance. No likely significant effects at a local level are predicted
Meadow Pipit	Displacement and barrier effect	There is the potential of disturbance to breeding meadow Pipit because the construction activities will disturb birds and displace them from the area. Based on continued bird surveys through the construction phase it is proposed to identify breeding sites and create a 50m buffer surrounding the zone (50m buffer is based on IECS Toolkit26). Works will avoid key breeding periods with works continuing after fledging.	Temporary and of negligible magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of the impact is assessed as Very Low. Medium sensitivity species + Negligible Impact = Very Low effect significance. No likely significant effects at a local level are predicted
Redwing	Direct Habitat Loss	Widespread winter visitor to Ireland from October to March from Iceland and Scandinavia. This species does not breed in Ireland. There were 15 sightings of a redwing flock within the site over the winter period. Highest numbers seen on site was 50 birds. The majority of the site will still be used as grassland post construction thus this species ability to occupy the site will remain.	Permanent and of low magnitude	Occurs once, irreversible	The magnitude of the impact is assessed as Low. Medium sensitivity species + low to medium Impact = Low effect significance. No likely significant effects at a local level are predicted

Species	Potential Impacts		Duration and Magnitude of potential impact	Frequency and reversibility	Magnitude and Significance of effect
	Displacement and barrier effect	There is the potential of disturbance to redwing because the construction activities will disturb birds and displace them from the area. This however will be temporary in nature and given the quantity of suitable alternative lands in the surrounds, it is unlikely to impact the local population	Temporary and of negligible magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of the impact is assessed as Very Low. Low sensitivity species + Negligible Impact = Very Low effect significance. No likely significant effects at a local level are predicted
Snipe	Direct Habitat Loss	The development footprint is dominated by improved grassland, which provides some suitable wintering habitat for the species particularly close to drains and in tillage. Breeding Snipe has been conducted. While three sighting of snipe occurred in March and two in April, none of these were breeding birds, rather remnant overwintering. No drumming or chirping was recorded and no sign of snipe was recorded in May. Post construction, the hydrological regime of the site will remain the same thus little long term impacts are expected.	Long term slight Negative	Occurs once, irreversible	The magnitude of the impact is assessed as Low. Medium sensitivity species + Low Impact = Low effect significance. No likely significant effects at a local level are predicted
	Displacement and barrier effect	Some displacement may occur. Pierce-Higgins et al (2012) note that snipe densities declined to the order of ca. 50% within 500 metres of turbines at wind farms during construction. Construction activities will be limited to the development footprint so direct disturbance effects will not extend beyond the works areas. There is potential for indirect disturbance to roosting (snipe from noise and visual stimuli associated with construction activities. However, given the low number of snipe that use the site in the context of the estimated national breeding population of 4,275,it is not considered to be a significant effect.	Temporary and of low to negligible magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Medium. Medium sensitivity species + Low Impact = Low effect significance. No likely significant effects at a local level are predicted
Whimbrel	Direct Habitat Loss	Whimbrel were recorded on one occasion during transect surveys flying to the east of the site. This migratory bird passes over Ireland, peaking in May and again October each year. This species utilises wetlands for feeding and can roost in a variety of terrestrial habitats. No impacts are expected.	Long-term Imperceptible neutral	Occurs once, irreversible	The magnitude of impact is assessed as Low. Low sensitivity species + Low Impact = Very Low effect significance. No likely significant negative effects at a local level are predicted
	Displacement and barrier effect	There is the potential of disturbance to migratory Whimbrel through construction phase solar panel arrays, or because the construction activities will disturb the birds and displace them from the area. Foraging and commuting birds may temporarily avoid construction areas owing to the noise and increased activity. Based on continued bird surveys through the construction phase it is proposed to identify breeding sites and create a 200m buffer (200m buffer is based on IECS Toolkit26.) Construction will be avoided here until fledging has occurred.	Temporary and of negligible magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Low. Low sensitivity species + Low Impact = Very Low effect significance. No likely significant effects at a local level are predicted
White-tailed eagle	Direct Habitat Loss	White tailed eagles breeding sites have a strong correlation to the edges and islands on large lakes. A juvenile white tailed eagle was recorded on one occasion flying over the neighbouring farm to the south-east. There is no breeding habitat for this bird on or surrounding the site. Although mainly	Long-term Imperceptible neutral	Occurs once, irreversible	The magnitude of impact is assessed as Low. High sensitivity species + Low Impact = Low effect significance. No likely significant negative effects at a local level are predicted

Species	Potential Impacts		Duration and Magnitude of potential impact	Frequency and reversibility	Magnitude and Significance of effect
		persist on a fish and waterfowl diet this bird will also scavenge dead animals. Farms can often have dead animals particularly in Spring and White-tailed eagles have ben known to take advantage of this food source in east Galway. The proposed development will not result in any loss of habitat for this species.			
	Displacement and barrier effect	Foraging birds may temporarily avoid construction areas owing to the noise and increased activity.	Temporary and of low magnitude and will not result in long-term adverse effects.	Occurs during construction phase	The magnitude of impact is assessed as Low. High sensitivity species + Low Impact = Low effect significance. No likely significant effects at a local level are predicted

5 Mitigation & Enhancement measures

5.1.1 Monitoring

An Ornithologist ECoW will be employed during the construction phase to micromanage construction locations to avoid disturbance on key species. Whilst halting the construction to times outside the wintering period was considered the scale of works was not considered impactful enough to negatively impact wintering birds both within the site and in the surrounds. Rather an ECoW will be involved in the construction and limit construction in areas based on when they are of value to birds. The monitoring section above outlines how bird surveys will continue during the construction phase and based on these results micro exclusion zones can be put in place. Table 4-3 goes through potential buffer zones and timings when works may need to be halted here. This method based on co-operation between overseeing ornithologist, site manager and NPWS / Local Authority representative will allow works to continue throughout the year whilst also avoiding disturbances to key species at vulnerable times.

5.1.2 Planting of native woodland

Planting of native tree species in linear features as well as woodland patches will provide ecological corridors, nest sites and will compensate for the loss of hedgerows as part of the development.

- Native providence tree species to be sourced from nurseries such as "Wild Oaks nursery".

5.1.3 Sustainable Drainage Systems – ponds for wildfowl

Sustainable Drainage Systems (SUDS) are widely used to reduce the impact of urban runoff on the aquatic environment. They can also provide new still water habitats and water-based recreational facilities. As part of the design plan two attenuation pond on site will be designed to enhance biodiversity value of the provision of new wetland habitats. These new habitats will provide a breeding site for waterbirds such as Mallard, as well as a roost site for wintering waterbirds such as Teal, Widgeon or Lapwing.

The attenuation ponds will be created with gentle sloping side slopes that cover a large area, planted with a variety of suitable native wetland species.

Landscaping around SUDS ponds can add pollutants to the system. To prevent this:

- Do not use nutrient rich topsoil in the catchment area of the SUDS pond and especially not in the pond margins.
- During the SUDS establishment phase, runoff from bare soils should be minimised. For example: (i) green cover on slopes should be rapidly established (ii) base-ofslope trenches should be used to intercept runoff and sediments, (iii) construction should be timed to avoid autumn and winter when high runoff rates are to be expected.
- Planting schemes which require biocide or fertiliser treatment should be avoided
- Tall emergent plants will be planted in most SUDS schemes to take-up pollutants. However, much planting of marginal, floating-leaved and aquatic plant species in SUDS ponds is unnecessary in terms of either function or visual affect, and appears

to be done merely to help the ponds 'colonise rapidly'. Natural colonisation is valuable because:

- The new pond stage is ecologically valuable in its own right in that it supports species which are not seen at later stages of colonisation.
- Planting also fills up space in ponds that could otherwise be exploited by self-colonising local species, and in doing so reduces the potential ecological value of the pond.

Contractors should have specific instructions to ensure that non-native aquatic or marginal are not included in planting schemes. SUDS schemes are part of the natural drainage system of a catchment, all planting should be regarded as de facto release to the wild. This means that there should be a general presumption against all forms of ornamental planting of aquatic and wetland plants. In assessing SUDS effectiveness, each non-native species occurring represents a negative impact on the environment.
Focus particularly on the more inconspicuous, but ecologically valuable, aquatic grasses, especially creeping bent (Agrostis stolonifera) and the sweetgrasses (Glyceria species) which provide good invertebrate habitats.
Ensure that an experienced botanist assesses planting schemes before projects are signed-off to check what has actually been planted (as opposed to specified). Check again for the presence of invasive species after one year

5.1.4 Purpose built roost house – barn owl & bat roost

Sheds will be demolished as part of the development. The sheds are used as breeding site for Barn swallow, House martin and Starling. Although no Barn Owls were seen on site, they are breeding within 1km of the site, therefore a purpose built building will be erected on site which will provide a suitable nest site for Barn Owl, kestrel and other roosting birds. The "house" will also contain an area suitable for bat species found on site and follow methodologies as provided at https://www.barnowltrust.org.uk/barn-owl-nestbox/wildlife-tower

- The barn owl tower will consist of a 2x2m block and faced in stone with a minimum hight of 4.5m and an upper and lower internal space.
- The A-frame roof should have an overhang to the east with the barn owl entrance located at a height of 3.5m.
- The west faced wall should provide a shallow open fronted cavity suitable for nesting kestrel (male and female recorded in the surrounds).
- South faced wall should have numerous cavities in the mortar for invertebrates and nesting passerines.
- All walls will have sparrow sized opening for hole nesting bird species
- Bats: the lower half of the building is a hibernation area for bats, designed to be permanently dark, cool and damp with a simple earth floor. A variety of bat species can access this through a wide horizontal slot situated just below the level of an internal floor, which separates the top half of the building from the hibernation area.

Figure 5-1 Sample roost house **Figure 5-2 Barn Owl feature in roost house**

The location has been carefully selected to be in a area not frequented by personnel working on the site post construction. The area will also be a dark zone, with no artificial lighting.

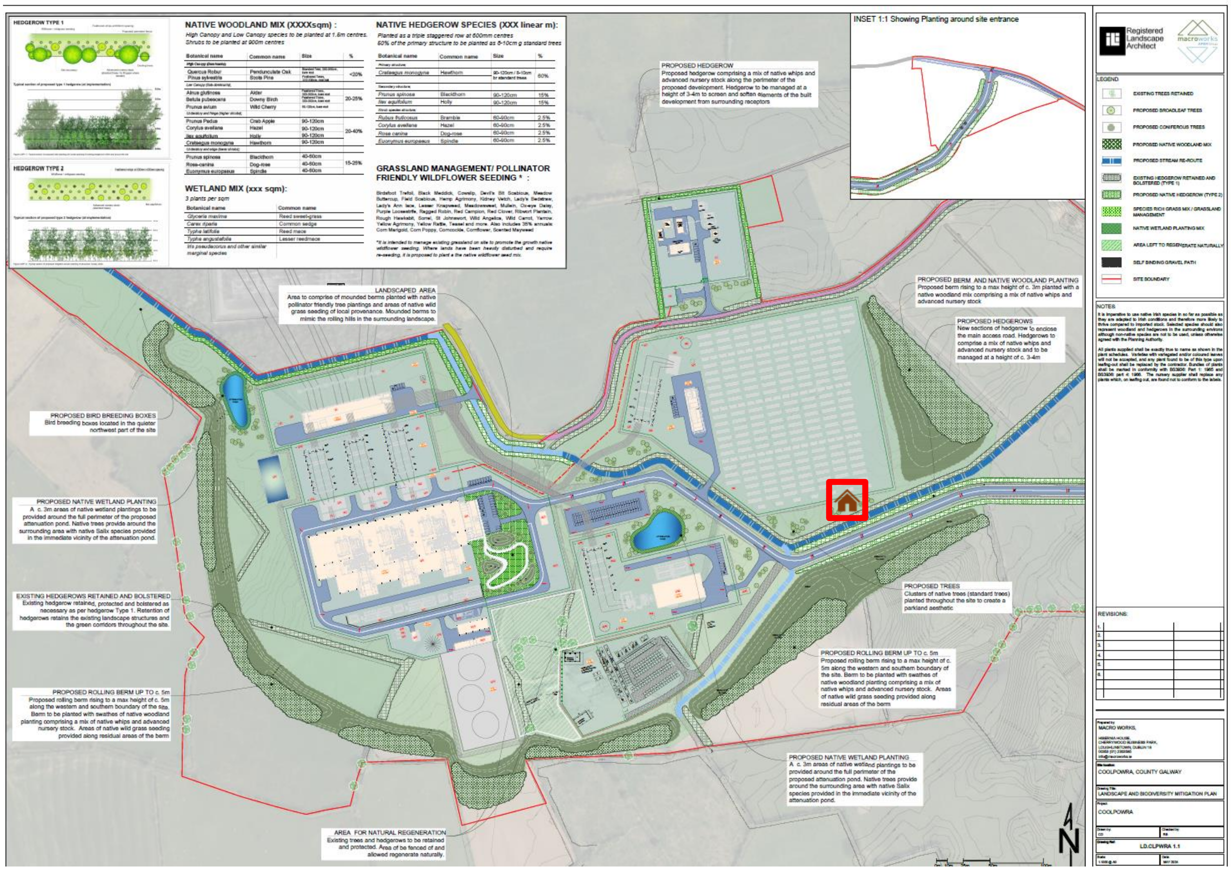


Figure 5-3 Purposed location of roost house

5.1.5 Barn swallow, house martin, swift boxes nest boxes

Barn swallow (added internally to suitable shed building), house martin and swift box nests will be added to suitable proposed buildings within the site.

6 Residual Impacts after Mitigation

Residual impacts are those that occur after the mitigation measures have taken effect. The mitigation measures outlined in section 5 will minimise impacts associated with the construction phase of the proposed development.

No significant indirect impacts on the habitats associated with rare and protected birds found utilising the site in the wintering and breeding seasons as long as best practice measures such as those outlined in section 5 are implemented fully.

As such residual Impacts on bird species will be low.

7 Conclusion

This report provides details from bird surveys conducted at Coolpowra, Co. Galway.

14 no. species of birds of interest were observed during fieldwork. 6 no. of these were identified as being red-listed; Barn owl, Kestrel, Meadow Pipit, Redwing and White tailed eagle. Of these species the value of the subject site was identified as local medium for; Barn Owl, Kestrel, Meadow pipit, redwing and snipe.

Lapwing and Black-headed gull; conservation objectives of the middle Shannon Callows SPA were observed either flying over or in the hinterland. These were not interacting with the site. A juvenile White-tailed eagle was also observed. Impacts on these species will be negligible.

Mitigation measures proposed will reduce the impact on all bird species while enhancement measures should result in a net overall benefit for the local bird population. The proposed development will not have a significant impact on any bird species on a local or county basis.

8 Figures

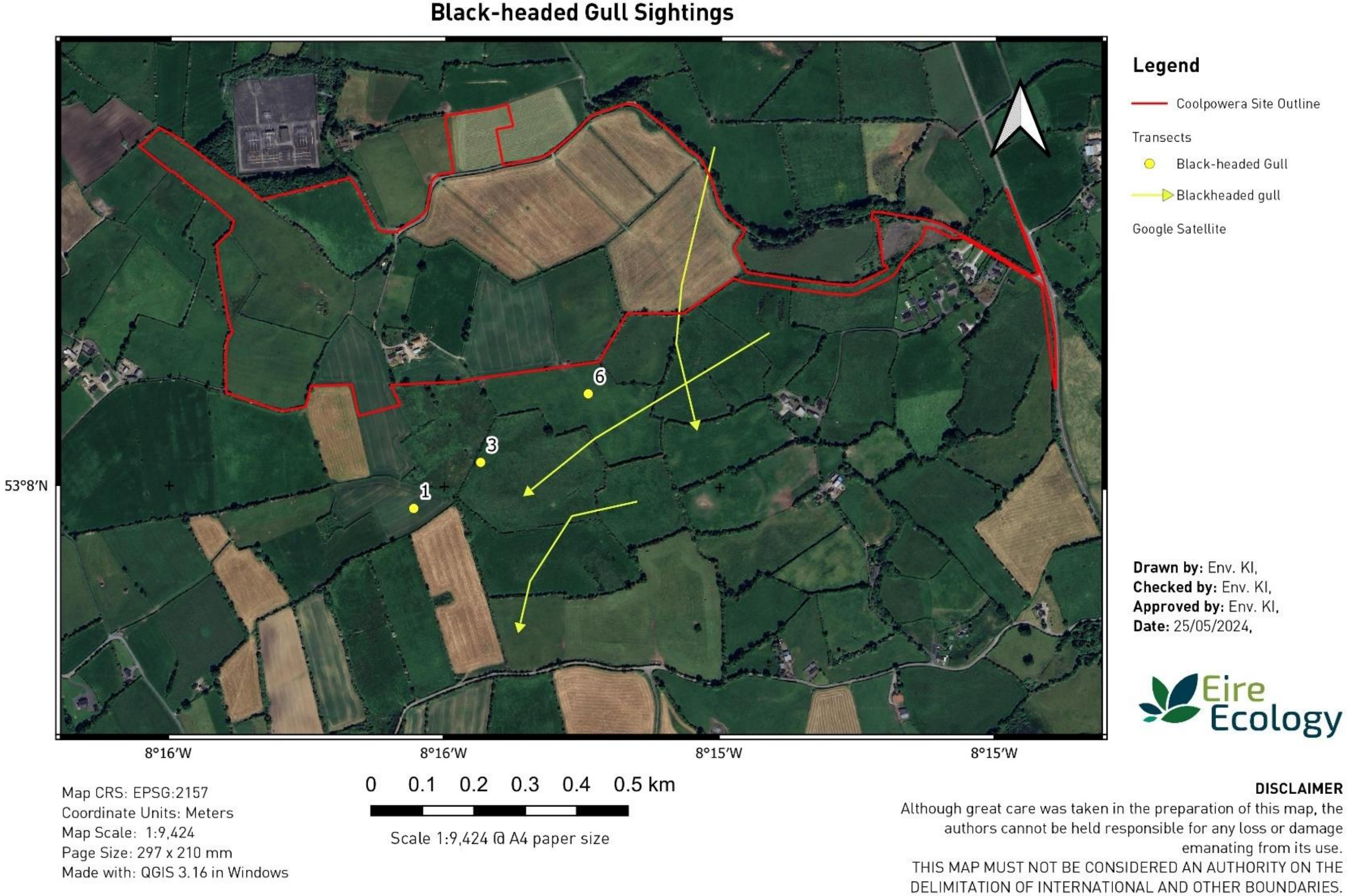


Figure 8-1 Black-headed gull sightings

Buzzard Sightings

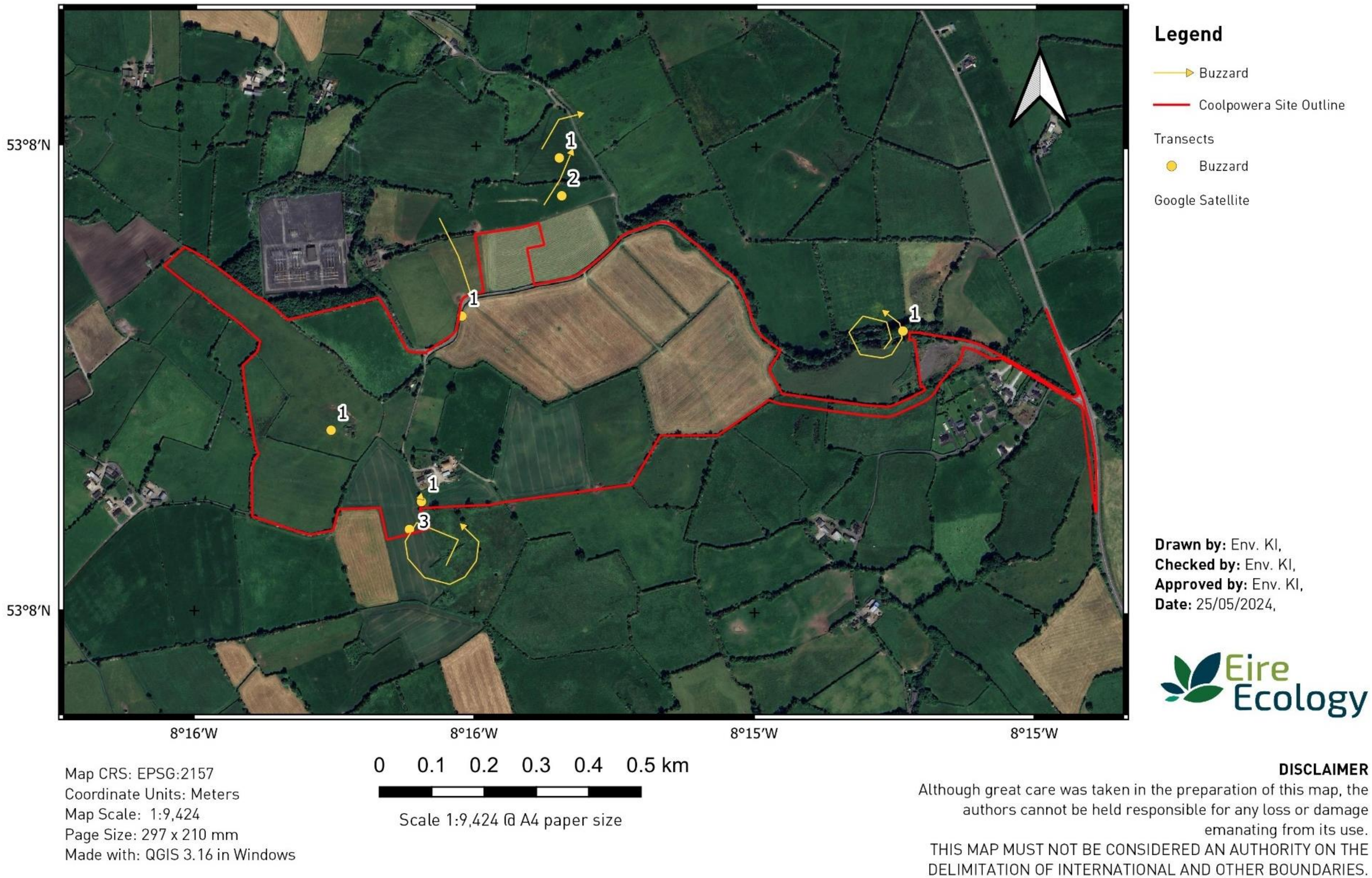


Figure 8-2: Buzzard sightings

Kestrel Sightings

Legend

Coolpowera Site Outline

Kestrel

Transects

Kestrel

Google Satellite

Drawn by: Env. KI,
Checked by: Env. KI,
Approved by: Env. KI,
Date: 25/05/2024,

Map CRS: EPSG:2157
Coordinate Units: Meters
Map Scale: 1:9,424
Page Size: 297 x 210 mm
Made with: QGIS 3.16 in Windows

0 0.1 0.2 0.3 0.4 0.5 km

Scale 1:9,424 @ A4 paper size

DISCLAIMER
Although great care was taken in the preparation of this map, the authors cannot be held responsible for any loss or damage emanating from its use.
THIS MAP MUST NOT BE CONSIDERED AN AUTHORITY ON THE DELIMITATION OF INTERNATIONAL AND OTHER BOUNDARIES.

Figure 8-3: Kestrel Sightings

Other Species

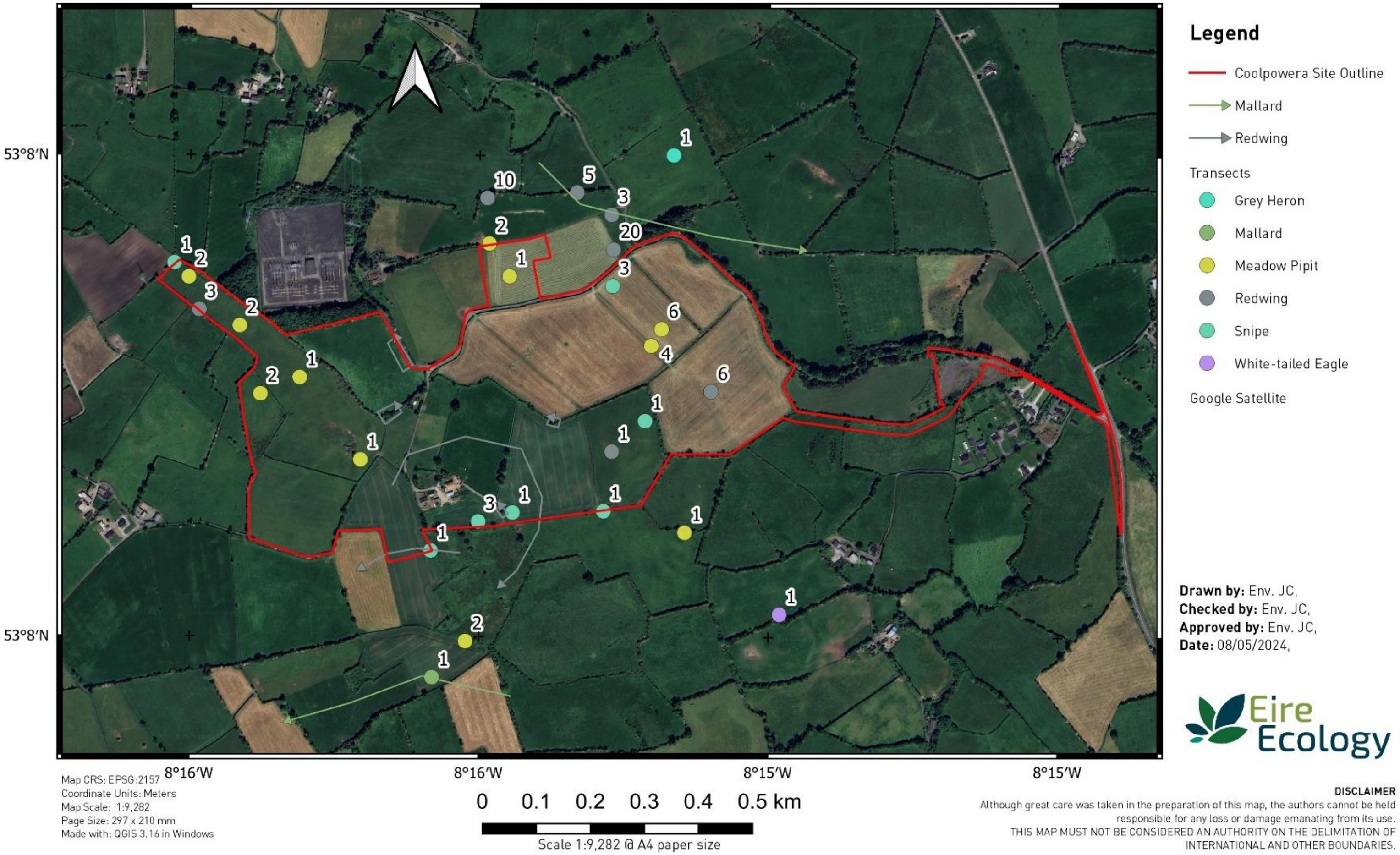


Figure 8-4: Other sightings

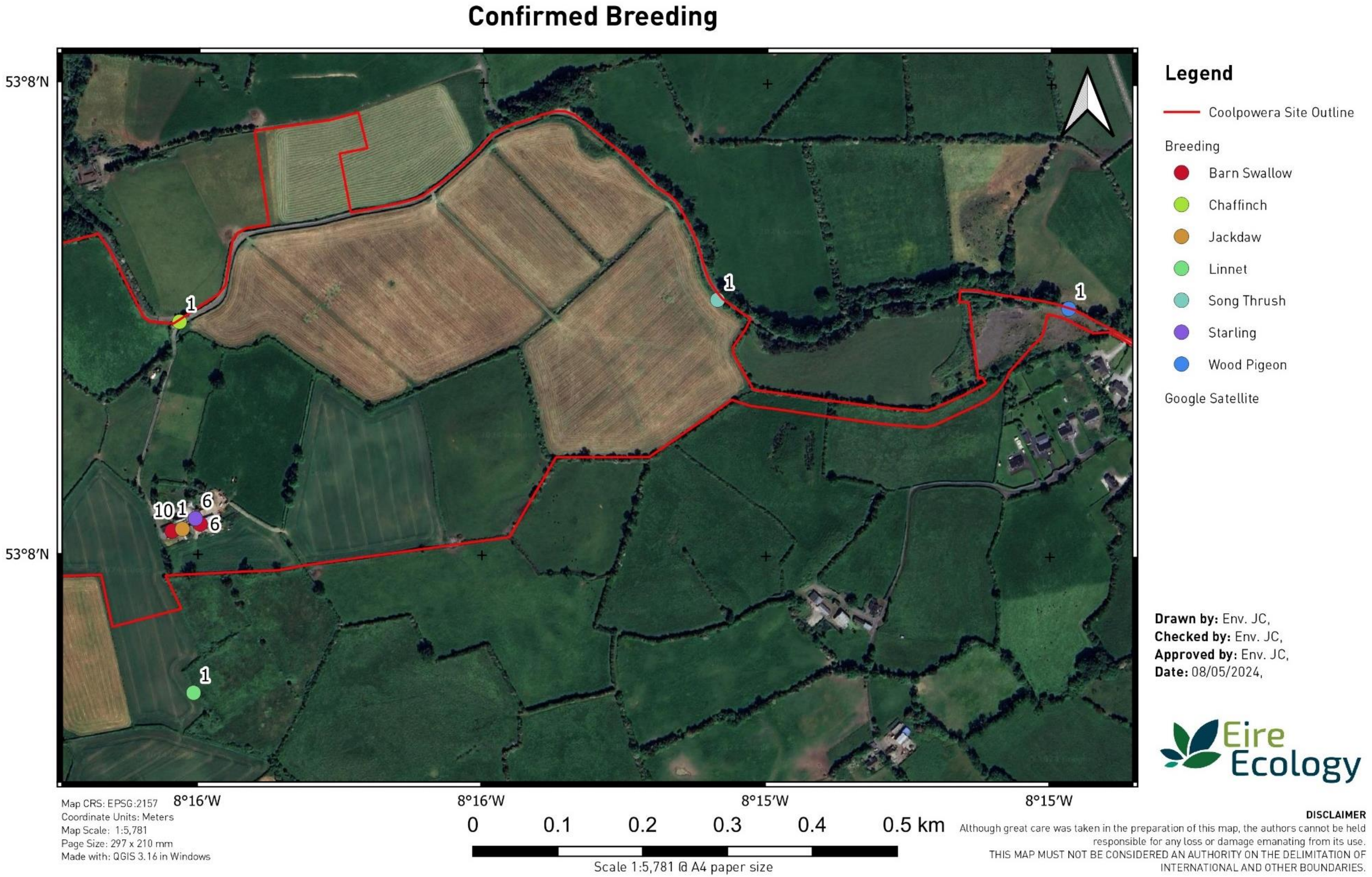


Figure 8-5: Confirmed Breeding

9 References

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10 APPENDIX 1 – Tables and Figures

Table 10-1 Survey dates and environmental data

Date	Sunset / sunrise	Start	Finish	Cloud	Wind speed (F)	Wind direction	Visibility	Precipitation	Survey method
09/01/2024	08:45	09:10	12:15	3	1	W	2	1	Transects
09/01/2024	16:37	12:30	15:30	3	1	W	1	0	Hinterland
25/01/2024	08:29	07:30	10:30	3	1	W	1	0	VP - Dawn survey
25/01/2024	17:04	11:00	14:00	3	1	W	1	0	VP 2
26/02/2024	07:29	08:20	12:00	3	1	W	1	0	Transects
26/02/2024	18:06	12:05	15:00	3	1	W	1	0	Hinterland
28/03/2024	06:16	09:40	12:55	3	1	W	1	0	Transects
28/03/2024	19:02	13:00	15:00	3	1	W	1	0	Hinterland
19/04/2024	06:25	08:30	12:10	3	1	W	1	0	Transects
19/04/2024	20:42	12:15	14:15	3	1	W	1	0	Hinterland
01/05/2024	21:03	20:30	22:30	3	1	W	1	0	Barn Owl survey
07/05/2024	21:13	15:15	21:45	1	1	SW	1	0	Dusk VP - Raptor
10/05/2024	05:43	05:15	11:15	1	0	N/A	1	0	Dawn Breeding transects
23/05/2024	05:24	06:00	11:00	1	2	W	1	0	Dawn Breeding transects

Table 10-2: Weather legend

Rain		Visibility		Cloud Cover	
0	None	1	Good (>2km)	1	0-32
1	Drizzle Mist	2	Moderate (1-2km)	2	33-65
2	Light Showers	3	Poor (<1km)	3	66-100
3	Heavy Showers	4	Limited (<500m)		
4	Heavy Rain	5	N visibility		

Table 10-3 Summary of surveys conducted

Visit No	Date	Survey type	Location	Start Time	End Time	Details	Sunset / sunrise
1	09/01/2024	Transects	-	09:10	12:15	4 Buzzard and 1 Kestrel observed. High levels of Field fare on site and other birds include 27 Skylark.	08:45
1	09/01/2024	Hinterland	-	12:30	15:30	Focused on bog areas, open fields and wetland areas in the surrounding vicinity of the site. 30 Lapwing in GA1 field close to Portumna town, also Buzzard and Black headed gull. No other birds of interest seen.	16:37
2	25/01/2024	VP - Dawn survey	582102 / 708993	07:30	10:30	No species of note recorded. Numerous Redwing on site (red listed) .	08:29
2	25/01/2024	VP 2	582102 / 708993	11:00	14:00	No species of note recorded. Flocks of Redwing flying over.	17:04
3	26/02/2024	Transects	-	08:20	12:00	1 Buzzard on site and Redwing. 3 Black-headed gulls flew over. No other birds of interest recorded	07:29
3	26/02/2024	Hinterland	-	12:05	15:00	Checked surrounding habitats, mainly to the south, SE and NE. Teal and Mallard found flooded areas of fields south of site.	18:06
4	28/03/2024	Transects	-	09:40	12:55	Buzzard and four Snipe (possibly still wintering) seen on site	06:16
4	28/03/2024	Hinterland	-	13:00	15:00	Checked areas within the SPA closest to the site. One water rail observed flying. No other birds of interest seen.	19:02
5	19/04/2024	Transects	-	08:30	12:10	1 black headed gull flew high over site, 5 buzzard, 1 male Kestrel huntung, 4 snipe seen on site. Juvenile White tailed eagle seen flying over neighbouring farm.	06:25
5	19/04/2024	Hinterland	-	12:15	14:15	Checked all areas where previous birds of interest were found. Checked fields north of site, to see where White tailed eagle landed but could not find it. No birds of interest seen.	20:42
6	01/05/2024	Barn Owl	581807 / 708197	20:30	22:30	Dusk watch of reported barn owl nest site. Barn Owl observed at derelict house and shed. Only observed at a distance to avoid disturbance	21:03

Visit No	Date	Survey type	Location	Start Time	End Time	Details	Sunset / sunrise
7	07/05/2024	Raptor VP	582096 / 708990	15:15	18:15	Dedicated raptor VP following on fron the white tailed eagle observed within buffer zone of site on 19/04/24. One Buzzard observed near site	05:48
7	07/05/2024	Raptor dusk VP	582596 / 709430	18:45	21:45	One Kestrel observed hunting north of site	21:13
8	10/05/2024	Transects	-	05:15	11:15	Transects starting at dawn. Ten Whimbrel and six black headed Gull flew over site but did not associate with site. No Snipe on site and no other birds of note recorded	05:43
9	23/05/2024	Transects	-	06:00	11:00	Transects conducted focusing on sections of site to the east where a new road entrance is required. Single sighting of flying Buzzard, two sightings of Meadow pipit one of which was probably breeding.	05:24

Table 10-4: Vantage Point Results: Target Species

Date	VP	Season	Species Name	No. of Birds	Time of flight	Duration of flight (s)	Habitat Code	Activity	Inside / outside of site
25/01/2024	1	winter	Redwing	20	07:40	not recorded	BC3	Flying	O
25/01/2024	1	winter	Redwing	25	08:30	not recorded	BC3	Flying	I
25/01/2024	1	winter	Redwing	5	09:11	not recorded	WL1	Flying, then perched in tree	I
25/01/2024	1	winter	Redwing	40	09:22	not recorded	GA1	Flying	I
25/01/2024	1	winter	Redwing	5	09:23	not recorded	WL1	Perched in tree	I
25/01/2024	1	winter	Redwing	10	09:24	not recorded	WL1	Perched in tree	I
25/01/2024	1	winter	Redwing	30	09:37	not recorded	WL2	Perched in tree	I

Date	VP	Season	Species Name	No. of Birds	Time of flight	Duration of flight (s)	Habitat Code	Activity	Inside / outside of site
25/01/2024	2	winter	Goldcrest	1	not recorded	not recorded	WL1	in hedgerow	I
25/01/2024	2	winter	Redwing	50	11:00	not recorded	GA1	Flying	I
07/05/2024	1	breeding	Mallard	1	17:15	50 seconds	GA1	flew over N / NW corner of site	I
07/05/2024	1	breeding	Buzzard	1	17:24	60 seconds	GA1	soaring high, to the north of site (not on site)	O
07/05/2024	1	breeding	Willow Warbler	1	not recorded	not recorded	WL1	in hedgerow	I
07/05/2024	1	breeding	Barn Swallow	5	not recorded	not recorded	BL3	nesting in sheds by the farmhouse	I
07/05/2024	2	breeding	Kestrel	1	18:30	180 seconds	GA1	Male, to north of site flying, then perched and flew off after 3 mins	O
07/05/2024	2	breeding	Grey Heron	2	19:11	180 seconds	GA1	flew east to west over site	I
07/05/2024	2	breeding	Grey Heron	1	19:14	50 seconds	GA1	one flew back west to east	I
07/05/2024	2	breeding	Willow Warbler	1	not recorded	not recorded	WL1	in hedgerow	I

Table 10-5: Vantage Point Result Non-Target

Date:	VP No.	Species	Est no. individuals	Notes
25/01/2024	1	Robin	1	
25/01/2024	1	Blackbird	4	
25/01/2024	1	Song Thrush	1	
25/01/2024	1	Magpie	4	
25/01/2024	1	Rook	2	
25/01/2024	1	Jackdaw	8	Numerous on site
25/01/2024	1	Chaffinch	8	
25/01/2024	1	Mistle thrush	1	
25/01/2024	1	Sky Lark	14	
25/01/2024	1	Long-tailed Tit	5	
25/01/2024	1	Starling	30	Flocks on field
25/01/2024	1	Pheasant	1	
25/01/2024	1	Wood Pigeon	5	
25/01/2024	1	Raven	2	
25/01/2024	1	Dunnock	1	
25/01/2024	1	Winter Wren	1	
25/01/2024	1	Rook	2	
25/01/2024	2	Rook	15	
25/01/2024	2	Pheasant	1	
25/01/2024	2	Great Tit	1	
25/01/2024	2	Wood Pigeon	2	
25/01/2024	2	Starling	20	
25/01/2024	2	Robin	1	
25/01/2024	2	Chaffinch	6	
25/01/2024	2	Jackdaw	3	
25/01/2024	2	Hooded Crow	1	
25/01/2024	2	Song Thrush	1	
25/01/2024	2	Pied Wagtail	1	
07/05/2024	1	Hooded Crow	3	
07/05/2024	1	Pheasant	1	
07/05/2024	1	Blackbird	2	
07/05/2024	1	Chiffchaff	1	
07/05/2024	1	Jackdaw	5	
07/05/2024	1	Winter Wren	1	
07/05/2024	1	Robin	1	
07/05/2024	1	Dunnock	1	
07/05/2024	1	Wood Pigeon	2	
07/05/2024	1	Starling	2	
07/05/2024	1	Blackcap	1	
07/05/2024	1	Raven	1	
07/05/2024	1	Magpie	2	
07/05/2024	2	Raven	1	
07/05/2024	2	Robin	1	
07/05/2024	2	Winter Wren	1	
07/05/2024	2	Song Thrush	1	
07/05/2024	2	Magpie	1	
07/05/2024	2	Blackbird	1	
07/05/2024	2	Wood Pigeon	1	
07/05/2024	2	Mistle Thrush	1	

Table 10-6: Barn Owl results

Obs No.	Date	time	Notes
1	01/05/24	21:35	Barn Owl flew out of shed into upstairs window of house
2	01/05/24	22:07	Flew over van towards the house
3	01/05/24	22:09	Made sound

Table 10-7 Transects Results

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
1	09/01/2024	09:00	09:39	Blackbird	2		N/A	53.133704	-8.261852
1	09/01/2024	09:00	09:39	Buzzard	1	Flew into tree	N/A	53.13308	-8.264384
1	09/01/2024	09:00	09:39	Buzzard	2	In field, flew off on disturbance	N/A	53.135154	-8.261547
1	09/01/2024	09:00	09:39	Fieldfare	43		N/A	53.13407	-8.261916
1	09/01/2024	09:00	09:39	Fieldfare	2	Feeding	N/A	53.133809	-8.259621
1	09/01/2024	09:00	09:39	Hooded Crow	7		N/A	53.134938	-8.263042
1	09/01/2024	09:00	09:39	House Sparrow	1		N/A	53.134939	-8.260999
1	09/01/2024	09:00	09:39	Kestrel	1	Female	N/A	53.132256	-8.263715
1	09/01/2024	09:00	09:39	Magpie	3		N/A	53.134949	-8.262459
1	09/01/2024	09:00	09:39	Meadow Pipit	2	Flying over	N/A	53.134535	-8.263738
1	09/01/2024	09:00	09:39	Meadow Pipit	1	Flying	N/A	53.133992	-8.263179
1	09/01/2024	09:00	09:39	Pied Wagtail	3		N/A	53.135052	-8.260672
2	09/01/2024	09:50	10:49	Blackbird	2		N/A	53.133515	-8.26295
2	09/01/2024	09:50	10:49	Fieldfare	40		N/A	53.133139	-8.263339
2	09/01/2024	09:50	10:49	Meadow Pipit	4	Flying over	N/A	53.132842	-8.259256
2	09/01/2024	09:50	10:49	Pied Wagtail	2		N/A	53.133979	-8.260615
2	09/01/2024	09:50	10:49	Raven	5		N/A	53.133619	-8.262398
2	09/01/2024	09:50	10:49	Snipe	3	Flew up when disturbed by observer	N/A	53.133836	-8.260327
2	09/01/2024	09:50	10:49	Starling	7		N/A	53.132731	-8.264564
2	09/01/2024	09:50	10:49	Wood Pigeon	3		N/A	53.130959	-8.257427
3	09/01/2024	10:50	11:38	Blackbird	1		N/A	53.133438	-8.270364
3	09/01/2024	10:50	11:38	Chaffinch	1		N/A	53.13374	-8.271119
3	09/01/2024	10:50	11:38	Fieldfare	20	In hedge outside of site	N/A	53.134741	-8.274939
3	09/01/2024	10:50	11:38	Great Tit	1		N/A	53.133866	-8.271418
3	09/01/2024	10:50	11:38	Hooded Crow	2	Flying	N/A	53.133231	-8.270664
3	09/01/2024	10:50	11:38	Jackdaw	2		N/A	53.133089	-8.269615
3	09/01/2024	10:50	11:38	Jackdaw	5	Flying over	N/A	53.133563	-8.271419
3	09/01/2024	10:50	11:38	Magpie	1		N/A	53.127835	-8.264574
3	09/01/2024	10:50	11:38	Meadow Pipit	1	Flying over	N/A	53.132306	-8.268971
3	09/01/2024	10:50	11:38	Pheasant	1	Male	N/A	53.129188	-8.265381

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
3	09/01/2024	10:50	11:38	Robin	1		N/A	53.133529	-8.270575
3	09/01/2024	10:50	11:38	Robin	1		N/A	53.132465	-8.265291
3	09/01/2024	10:50	11:38	Sky Lark	27		N/A	53.128443	-8.265768
3	09/01/2024	10:50	11:38	Snipe	1	Flew out of drain	N/A	53.134207	-8.272444
3	09/01/2024	10:50	11:38	Starling	3		N/A	53.130068	-8.266285
3	09/01/2024	10:50	11:38	Winter Wren	1		N/A	53.133115	-8.269796
3	09/01/2024	10:50	11:38	Wood Pigeon	2		N/A	53.133429	-8.270087
1	26/02/2024	08:20	08:50	Blackbird	1		N/A	53.13516	-8.260294
1	26/02/2024	08:20	08:50	Buzzard	1	Being chased by hc	N/A	53.135804	-8.261621
1	26/02/2024	08:20	08:50	Chaffinch	1		N/A	53.135206	-8.260793
1	26/02/2024	08:20	08:50	Fieldfare	12		N/A	53.135002	-8.264009
1	26/02/2024	08:20	08:50	Fieldfare	5		N/A	53.134169	-8.260509
1	26/02/2024	08:20	08:50	Fieldfare	4		N/A	53.134548	-8.261236
1	26/02/2024	08:20	08:50	Great Tit	1		N/A	53.134948	-8.260101
1	26/02/2024	08:20	08:50	Hooded Crow	1		N/A	53.1356	-8.262003
1	26/02/2024	08:20	08:50	Jackdaw	3		N/A	53.135293	-8.262915
1	26/02/2024	08:20	08:50	Redwing	10		N/A	53.135292	-8.263793
1	26/02/2024	08:20	08:50	Redwing	20	Singing in trees	N/A	53.134442	-8.260307
1	26/02/2024	08:20	08:50	Redwing	5		N/A	53.135387	-8.261317
1	26/02/2024	08:20	08:50	Redwing	3		N/A	53.135019	-8.260361
1	26/02/2024	08:20	08:50	Winter Wren	1		N/A	53.135348	-8.260547
1	26/02/2024	08:20	08:50	Wood Pigeon	2	Flying over	N/A	53.135038	-8.260878
2	26/02/2024	08:52	09:30	Blackbird	1		N/A	53.130814	-8.25917
2	26/02/2024	08:52	09:30	Fieldfare	15	Flying over	N/A	53.130443	-8.258619
2	26/02/2024	08:52	09:30	Goldfinch	20		N/A	53.129988	-8.26176
2	26/02/2024	08:52	09:30	Great Tit	1		N/A	53.130354	-8.259433
2	26/02/2024	08:52	09:30	House Sparrow	3		N/A	53.13188	-8.260607
2	26/02/2024	08:52	09:30	Long-tailed Tit	2		N/A	53.129401	-8.261532
2	26/02/2024	08:52	09:30	Magpie	2		N/A	53.130137	-8.259151
2	26/02/2024	08:52	09:30	Redwing	6	Flying over	N/A	53.132084	-8.257602
2	26/02/2024	08:52	09:30	Robin	1		N/A	53.131081	-8.258587
2	26/02/2024	08:52	09:30	Winter Wren	1		N/A	53.132146	-8.259915
3	26/02/2024	09:37	11:20	Blackbird	3		N/A	53.129084	-8.265693

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
3	26/02/2024	09:37	11:20	Black-headed Gull	3	Flying over outside of site	N/A	53.128428	-8.26295
3	26/02/2024	09:37	11:20	Bullfinch	1		N/A	53.127452	-8.267278
3	26/02/2024	09:37	11:20	Chaffinch	30	Flock on ground	N/A	53.130034	-8.267445
3	26/02/2024	09:37	11:20	Chaffinch	24	Flock of male and female chaffinch	N/A	53.129732	-8.266732
3	26/02/2024	09:37	11:20	Chaffinch	1		N/A	53.128088	-8.266812
3	26/02/2024	09:37	11:20	Chaffinch	1		N/A	53.132215	-8.265601
3	26/02/2024	09:37	11:20	Goldfinch	3		N/A	53.132343	-8.2655
3	26/02/2024	09:37	11:20	Great Tit	1		N/A	53.128071	-8.26697
3	26/02/2024	09:37	11:20	Greenfinch	1	Flew over	N/A	53.127549	-8.265028
3	26/02/2024	09:37	11:20	Hooded Crow	3		N/A	53.127974	-8.267166
3	26/02/2024	09:37	11:20	House Sparrow	1		N/A	53.129592	-8.266696
3	26/02/2024	09:37	11:20	House Sparrow	20	Flying over	N/A	53.128532	-8.265541
3	26/02/2024	09:37	11:20	Meadow Pipit	2	Flew over	N/A	53.127926	-8.264374
3	26/02/2024	09:37	11:20	Robin	1		N/A	53.132067	-8.265612
3	26/02/2024	09:37	11:20	Siskin	2	In tree	N/A	53.12734	-8.26722
3	26/02/2024	09:37	11:20	Sky Lark	5		N/A	53.128848	-8.266184
3	26/02/2024	09:37	11:20	Starling	30	Flying	N/A	53.130308	-8.266691
3	26/02/2024	09:37	11:20	Winter Wren	1		N/A	53.128043	-8.265143
3	26/02/2024	09:37	11:20	Winter Wren	1		N/A	53.127586	-8.267262
3	26/02/2024	09:37	11:20	Winter Wren	1		N/A	53.128318	-8.26492
3	26/02/2024	09:37	11:20	Winter Wren	1		N/A	53.131908	-8.265482
3	26/02/2024	09:37	11:20	Wood Pigeon	2		N/A	53.129883	-8.265137
3	26/02/2024	09:37	11:20	Wood Pigeon	2		N/A	53.127857	-8.267153
3	26/02/2024	09:37	11:20	Wood Pigeon	2		N/A	53.131956	-8.265844
4	26/02/2024	11:22	12:00	Blackbird	1		N/A	53.131877	-8.26569
4	26/02/2024	11:22	12:00	Blue Tit	2		N/A	53.132098	-8.267632
4	26/02/2024	11:22	12:00	Dunnock	1		N/A	53.133636	-8.270797
4	26/02/2024	11:22	12:00	Fieldfare	7	Flew out of hedge	N/A	53.132245	-8.267842
4	26/02/2024	11:22	12:00	Goldfinch	1		N/A	53.131616	-8.266596
4	26/02/2024	11:22	12:00	Great Tit	1		N/A	53.133711	-8.272415
4	26/02/2024	11:22	12:00	Grey Heron	1	Flew over outside of site	N/A	53.136011	-8.258647

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
4	26/02/2024	11:22	12:00	Jackdaw	2		N/A	53.13289	-8.270259
4	26/02/2024	11:22	12:00	Jackdaw	9		N/A	53.134061	-8.27145
4	26/02/2024	11:22	12:00	Jackdaw	4		N/A	53.133495	-8.271414
4	26/02/2024	11:22	12:00	Jackdaw	2		N/A	53.133954	-8.272256
4	26/02/2024	11:22	12:00	Meadow Pipit	2		N/A	53.133973	-8.272046
4	26/02/2024	11:22	12:00	Meadow Pipit	2	Flying	N/A	53.133166	-8.270632
4	26/02/2024	11:22	12:00	Mistle Thrush	2		N/A	53.131713	-8.267098
4	26/02/2024	11:22	12:00	Redwing	3		N/A	53.133431	-8.271753
4	26/02/2024	11:22	12:00	Robin	1		N/A	53.133735	-8.27121
4	26/02/2024	11:22	12:00	Robin	1		N/A	53.131663	-8.266719
4	26/02/2024	11:22	12:00	Winter Wren	1		N/A	53.133861	-8.270664
4	26/02/2024	11:22	12:00	Wood Pigeon	2	Flying	N/A	53.133713	-8.271925
5	25/03/2024	09:50	12:50	Pheasant	1	-	N/A	53.132026	-8.265495
5	25/03/2024	09:50	12:50	Starling	4	Starling	N/A	53.130424	-8.264939
5	25/03/2024	09:50	12:50	Buzzard	1	Pretty sure its hidden in tree	N/A	53.12989	-8.265523
5	25/03/2024	09:50	12:50	Snipe	1	Flew out of Hedge	N/A	53.129429	-8.265339
5	25/03/2024	09:50	12:50	Winter Wren	2	-	N/A	53.128866	-8.265128
5	25/03/2024	09:50	12:50	Robin	1	-	N/A	53.127765	-8.263621
5	25/03/2024	09:50	12:50	Blackbird	1	-	N/A	53.127121	-8.265214
5	25/03/2024	09:50	12:50	Chaffinch	1	-	N/A	53.127067	-8.265508
5	25/03/2024	09:50	12:50	Pheasant	3	-	N/A	53.128609	-8.266243
5	25/03/2024	09:50	12:50	Linnet	15	-	N/A	53.129146	-8.266346
5	25/03/2024	09:50	12:50	Magpie	1	Nest in tree.	N/A	53.129681	-8.267907
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.130188	-8.265705
5	25/03/2024	09:50	12:50	Blue Tit	1	-	N/A	53.129798	-8.265447
5	25/03/2024	09:50	12:50	Chaffinch	3	-	N/A	53.129942	-8.265554
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.131711	-8.259222
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.129757	-8.258315
5	25/03/2024	09:50	12:50	Chaffinch	1	-	N/A	53.128573	-8.257726
5	25/03/2024	09:50	12:50	Wood Pigeon	1	-	N/A	53.128433	-8.259218
5	25/03/2024	09:50	12:50	Great Tit	1	-	N/A	53.128598	-8.259475
5	25/03/2024	09:50	12:50	Robin	1	-	N/A	53.129027	-8.259728
5	25/03/2024	09:50	12:50	Great Tit	2	-	N/A	53.128981	-8.260949

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.128907	-8.260639
5	25/03/2024	09:50	12:50	Snipe	1	-	N/A	53.130091	-8.260564
5	25/03/2024	09:50	12:50	Blue Tit	1	-	N/A	53.1301	-8.263348
5	25/03/2024	09:50	12:50	Snipe	3	Possibly still wintering	N/A	53.129914	-8.264026
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.130756	-8.265553
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.130717	-8.265104
5	25/03/2024	09:50	12:50	Blackbird	1	-	N/A	53.132099	-8.264558
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.130578	-8.263461
5	25/03/2024	09:50	12:50	Starling	3	Starling flew out of shed	N/A	53.130354	-8.264673
5	25/03/2024	09:50	12:50	Robin	1	-	N/A	53.132745	-8.264526
5	25/03/2024	09:50	12:50	Blackbird	1	-	N/A	53.13191	-8.265837
5	25/03/2024	09:50	12:50	Blackbird	2	-	N/A	53.131933	-8.265912
5	25/03/2024	09:50	12:50	Song Thrush	2	-	N/A	53.131764	-8.265669
5	25/03/2024	09:50	12:50	Magpie	1	Flying	N/A	53.130434	-8.265907
5	25/03/2024	09:50	12:50	Hooded Crow	2	Perched on ground	N/A	53.131283	-8.266866
5	25/03/2024	09:50	12:50	Raven	1	Sound of Raven in distance	N/A	53.135301	-8.267981
5	25/03/2024	09:50	12:50	Jackdaw	2	Feeding on ground	N/A	53.131644	-8.269993
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.132472	-8.270086
5	25/03/2024	09:50	12:50	Dunnock	1	-	N/A	53.134024	-8.272711
5	25/03/2024	09:50	12:50	Robin	1	-	N/A	53.133294	-8.269883
5	25/03/2024	09:50	12:50	Chiffchaff	1	-	N/A	53.133219	-8.269578
5	25/03/2024	09:50	12:50	Hooded Crow	1	-	N/A	53.134122	-8.272736
5	25/03/2024	09:50	12:50	Blackbird	1	-	N/A	53.133338	-8.267419
5	25/03/2024	09:50	12:50	Robin	1	-	N/A	53.133097	-8.26895
5	25/03/2024	09:50	12:50	Winter Wren	3	-	N/A	53.133315	-8.267789
5	25/03/2024	09:50	12:50	Blackbird	1	-	N/A	53.132538	-8.268302
5	25/03/2024	09:50	12:50	Wood Pigeon	2	-	N/A	53.133138	-8.268417
5	25/03/2024	09:50	12:50	Jackdaw	2	Flying over	N/A	53.132198	-8.26615
5	25/03/2024	09:50	12:50	Robin	1	-	N/A	53.132049	-8.265675
5	25/03/2024	09:50	12:50	Magpie	1	-	N/A	53.134551	-8.264928
5	25/03/2024	09:50	12:50	Robin	1	Patch of Scots pine	N/A	53.134595	-8.259797
5	25/03/2024	09:50	12:50	Blackbird	1		N/A	53.134914	-8.258801

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
5	25/03/2024	09:50	12:50	Wood Pigeon	2	Perched on young ash to small for roost	N/A	53.131821	-8.259242
5	25/03/2024	09:50	12:50	Blackbird	1	-	N/A	53.131432	-8.256208
5	25/03/2024	09:50	12:50	Winter Wren	1	-	N/A	53.13245	-8.256022
1	19/04/2024	11:33	12:30	Blackbird	2	P	PRB Pair	53.135433	-8.260466
1	19/04/2024	11:33	12:30	Blackbird	1		PSB Suitable Habitat	53.134631	-8.259896
1	19/04/2024	11:33	12:30	Barn Swallow	1	Flying over old farmstead	PSB Suitable Habitat	53.134254	-8.2662
1	19/04/2024	11:33	12:30	Blue Tit	1		PSB Suitable Habitat	53.135067	-8.260498
1	19/04/2024	11:33	12:30	Black-headed Gull	1	Flew over, high over site	Flying	53.127618	-8.26489
1	19/04/2024	11:33	12:30	Buzzard	3	3 buzzards soaring over farm, then moved off down the valley	Flying	53.129411	-8.265863
1	19/04/2024	11:33	12:30	Chaffinch	1		PSB Suitable Habitat	53.135034	-8.26066
1	19/04/2024	11:33	12:30	Chiffchaff	1		PSB Suitable Habitat	53.13376	-8.263557
1	19/04/2024	11:33	12:30	Kestrel	1	Seen hunting. Single male	PSB Suitable Habitat	53.130043	-8.264562
1	19/04/2024	11:33	12:30	Robin	1		PSB Suitable Habitat	53.135251	-8.262408
1	19/04/2024	11:33	12:30	Robin	1		PSB Suitable Habitat	53.134768	-8.260015
2	19/04/2024	10:28	10:54	Blackbird	1		PSB Suitable Habitat	53.131414	-8.258984
2	19/04/2024	10:28	10:54	Blackbird	1	Flying	PSB Suitable Habitat	53.132524	-8.257644
2	19/04/2024	10:28	10:54	Buzzard	1	Circling over trees	PSB Suitable Habitat	53.132851	-8.251786
2	19/04/2024	10:28	10:54	Hooded Crow	1	Feeding	PSB Suitable Habitat	53.132629	-8.256522
2	19/04/2024	10:28	10:54	Pheasant	1	Female	PSB Suitable Habitat	53.133655	-8.260994
2	19/04/2024	10:28	10:54	White-tailed Eagle	1	Juvenile, flying over the neighbouring farm	Flying	53.12838	-8.255696
2	19/04/2024	10:28	10:54	Wood Pigeon	1	P	PRB Pair	53.131961	-8.258336
3	19/04/2024	09:03	10:20	Blackbird	1	Flying	Flying	53.129716	-8.2599
3	19/04/2024	09:03	10:20	Blackbird	2	P	PRB Pair	53.128774	-8.259566
3	19/04/2024	09:03	10:20	Blackbird	2	P	PRB Pair	53.129391	-8.265243
3	19/04/2024	09:03	10:20	Blackbird	2	P	PRB Pair	53.12767	-8.264038
3	19/04/2024	09:03	10:20	Blackbird	1		PSB Suitable Habitat	53.1306	-8.259275
3	19/04/2024	09:03	10:20	Blackbird	1		PSB Suitable Habitat	53.129874	-8.264919
3	19/04/2024	09:03	10:20	Blackbird	1		PSB Suitable Habitat	53.127548	-8.266119
3	19/04/2024	09:03	10:20	Barn Swallow	6	Nest building in sheds	Breeding Occupied nest	53.130321	-8.264961

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
3	19/04/2024	09:03	10:20	Barn Swallow	1	Flying	PSB Suitable Habitat	53.130811	-8.263639
3	19/04/2024	09:03	10:20	Blue Tit	1	Alert	PRB Agitated behaviour	53.130444	-8.263524
3	19/04/2024	09:03	10:20	Bullfinch	1		PSB Suitable Habitat	53.129944	-8.261898
3	19/04/2024	09:03	10:20	Chaffinch	1	Alert	PRB Agitated behaviour	53.130873	-8.263186
3	19/04/2024	09:03	10:20	Chaffinch	1	Alert	PRB Agitated behaviour	53.129874	-8.262904
3	19/04/2024	09:03	10:20	Chaffinch	2	Courtship	PRB Display	53.12995	-8.262868
3	19/04/2024	09:03	10:20	Chaffinch	2	P	PRB Pair	53.130909	-8.258805
3	19/04/2024	09:03	10:20	Chaffinch	2	P	PRB Pair	53.130163	-8.263356
3	19/04/2024	09:03	10:20	Chaffinch	2	P	PRB Pair	53.129746	-8.265506
3	19/04/2024	09:03	10:20	Chaffinch	2	P	PRB Pair	53.129234	-8.265228
3	19/04/2024	09:03	10:20	Dunnock	1		PSB Suitable Habitat	53.129085	-8.260961
3	19/04/2024	09:03	10:20	Dunnock	1		PSB Suitable Habitat	53.128736	-8.265098
3	19/04/2024	09:03	10:20	Goldfinch	1	Flying	Flying	53.127276	-8.26752
3	19/04/2024	09:03	10:20	Goldfinch	1	Flying over	Flying	53.129824	-8.266335
3	19/04/2024	09:03	10:20	Goldfinch	2	P	PRB Pair	53.129055	-8.260085
3	19/04/2024	09:03	10:20	Goldfinch	1		PSB Suitable Habitat	53.130735	-8.264357
3	19/04/2024	09:03	10:20	Great Tit	1	Singing male	PSB Suitable Habitat	53.130624	-8.264573
3	19/04/2024	09:03	10:20	Jackdaw	1	Flying	Flying	53.130087	-8.264084
3	19/04/2024	09:03	10:20	Jackdaw	1	Flying	Flying	53.130939	-8.266921
3	19/04/2024	09:03	10:20	Linnet	1	Bringing food to nest	Breeding Food fecal sac	53.128535	-8.265069
3	19/04/2024	09:03	10:20	Linnet	2	P	PRB Pair	53.127305	-8.266796
3	19/04/2024	09:03	10:20	Magpie	1	On field	PSB Suitable Habitat	53.130159	-8.266799
3	19/04/2024	09:03	10:20	Mallard	1	Flying	Flying	53.127323	-8.265297
3	19/04/2024	09:03	10:20	Mistle Thrush	1		PSB Suitable Habitat	53.129916	-8.263171
3	19/04/2024	09:03	10:20	Pheasant	1	Male sitting in field	PSB Suitable Habitat	53.129725	-8.261763
3	19/04/2024	09:03	10:20	Pheasant	1	Male	PSB Suitable Habitat	53.127322	-8.267245
3	19/04/2024	09:03	10:20	Redwing	1		PSB Suitable Habitat	53.131083	-8.26034
3	19/04/2024	09:03	10:20	Robin	1		PSB Suitable Habitat	53.131412	-8.264945
3	19/04/2024	09:03	10:20	Robin	1		PSB Suitable Habitat	53.131932	-8.26025
3	19/04/2024	09:03	10:20	Robin	1		PSB Suitable Habitat	53.130712	-8.267078
3	19/04/2024	09:03	10:20	Rook	2	P	PRB Pair	53.127484	-8.267373
3	19/04/2024	09:03	10:20	Snipe	1	Flew up from wet area in field	Migration	53.131591	-8.259419

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
3	19/04/2024	09:03	10:20	Snipe	1	Flew up out of field when spproached	Migration	53.130066	-8.263077
3	19/04/2024	09:03	10:20	Starling	1	Flying	Flying	53.130571	-8.261333
3	19/04/2024	09:03	10:20	Starling	1		PSB Suitable Habitat	53.130699	-8.265251
3	19/04/2024	09:03	10:20	Willow Warbler	1	Singing	PSB Singing male	53.130095	-8.260735
3	19/04/2024	09:03	10:20	Willow Warbler	1	Singing	PSB Singing male	53.128862	-8.265092
3	19/04/2024	09:03	10:20	Winter Wren	1	Alert	PRB Agitated behaviour	53.129358	-8.26128
3	19/04/2024	09:03	10:20	Winter Wren	1	Alert	PRB Agitated behaviour	53.127371	-8.265803
3	19/04/2024	09:03	10:20	Winter Wren	1	Alert	PRB Agitated behaviour	53.130604	-8.267298
3	19/04/2024	09:03	10:20	Winter Wren	1	Singing	PSB Singing male	53.12986	-8.264276
3	19/04/2024	09:03	10:20	Winter Wren	1		PSB Suitable Habitat	53.129073	-8.265093
3	19/04/2024	09:03	10:20	Winter Wren	1		PSB Suitable Habitat	53.127136	-8.26736
3	19/04/2024	09:03	10:20	Winter Wren	1		PSB Suitable Habitat	53.129601	-8.266663
3	19/04/2024	09:03	10:20	Wood Pigeon	1	Flying	Flying	53.130689	-8.262049
3	19/04/2024	09:03	10:20	Wood Pigeon	1	Flying	Flying	53.12949	-8.259097
3	19/04/2024	09:03	10:20	Wood Pigeon	1		PSB Suitable Habitat	53.128757	-8.267681
3	19/04/2024	09:03	10:20	Wood Pigeon	1		PSB Suitable Habitat	53.127466	-8.266659
4	19/04/2024	08:30	09:03	Blackbird	1	Alert sound	PRB Agitated behaviour	53.133232	-8.269865
4	19/04/2024	08:30	09:03	Blackbird	2	P	PRB Pair	53.131719	-8.267174
4	19/04/2024	08:30	09:03	Blackbird	2	P	PRB Pair	53.131921	-8.265926
4	19/04/2024	08:30	09:03	Blackbird	1		PSB Suitable Habitat	53.131967	-8.269557
4	19/04/2024	08:30	09:03	Blackbird	1		PSB Suitable Habitat	53.130838	-8.267392
4	19/04/2024	08:30	09:03	Blue Tit	1		PSB Suitable Habitat	53.131833	-8.267252
4	19/04/2024	08:30	09:03	Chaffinch	1		PSB Suitable Habitat	53.131933	-8.267376
4	19/04/2024	08:30	09:03	Chiffchaff	1		PSB Suitable Habitat	53.133272	-8.269166
4	19/04/2024	08:30	09:03	Chiffchaff	1		PSB Suitable Habitat	53.132248	-8.26775
4	19/04/2024	08:30	09:03	House Sparrow	1	Flying	Flying	53.132077	-8.267412
4	19/04/2024	08:30	09:03	House Sparrow	2	P	PRB Pair	53.13253	-8.268557
4	19/04/2024	08:30	09:03	House Sparrow	1		PSB Suitable Habitat	53.132949	-8.269381
4	19/04/2024	08:30	09:03	Magpie	1	Flying	Flying	53.131141	-8.268869
4	19/04/2024	08:30	09:03	Magpie	1	Flying	Flying	53.132782	-8.269041
4	19/04/2024	08:30	09:03	Magpie	1	Flying	Flying	53.130978	-8.268783
4	19/04/2024	08:30	09:03	Meadow Pipit	1	Flying	Flying	53.130939	-8.267286

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
4	19/04/2024	08:30	09:03	Rook	1		PSB Suitable Habitat	53.13294	-8.269374
4	19/04/2024	08:30	09:03	Song Thrush	1		PSB Suitable Habitat	53.132824	-8.26914
4	19/04/2024	08:30	09:03	Song Thrush	1		PSB Suitable Habitat	53.131751	-8.266288
4	19/04/2024	08:30	09:03	Willow Warbler	1		PSB Suitable Habitat	53.13397	-8.271895
4	19/04/2024	08:30	09:03	Winter Wren	1	Pair	PRB Pair	53.133575	-8.270481
4	19/04/2024	08:30	09:03	Winter Wren	1		PSB Suitable Habitat	53.132197	-8.269891
4	19/04/2024	08:30	09:03	Wood Pigeon	1	Flying	Flying	53.130862	-8.268046
4	19/04/2024	08:30	09:03	Wood Pigeon	1	Flying	Flying	53.133902	-8.272496
4	19/04/2024	08:30	09:03	Wood Pigeon	1	Flying	Flying	53.13096	-8.26812
1	10/05/2024	08:45	11:15	Blackbird	2		PRB Pair	53.133232	-8.264497
1	10/05/2024	08:45	11:15	Blackbird	2		PRB Pair	53.135343	-8.261637
1	10/05/2024	08:45	11:15	Blackbird	2		PSB Suitable Habitat	53.133757	-8.260835
1	10/05/2024	08:45	11:15	Barn Swallow	1		PSB Suitable Habitat	53.13498	-8.263255
1	10/05/2024	08:45	11:15	Chaffinch	1		Breeding Food fecal sac	53.132461	-8.26534
1	10/05/2024	08:45	11:15	Chiffchaff	1		PSB Suitable Habitat	53.134462	-8.259699
1	10/05/2024	08:45	11:15	House Sparrow	1		PSB Suitable Habitat	53.135054	-8.260346
1	10/05/2024	08:45	11:15	House Sparrow	4		PSB Suitable Habitat	53.13437	-8.260775
1	10/05/2024	08:45	11:15	Robin	1		PSB Suitable Habitat	53.133423	-8.264193
1	10/05/2024	08:45	11:15	Robin	1		PSB Suitable Habitat	53.135336	-8.262504
1	10/05/2024	08:45	11:15	Song Thrush	2		PRB Display	53.134796	-8.259939
1	10/05/2024	08:45	11:15	Winter Wren	1		PSB Singing male	53.13542	-8.260598
1	10/05/2024	08:45	11:15	Winter Wren	1		PSB Suitable Habitat	53.133022	-8.264577
2	10/05/2024	05:15	06:30	Blackbird	3		PRB Pair	53.133885	-8.260863
2	10/05/2024	05:15	06:30	Blackbird	2		PRB Pair	53.132095	-8.258943
2	10/05/2024	05:15	06:30	Blackbird	2		PRB Pair	53.132831	-8.258306
2	10/05/2024	05:15	06:30	Blackbird	3		PRB Pair	53.132501	-8.257669
2	10/05/2024	05:15	06:30	Chaffinch	1		PRB Agitated behaviour	53.13284	-8.257264
2	10/05/2024	05:15	06:30	Chiffchaff	1		PSB Suitable Habitat	53.133253	-8.25606
2	10/05/2024	05:15	06:30	House Sparrow	3		PRB Pair	53.132949	-8.259396
2	10/05/2024	05:15	06:30	Rook	2		PSB Suitable Habitat	53.132025	-8.257036
2	10/05/2024	05:15	06:30	Song Thrush	1		Breeding Food fecal sac	53.132713	-8.255867
2	10/05/2024	05:15	06:30	Song Thrush	2		PRB Pair	53.132131	-8.255683
2	10/05/2024	05:15	06:30	Whimbrel	10		Flying	53.12975	-8.255843

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
2	10/05/2024	05:15	06:30	Willow Warbler	1		PSB Suitable Habitat	53.132331	-8.259331
2	10/05/2024	05:15	06:30	Winter Wren	1		PRB Agitated behaviour	53.133482	-8.256408
2	10/05/2024	05:15	06:30	Winter Wren	1		PSB Suitable Habitat	53.132504	-8.258998
2	10/05/2024	05:15	06:30	Winter Wren	1		PSB Suitable Habitat	53.131794	-8.259198
2	10/05/2024	05:15	06:30	Wood Pigeon	4		PSB Suitable Habitat	53.132658	-8.255473
3	10/05/2024	06:40	07:50	Blackbird	1		PRB Agitated behaviour	53.129292	-8.258059
3	10/05/2024	06:40	07:50	Blackbird	2		PRB Pair	53.130002	-8.262568
3	10/05/2024	06:40	07:50	Blackbird	3		PSB Suitable Habitat	53.130645	-8.263443
3	10/05/2024	06:40	07:50	Blackbird	2		PSB Suitable Habitat	53.130894	-8.260612
3	10/05/2024	06:40	07:50	Blackbird	1		PSB Suitable Habitat	53.130133	-8.259652
3	10/05/2024	06:40	07:50	Blackbird	1		PSB Suitable Habitat	53.128468	-8.258812
3	10/05/2024	06:40	07:50	Barn Swallow	10		Breeding Occupied nest	53.130245	-8.265458
3	10/05/2024	06:40	07:50	Barn Swallow	1		PSB Suitable Habitat	53.129163	-8.258946
3	10/05/2024	06:40	07:50	Barn Swallow	3		PSB Suitable Habitat	53.132429	-8.261284
3	10/05/2024	06:40	07:50	Black-headed Gull	6		Flying	53.129634	-8.25983
3	10/05/2024	06:40	07:50	Chaffinch	2		PRB Pair	53.132271	-8.263768
3	10/05/2024	06:40	07:50	Chaffinch	2		PRB Pair	53.130243	-8.263494
3	10/05/2024	06:40	07:50	Chaffinch	2		PRB Pair	53.129982	-8.263144
3	10/05/2024	06:40	07:50	Dunnock	1		PSB Suitable Habitat	53.129962	-8.259301
3	10/05/2024	06:40	07:50	Greenfinch	1		PSB Suitable Habitat	53.130826	-8.265903
3	10/05/2024	06:40	07:50	Hooded Crow	2		PSB Suitable Habitat	53.131516	-8.261547
3	10/05/2024	06:40	07:50	House Martin	3		PSB Suitable Habitat	53.130062	-8.264746
3	10/05/2024	06:40	07:50	House Sparrow	2		PSB Suitable Habitat	53.13009	-8.263208
3	10/05/2024	06:40	07:50	House Sparrow	2		PSB Suitable Habitat	53.129244	-8.259865
3	10/05/2024	06:40	07:50	House Sparrow	3		PSB Suitable Habitat	53.130351	-8.258649
3	10/05/2024	06:40	07:50	Jackdaw	1		Breeding Occupied nest	53.130268	-8.265276
3	10/05/2024	06:40	07:50	Linnet	2		PRB Display	53.130081	-8.259435
3	10/05/2024	06:40	07:50	Linnet	2		PRB Pair	53.130111	-8.263865
3	10/05/2024	06:40	07:50	Linnet	2		PRB Pair	53.130042	-8.260947
3	10/05/2024	06:40	07:50	Linnet	1		PSB Suitable Habitat	53.132044	-8.264886
3	10/05/2024	06:40	07:50	Magpie	1		PSB Suitable Habitat	53.131707	-8.263844
3	10/05/2024	06:40	07:50	Magpie	1		PSB Suitable Habitat	53.132805	-8.261168

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
3	10/05/2024	06:40	07:50	Meadow Pipit	1		PSB Suitable Habitat	53.129738	-8.258321
3	10/05/2024	06:40	07:50	Pheasant	1		PSB Suitable Habitat	53.131485	-8.262668
3	10/05/2024	06:40	07:50	Robin	1		PSB Suitable Habitat	53.131556	-8.263346
3	10/05/2024	06:40	07:50	Robin	1		PSB Suitable Habitat	53.129999	-8.258902
3	10/05/2024	06:40	07:50	Rook	2		PSB Suitable Habitat	53.130733	-8.26215
3	10/05/2024	06:40	07:50	Starling	6		Breeding Occupied nest	53.130379	-8.265047
3	10/05/2024	06:40	07:50	Willow Warbler	1		PSB Suitable Habitat	53.130139	-8.260528
3	10/05/2024	06:40	07:50	Winter Wren	1		PRB Agitated behaviour	53.131439	-8.263195
3	10/05/2024	06:40	07:50	Winter Wren	1		PSB Suitable Habitat	53.132015	-8.263329
3	10/05/2024	06:40	07:50	Winter Wren	1		PSB Suitable Habitat	53.130466	-8.263372
3	10/05/2024	06:40	07:50	Winter Wren	1		PSB Suitable Habitat	53.130162	-8.260389
3	10/05/2024	06:40	07:50	Wood Pigeon	2		PRB Pair	53.129722	-8.258329
3	10/05/2024	06:40	07:50	Wood Pigeon	3		PSB Suitable Habitat	53.128877	-8.259447
4	10/05/2024	07:55	08:40	Blackbird	1		PSB Suitable Habitat	53.132249	-8.26555
4	10/05/2024	07:55	08:40	Blackbird	1		PSB Suitable Habitat	53.133153	-8.269966
4	10/05/2024	07:55	08:40	Blackbird	1		PSB Suitable Habitat	53.133852	-8.271864
4	10/05/2024	07:55	08:40	Blackbird	1		PSB Suitable Habitat	53.13081	-8.266382
4	10/05/2024	07:55	08:40	Blackbird	1		PSB Suitable Habitat	53.130918	-8.266966
4	10/05/2024	07:55	08:40	Barn Swallow	1		PSB Suitable Habitat	53.133851	-8.273001
4	10/05/2024	07:55	08:40	Barn Swallow	2		PSB Suitable Habitat	53.133577	-8.271025
4	10/05/2024	07:55	08:40	Barn Swallow	3		PSB Suitable Habitat	53.129122	-8.265926
4	10/05/2024	07:55	08:40	Blue Tit	1		PSB Suitable Habitat	53.130744	-8.266151
4	10/05/2024	07:55	08:40	Chaffinch	1		PSB Singing male	53.131624	-8.266884
4	10/05/2024	07:55	08:40	Chiffchaff	1		PSB Suitable Habitat	53.132878	-8.267925
4	10/05/2024	07:55	08:40	Goldcrest	1		PSB Suitable Habitat	53.132101	-8.265465
4	10/05/2024	07:55	08:40	Goldcrest	1		PSB Suitable Habitat	53.131221	-8.267912
4	10/05/2024	07:55	08:40	House Martin	1		PSB Suitable Habitat	53.131475	-8.266424
4	10/05/2024	07:55	08:40	House Martin	2		PSB Suitable Habitat	53.128479	-8.26568
4	10/05/2024	07:55	08:40	House Sparrow	1		PSB Suitable Habitat	53.132878	-8.267925
4	10/05/2024	07:55	08:40	House Sparrow	1		PSB Suitable Habitat	53.131088	-8.266626
4	10/05/2024	07:55	08:40	Jackdaw	2		PRB Pair	53.129108	-8.265216
4	10/05/2024	07:55	08:40	Jackdaw	2		PSB Suitable Habitat	53.133877	-8.272056
4	10/05/2024	07:55	08:40	Jackdaw	2		PSB Suitable Habitat	53.13132	-8.267136

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
4	10/05/2024	07:55	08:40	Jackdaw	3		PSB Suitable Habitat	53.133591	-8.271565
4	10/05/2024	07:55	08:40	Jackdaw	1		PSB Suitable Habitat	53.132604	-8.267438
4	10/05/2024	07:55	08:40	Jackdaw	3		PSB Suitable Habitat	53.133863	-8.272293
4	10/05/2024	07:55	08:40	Jackdaw	5		PSB Suitable Habitat	53.133687	-8.272102
4	10/05/2024	07:55	08:40	Jackdaw	5		PSB Suitable Habitat	53.128747	-8.265882
4	10/05/2024	07:55	08:40	Raven	1		PSB Suitable Habitat	53.133294	-8.269576
4	10/05/2024	07:55	08:40	Robin	1		PSB Suitable Habitat	53.132341	-8.265482
4	10/05/2024	07:55	08:40	Starling	2		PRB Pair	53.129638	-8.26624
4	10/05/2024	07:55	08:40	Starling	3		PSB Suitable Habitat	53.129901	-8.265498
4	10/05/2024	07:55	08:40	Willow Warbler	1		PSB Suitable Habitat	53.133427	-8.271823
4	10/05/2024	07:55	08:40	Winter Wren	1		PSB Singing male	53.131123	-8.26752
4	10/05/2024	07:55	08:40	Winter Wren	1		PSB Suitable Habitat	53.132134	-8.265566
4	10/05/2024	07:55	08:40	Winter Wren	1		PSB Suitable Habitat	53.132841	-8.269403
4	10/05/2024	07:55	08:40	Winter Wren	1		PSB Suitable Habitat	53.13095	-8.266606
4	10/05/2024	07:55	08:40	Wood Pigeon	2		PRB Pair	53.130053	-8.26658
4	10/05/2024	07:55	08:40	Wood Pigeon	1		PSB Suitable Habitat	53.133231	-8.271252
4	10/05/2024	07:55	08:40	Wood Pigeon	1		PSB Suitable Habitat	53.133747	-8.270621
6	23/05/2024	06:00	11:00	Blackbird	4	On tilled field	PSB Suitable Habitat	53.130025	-8.267583
6	23/05/2024	06:00	11:00	Blackbird	2	-	PRB Pair	53.130821	-8.269094
6	23/05/2024	06:00	11:00	Blackbird	1	-	PSB Suitable Habitat	53.131828	-8.270592
6	23/05/2024	06:00	11:00	Blackbird	1	-	Flying	53.132485	-8.249137
6	23/05/2024	06:00	11:00	Blackbird	1	-	PSB Suitable Habitat	53.132693	-8.250814
6	23/05/2024	06:00	11:00	Blackbird	1	-	PSB Suitable Habitat	53.132706	-8.266133
6	23/05/2024	06:00	11:00	Blackbird	1	-	PSB Suitable Habitat	53.13275	-8.249957
6	23/05/2024	06:00	11:00	Blackbird	1	-	PSB Suitable Habitat	53.132833	-8.25169
6	23/05/2024	06:00	11:00	Blackbird	1	-	PSB Suitable Habitat	53.132881	-8.251411
6	23/05/2024	06:00	11:00	Barn Swallow	2		Flying	53.130345	-8.269727
6	23/05/2024	06:00	11:00	Barn Swallow	2		Flying	53.130709	-8.269554
6	23/05/2024	06:00	11:00	Barn Swallow	2		Flying	53.13227	-8.250788
6	23/05/2024	06:00	11:00	Barn Swallow	1		Flying	53.132933	-8.267078
6	23/05/2024	06:00	11:00	Barn Swallow	2	-	Flying	53.133043	-8.267804
6	23/05/2024	06:00	11:00	Barn Swallow	2	-	Flying	53.133194	-8.267372

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
6	23/05/2024	06:00	11:00	Buzzard	1	Flying over site for 30 secs, then flew off	Flying	53.13111	-8.268111
6	23/05/2024	06:00	11:00	Chaffinch	1	-	PSB Suitable Habitat	53.132003	-8.251282
6	23/05/2024	06:00	11:00	Chaffinch	1	On fence	PSB Suitable Habitat	53.133097	-8.266863
6	23/05/2024	06:00	11:00	Chiffchaff	1	-	PSB Suitable Habitat	53.132752	-8.251102
6	23/05/2024	06:00	11:00	Chiffchaff	1	-	PSB Suitable Habitat	53.13277	-8.250094
6	23/05/2024	06:00	11:00	Goldcrest	1		PSB Suitable Habitat	53.131912	-8.25143
6	23/05/2024	06:00	11:00	Goldcrest	1		PRB Agitated behaviour	53.132092	-8.250475
6	23/05/2024	06:00	11:00	Goldcrest	1		PSB Suitable Habitat	53.132862	-8.26637
6	23/05/2024	06:00	11:00	Jackdaw	3	-	Flying	53.130346	-8.268938
6	23/05/2024	06:00	11:00	Jackdaw	5	-	Flying	53.130542	-8.267636
6	23/05/2024	06:00	11:00	Jackdaw	1	-	Flying	53.131888	-8.251227
6	23/05/2024	06:00	11:00	Jackdaw	2	-	Flying	53.13219	-8.270315
6	23/05/2024	06:00	11:00	Jackdaw	2	-	Flying	53.132624	-8.250137
6	23/05/2024	06:00	11:00	Long-tailed Tit	2	-	PRB Pair	53.132473	-8.251272
6	23/05/2024	06:00	11:00	Long-tailed Tit	4	At least 4 pairs of long-tailed tits in scrub and sally patch	PRB Pair	53.132506	-8.251081
6	23/05/2024	06:00	11:00	Long-tailed Tit	2	-	PRB Pair	53.132587	-8.251141
6	23/05/2024	06:00	11:00	Long-tailed Tit	2	-	PRB Pair	53.132591	-8.251239
6	23/05/2024	06:00	11:00	Long-tailed Tit	1	Long tailed tit	Flying	53.132703	-8.250634
6	23/05/2024	06:00	11:00	Magpie	1	Perched in tree	PSB Suitable Habitat	53.13028	-8.267604
6	23/05/2024	06:00	11:00	Meadow Pipit	2	Flying over	Flying	53.132033	-8.270058
6	23/05/2024	06:00	11:00	Meadow Pipit	6	Flew out of long grass, then hoovering, flying in area	PRB Agitated behaviour	53.133119	-8.25897
6	23/05/2024	06:00	11:00	Reed Bunting	1	Reed bunting	PSB Suitable Habitat	53.131125	-8.270196
6	23/05/2024	06:00	11:00	Reed Bunting	1	Reed bunting in rushes	PSB Suitable Habitat	53.131308	-8.269873
6	23/05/2024	06:00	11:00	Robin	1	-	PSB Suitable Habitat	53.132748	-8.252016
6	23/05/2024	06:00	11:00	Rook	1	Rook	Flying	53.131974	-8.266072
6	23/05/2024	06:00	11:00	Starling	8	Flock starling flew over into hedge	Flying	53.130011	-8.268083
6	23/05/2024	06:00	11:00	Starling	3	-	Flying	53.133261	-8.266838
6	23/05/2024	06:00	11:00	Willow Warbler	1	-	PSB Suitable Habitat	53.13175	-8.255505
6	23/05/2024	06:00	11:00	Willow Warbler	1	-	PSB Suitable Habitat	53.131922	-8.250868

T. no.	Date	Start time	Finish	Species	No's.	Observations	Breeding Code if applicable	Lat	Lon
6	23/05/2024	06:00	11:00	Willow Warbler	1	-	PSB Suitable Habitat	53.132749	-8.251262
6	23/05/2024	06:00	11:00	Winter Wren	1	-	PSB Suitable Habitat	53.131594	-8.270445
6	23/05/2024	06:00	11:00	Winter Wren	1	-	PSB Suitable Habitat	53.132061	-8.250672
6	23/05/2024	06:00	11:00	Winter Wren	1	-	PSB Suitable Habitat	53.132163	-8.250216
6	23/05/2024	06:00	11:00	Winter Wren	1	-	PSB Suitable Habitat	53.132733	-8.250389
6	23/05/2024	06:00	11:00	Winter Wren	1	-	PSB Suitable Habitat	53.132794	-8.250997
6	23/05/2024	06:00	11:00	Winter Wren	2	-	PRB Agitated behaviour	53.132869	-8.251147
6	23/05/2024	06:00	11:00	Winter Wren	1	-	PSB Suitable Habitat	53.133068	-8.266497
6	23/05/2024	06:00	11:00	Wood Pigeon	3	-	Flying	53.132275	-8.251102
6	23/05/2024	06:00	11:00	Wood Pigeon	1	-	Breeding Food fecal sac	53.132631	-8.249681
6	23/05/2024	06:00	11:00	Wood Pigeon	1	-	Flying	53.132671	-8.249946
6	23/05/2024	06:00	11:00	Wood Pigeon	1	Flew out of trees	Flying	53.133121	-8.268026

Table 10-8 Transect description

Transect No	Description of habitats along transect
1	Northeast of site- improved grassland with hedgerows and treelines
2	Southeast of site - improved grassland with hedgerows and treelines
3	Northwest of site - improved grassland with hedgerows and treelines
4	Southwest of site - improved grassland with hedgerows and treelines. One field of tillage and one small field planted with native tree saplings
5	Transect conducted throughout the site
6	Transect to West and East

Table 10-9 Hinterland Results

Date	Species	Numbers	Observations	lat	long
09/01/2024	Northern Lapwing	30	in field	53.10765627	-8.234963045
09/01/2024	Black-headed Gull	2	feeding on fresh slurry field	53.15430925	-8.26568272
09/01/2024	Fieldfare	20	-	53.14446983	-8.28693157
09/01/2024	Buzzard	1	perched on post	53.14198317	-8.254580386
26/02/2024	Teal	2	in ponding on field	53.12603339	-8.26381322
26/02/2024	Mallard	10	in ponding on field	53.12373882	-8.255959377
26/02/2024	Teal	20	in ponding on field	53.12376075	-8.256023079
25/03/2024	N/A	-	Private property. as close as I can get to SPA	53.1245033	-8.18390342
25/03/2024	N/A	-	closest I can get to spa. flock of rook	53.13169858	-8.194012083
25/03/2024	N/A	-	nothing of note	53.12376296	-8.256035484
25/03/2024	N/A	-	nothing of note	53.12603601	-8.264008686
25/03/2024	Buzzard	1	-	53.1002369	-8.18808869
25/03/2024	Water Rail	1	-	53.09833663	-8.184592836
19/04/2024	Kestrel	1	Male, hunting over field	53.13920837	-8.272607848

APPENDIX 8.1

STAGE 3 FLOOD RISK ASSESSMENT REPORT

Stage 3 Flood Risk Assessment

LOCATION:	Coolpowra, Ballyneheskerah, Coolnagrenagh and Gortlusky, Co. Galway
PREPARED FOR:	Halston
PREPARED BY:	Cian O'Sullivan (MSc) and Regan Phipps (PgCert)
REVIEWD BY:	Colin O'Reilly PhD (Hydrology)
DATE:	30th April 2024
REFERENCE:	3064

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1 INTRODUCTION

The following flood risk assessment has been prepared by Cian O'Sullivan (MSc) and Regan Phipps (PGCert) and been reviewed by Colin O'Reilly (PhD) of Envirologic Ltd. on behalf of Halston.

This report is intended to satisfy the requirements of Galway County Council, relating to a proposed development in the townlands of Coolpowra, Ballynaheskeragh, Coolnageeragh and Gortlusky, Co. Galway. The proposed development is being referred to as 'Project Coolpowra' and will consist of a Reserve Gas-Fired Power Generator, GIS Substation and Energy Storage System.

As per the Flood Risk Management Guidelines (2009), where flood risk may be an issue for any proposed development, a flood risk assessment (FRA) should be carried out that is appropriate to the scale and nature of the development and the risks arising. The flood risk assessment outlined herein is intended to be sufficiently detailed to quantify the risks and effects of any flooding, necessary mitigation measures, together with recommendations on how to best manage any residual risks. As per the document 'The Planning System and Flood Risk Management (2009)' the flood risk assessment will consist of the following sections:

- Site description
- Site layout
- S-P-R model; sequential approach; justification test
- Determination of flood level
- Mitigation measures
- Conclusions

A site walkover and surveys of local hydrology was performed by Envirologic on 1st and 2nd May 2024 and 21st May 2024.

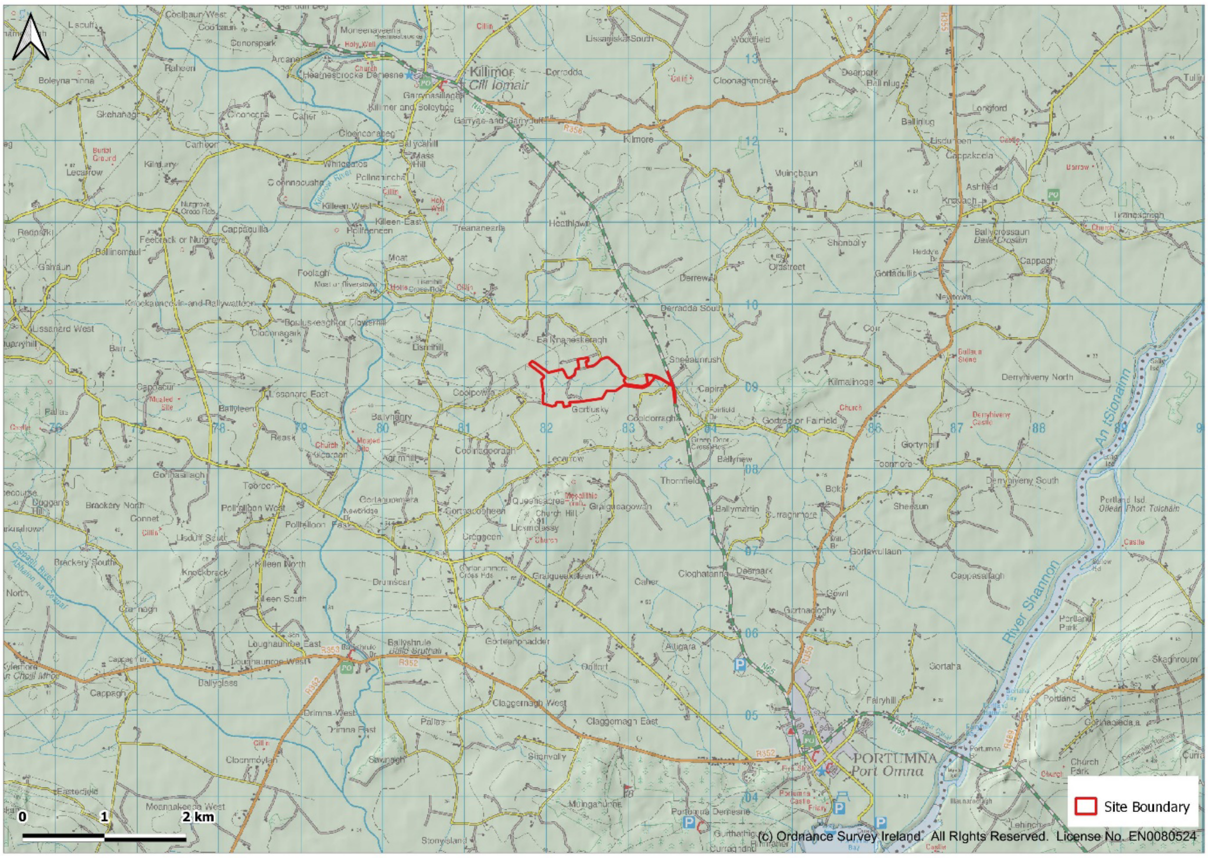
2 SITE DESCRIPTION

2.1 SITE LOCATION

The subject site is located in the townlands of Coolpowra, Ballynaheskeragh, Coolnageeragh and Gortlusky, Co. Galway, approximately 5 km northwest of Portumna town (Figure 1). The main portion of the site is positioned 500 m west of the N65, with an internal site access road providing connection between the two.

The regional topography is considered flat to gently undulating. The 1:50,000 OS Discovery map shows that the nearest topographical feature of note in the locality is a small hummock at Churchill (91 mOD), 2 km to the south. The surrounding landscape is dominated by moderate intensity grassland agriculture.

Figure 1 - Site Location and Topography



2.2 SITE LAYOUT

The proposed development site has an area of 42 ha. The site can be described as having an irregular shape comprised of (i) a central area which has an east-west length of 995 m and north-south width of 415 m. This area is bounded to the east by a local road, (ii) an internal access road which connects the eastern end of this central area with the N65, and (iii) a 230 m northwestern spur. An existing 400kv GIS substation is located adjacent to the northeast boundary of the site. There is one detached house standing within the site boundary, with farmyard infrastructure present (Figure 2). It is intended to demolish existing infrastructure on the site and construct the following:

- A Reserve Gas-Fired Generator comprised of three OCGT Units;
- Upgrade and replacement of the existing 400kV AIS substation with a 400kV GIS substation;
- Alternative Technology infrastructure such as Long Duration Energy Storage (LDES) and a Synchronous Condenser.

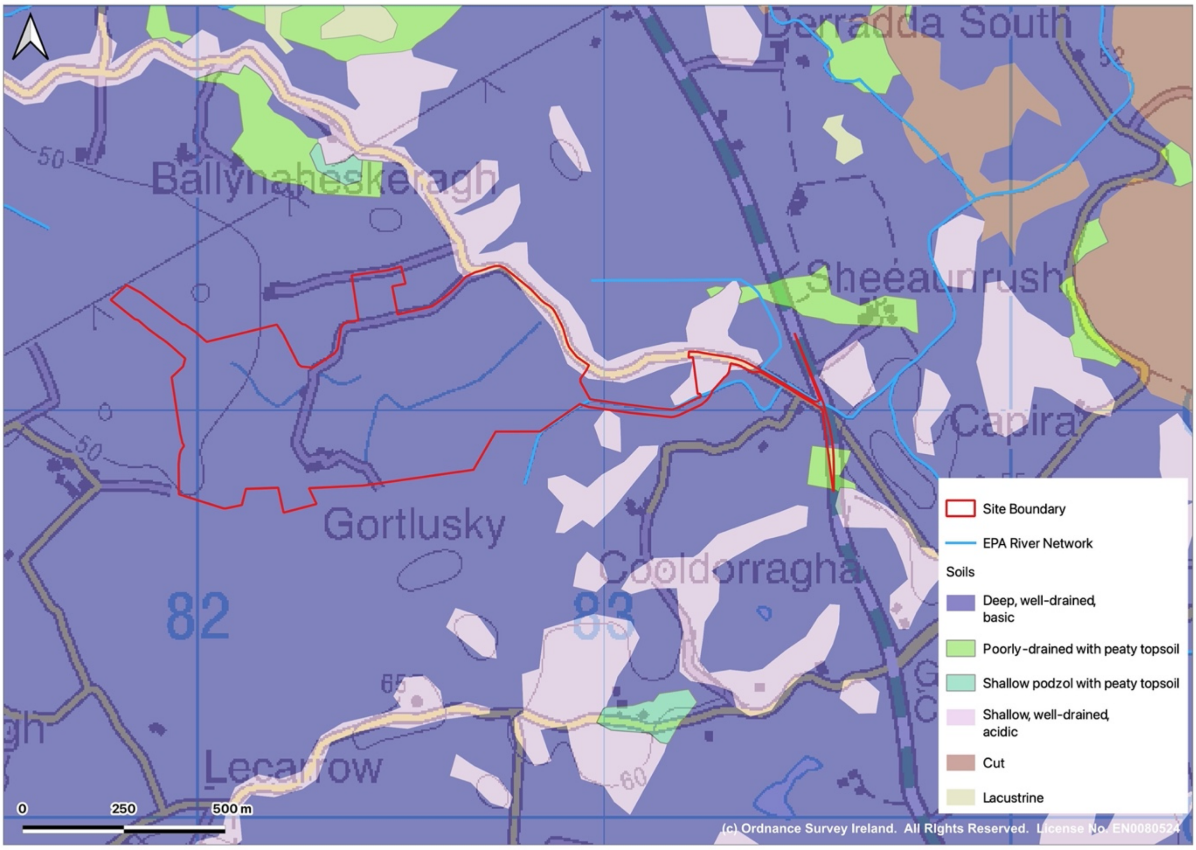
Figure 2 - Current Site Layout with EPA river network overlain

2.3 SOILS & GEOLOGY

2.3.1 Soils

Teagasc soil maps indicate that the soil within the application boundary is a uniform cover of deep, well-drained mineral soil with a basic chemical signature (Figure 3). The soil group can be described as a Grey Brown Podzolic or Brown Earth.

Figure 3- General Soil Classification

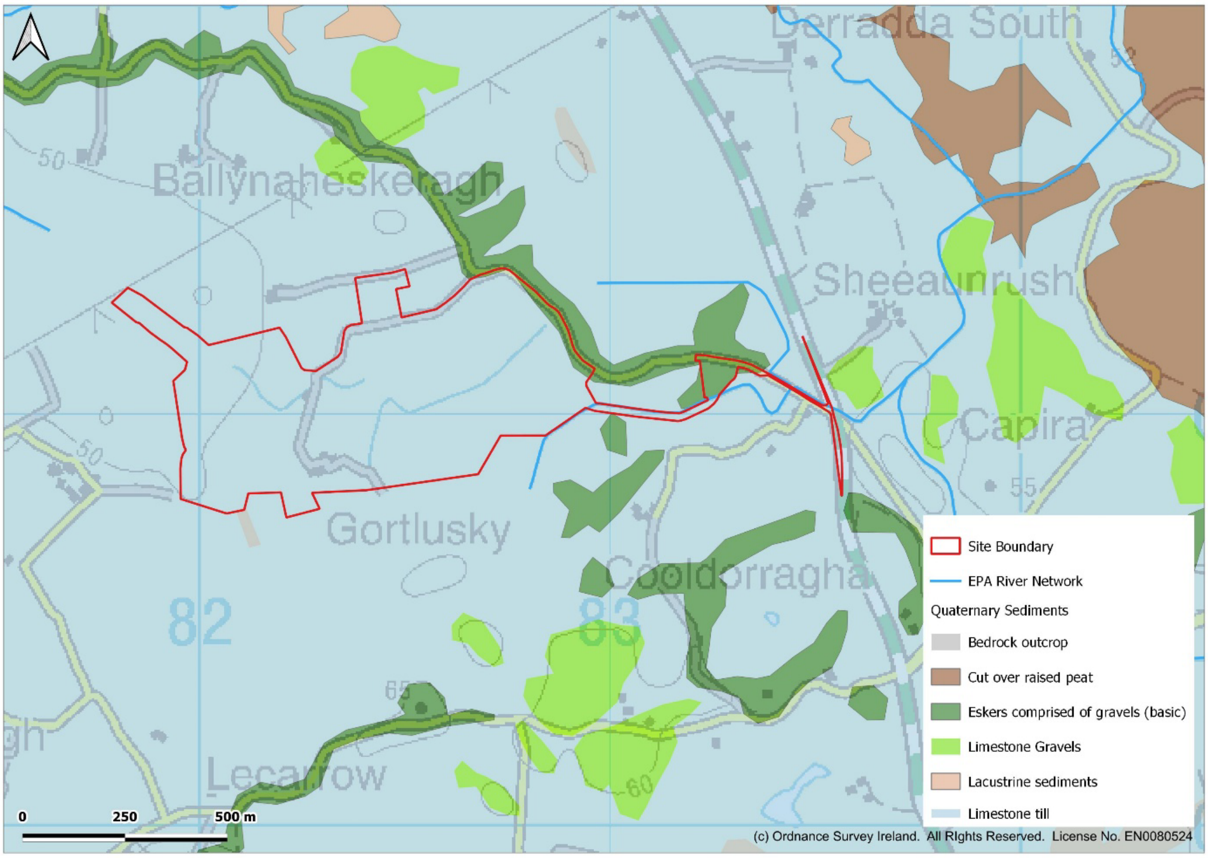


2.3.2 Quaternary Deposits

The quaternary period encompasses the last 1.6 million years and deals with the subsoils and sediments that were deposited over the bedrock described below. The Pleistocene (1.6 million years – 10,000 years ago) is commonly known as the last Ice Age, which was a period of intense glaciation separated by warmer inter-glacial periods, and it is during this period that the quaternary sediments seen today were deposited. Large amounts of ponded water were present at this stage resulting in considerable fluvioglacial sedimentation.

The majority of the site is underlain by glacial till derived from limestone. Some isolated mounds of limestone gravels are present in the area along with a graded ridge of esker sands and gravels which underlie the local road to the east (Figure 4). This combination of deposit type is characteristic of sub-glacial mechanisms resulting in well drained soils of homogenous nature.

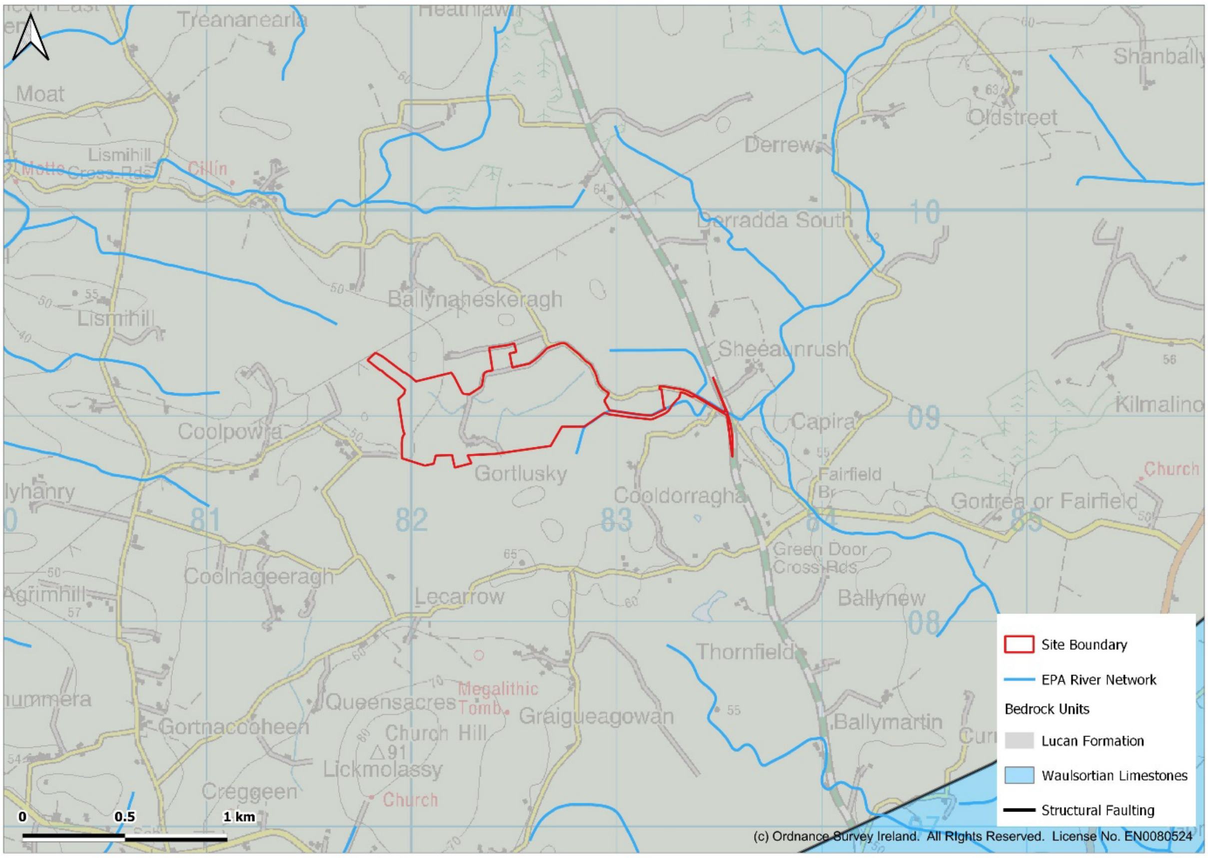
Figure 4 - Quaternary Deposits



2.3.3 Bedrock & Structural Geology

The site is underlain by the Lucan Formation. This formation consists of impure bedded limestone with shale and/or clay impurities. There are no structural geological features such as faulting mapped in the immediate vicinity of the site, as demonstrated in Figure 5.

Figure 5 - Geology of the Surrounding Area



2.4 HYDROLOGY

2.4.1 Catchment Description

The two dominant sub-catchments in the area are the Gortaha (Catchment 025B), which drains to the east, and the Kilcrow (Catchment 025C), which drains to the west. These rivers are both part of the Lower Shannon Hydrometric Area.

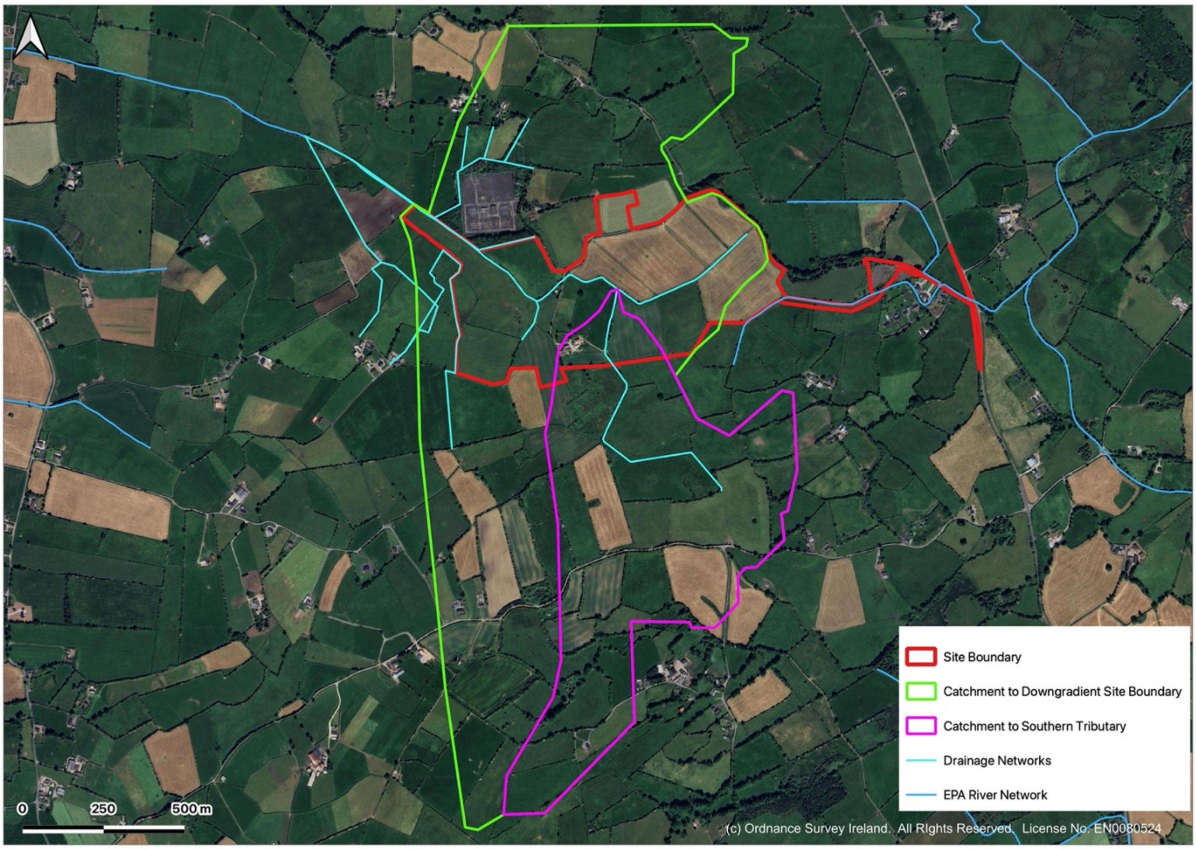
The EPA River Network database suggests that the divide between the Gortaha and Kilcrow river catchments lies within the site boundary, near the current Oldhill Substation. Subsequent groundtruthing and consultation of the OPW Drainage Maps indicate however that the catchment divide is just east of the site and that all rainfall-runoff generated on the site drains westwards, outfalling to the Kilcrow River, 2 km to the west.

The drainage network serving the site is dominated by an east to west flowing central channel which itself becomes the Treananearla Stream (first order stream) a short distance downstream of the site. This central channel originates at the eastern end of the central site area, stopping just short of the local road. This catchment was delineated by topographical contours, reference to the OPW and EPA drainage network maps, and ground truthing as part of the site walkover. The catchment area contributing run-off to the downgradient site boundary has an area of 2.0 km^2 (see Figure 6).

There are two culverts in place along the central channel within the site boundary. These provide road crossings for access to farm land and a dwelling. Both culverts have a diameter of 950 mm.

There are several field boundary drains present within the site that contribute to the runoff at its downstream end. The largest of these drains extends 950 m south, outfalling to the central stream just east of the on-site dwelling. This drainage channel has a sub-catchment of 0.675 km^2. There are two culverts present on this tributary, with pipe diameters of 650 mm and 500 mm. The 500 mm culvert lies immediately upstream of the confluence of the tributary and the main channel whilst the 650 mm culvert acts as a field crossing further upstream. There is a 1 m drop from the invert of the tributary channel to the invert of the main channel, resulting in a high velocity cascading flow regime at the confluence. The combined flows then continue westward. There are no other drainage channels that contribute significant flow to the central channel within the site.

Figure 6 - Contributing Catchment to Site Run-off



2.4.2 Designated Areas

Designated areas within the area are presented in Table 1. The River Shannon is hydraulically connected to the site via downstream drainage. There are a number of sites associated with Lough Derg to the south, as well as the Ardgraigue Bog SAC to the north.

Table 1– Summary of Designated Sites Within a 15 km Radius of the Site

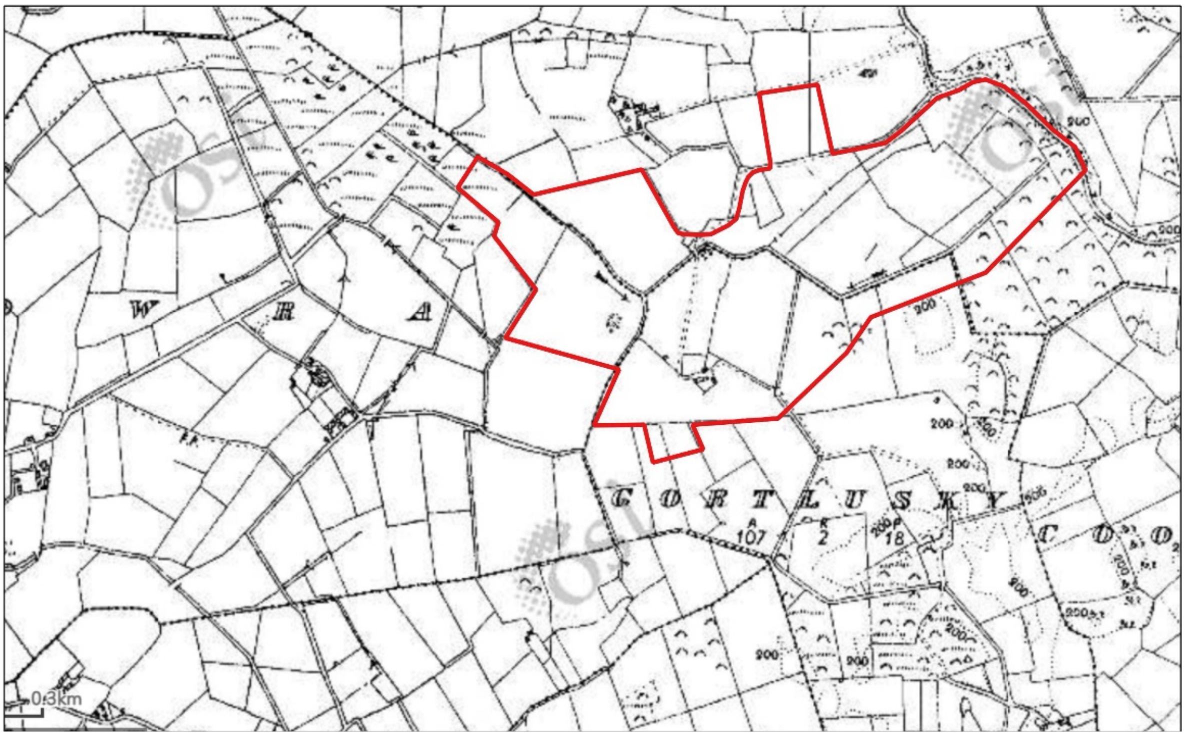
Natura 2000 Site	Site Code	Location at Closest Point to the Proposed Project
River Shannon Callows SAC	000216	6 km east
Ardgraigue Bog SAC	004026	4.5 km north
Lough Derg, North East Shore SAC	002241	5.5 km south
Lough Derg SPA	004058	5.5 km south

2.4.3 Flooding History

2.4.3.1 Historical OSI Maps

The historical 6" OSI maps (1830-1930) show no evidence of historical flooding at the application site (Plate 1). It is noted from the historical 6" maps that flow direction on the central channel is towards the centre of the site but the flow direction from this point is unclear. It is likely that subsequent arterial drainage works deepened drains to promote a westerly flow direction.

Plate 1 - Historical 6" OSI maps (1830 – 1930)



2.4.3.2 OPW Flood Hazard Mapping

Consultation of the OPW flood hazard mapping tool shows that no previous flood events occurred within or near the site. Two flood events have been reported within 5 km of the site boundary. The nearest of these was in 1995, 3 km to the southwest where the Kilcrow River passes through Newbridge Bridge at Gortanummera. It was recommended at the time that additional drainage maintenance works be deemed a priority for the area.

2.4.4 Flood Risk Indicators

2.4.4.1 National Indicative Fluvial Mapping (NIFM)

The margins flanking the Kilcrow and Gortaha rivers are covered by the OPW National Indicative Fluvial Mapping (NIFM), demonstrating flooding is not extensive. The drainage channels within the site, or immediately downstream, have not been covered by the OPW NFIM programme.

2.4.5 CFRAM

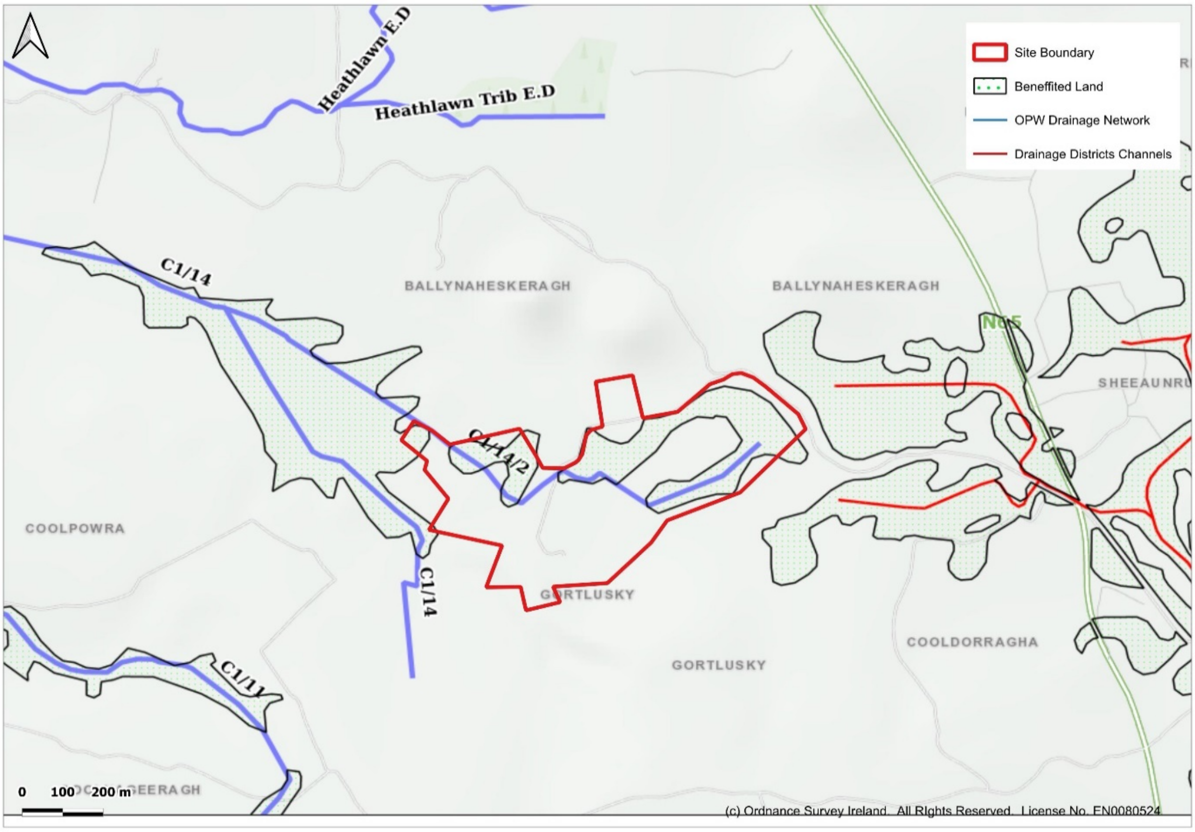
The OPW FloodInfo resource shows that neither the site nor the Kilcrow or Gortaha rivers have been covered by detailed CFRAM hydraulic modelling.

2.4.6 Benefiting Lands

Plate 2 shows that a portion of the application area lies within benefitting lands. These maps were prepared to identify areas that would benefit from land drainage schemes and typically indicate low lying land near watercourses that would be prone to flooding. The emphasis of these schemes was the improvement of agricultural land. With respect to the application site the map confirms that the central channel is maintained as part of the Killimor Arterial Drainage Scheme (Channel 14/2).

It is noted that the OPW Drainage Map also corresponds with the drainage network layout that was groundtruthed as part of the site walkover. This is further evidence that the EPA river network is incorrect.

Plate 2 - Drainage Channels and Benefitting lands proximal to the site boundary



3 SEQUENTIAL TEST & VULNERABILITY MATRIX

3.1 SEQUENTIAL APPROACH

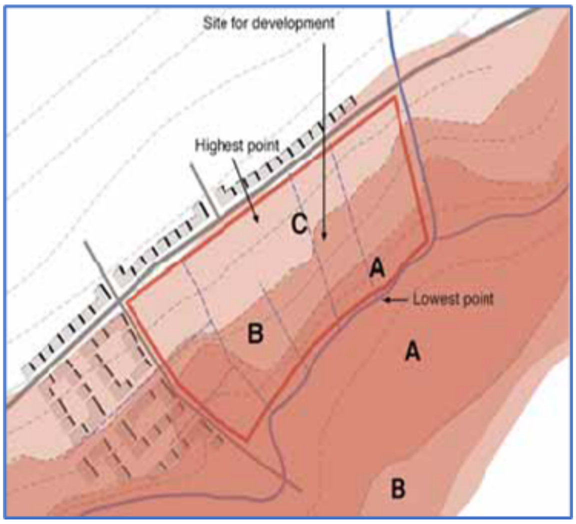
The 'Planning System and Flood Risk Management Guidelines for Planning Authorities (2009)' require the planning system at national, regional, and local levels to:

- Avoid development in areas at risk of flooding by not permitting development in flood risk areas, particularly floodplains, unless where it is fully justified that there are wider sustainability grounds for appropriate development and unless the flood risk can be managed to an acceptable level without increasing flood risk elsewhere and where possible, reducing flood risk overall.
- Adopt a sequential approach to flood risk management based on avoidance, reduction and then mitigation of flood risk as the overall framework for assessing the location of new development in the development planning processes; and
- Incorporate flood risk assessment into the process of making decisions on planning applications and planning appeals.

The sequential approach is used to assess flood risk at the site and, where there is variability, to assign appropriate zones in accordance with the Guidelines (DoEHLG, 2009). As shown inPlate 3, Zone A, applied to areas with a high probability of flooding, defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100). Development in this zone should be avoided and/or only considered in exceptional circumstances. Development should only be permitted in areas at risk of flooding when there are no alternative, reasonable sites available in areas at lower risk that also meet the objectives of proper planning and sustainable development. Zone B is applied to areas with a moderate probability of flooding from rivers. (i.e. a 0.1% to 1% probability or between 1 in 1000 and 1 in 100), with Zone C having a low probability of flooding.

With respect to coastal flooding Zone A is applied to areas with the highest risk of coastal flooding (i.e. more than 0.5% probability or more than 1 in 200 year return period). Development in this zone should be avoided and/or only considered in specified circumstances. Zone B is applied to areas with a moderate probability of coastal flooding (between 1 in 200 and 1 in 1000), with Zone C having a low probability of coastal flooding (less than 0.1% or 1 in 1000). The Flood Risk Assessment will clarify within which zone the site lies.

Plate 3 – Schematic map showing use of the Sequential Approach to assign Flood Risk Zones (DoEHLG, 2009)



3.2 VULNERABILITY MATRIX

Clause 2.16 of the Flood Management Guidelines (OPW, 2009) states: 'The classification of different land uses and types of development as highly vulnerable, less vulnerable and water-compatible is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings.'

The Planning System and Flood Risk Management guidelines provide three vulnerability categories based on the development type. The proposed works fall into the following vulnerability categories as follows:

- **Highly vulnerable = residential, hospitals, schools, essential infrastructure, emergency service facilities.**
- Less vulnerable = buildings used for retail, warehousing, commercial, industrial and non-residential institutions.
- Water-compatible development = amenity open space, outdoor sport and recreation.

The proposed development is considered to be 'essential infrastructure' and therefore comes under 'highly vulnerable development'. Different types of development are appropriate in each of the Flood Zones, based on their vulnerability to flood risk. Hence:

- **Highly vulnerable: requires Justification test in Flood Zone A and Flood Zone B, appropriate in Flood Zone C;**
- Less vulnerable: requires Justification test in Flood Zone A; appropriate in Flood Zone B and Flood Zone C;
- Water-compatible: appropriate in Flood Zones A, B and C.

Highly vulnerable development should only be considered in zones A and B if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed at the site.

Based on desktop information collected to this point the site is deemed to be within Flood Zone C. A conservative approach is being applied and the assessment will proceed to quantitative determination of flood levels in watercourses adjacent to the site. Unless the quantitiative assessment shows the site to be in Flood Zone A or Flood Zone B then a Justification Test is not required.

3.3 S-P-R MODEL

The flood risk assessment is carried out using the source-pathway-receptor (S-P-R) model, as outlined below. The S-P-R model is used to identify the sources of flood water, the people and assets affected by potential flooding, and the pathways by which the flood water reaches those receptors.

Consideration will be given to the predominant sources, pathways and receptors in terms of the influence they have on site flooding, or the manner in which they may be impacted. The primary water sources on site are as follows:

Sources	Pathways	Receptors
Storm rainfall event (1 in 100 year)	Pluvial Flooding	Proposed Site
Kilcrow River Tributaries	Fluvial Flooding	Proposed Site Infrastructure
Runoff from upgradient lands	Road Runoff	Local Road
Drainage/throughflow from upgradient lands		Third Party Lands and Property
Gortaha River Tributaries		

Flooding mechanisms will be looked at in more detail to quantify flood risk from the Kilcrow River catchment. Quantification of this risk will be achieved by firstly determining flood flows in the watercourses as they flow through/past the site.

A hydraulic model will then be compiled to facilitate estimation of flood levels within, and adjacent to, the site when these peak flows are passed through a series of surveyed cross sections. Mitigation measures will then be applied as appropriate.

4 SUBJECT SITE FLUVIAL FLOOD FLOW CALCULATIONS

4.1 OPW ADVICE

In selecting appropriate formulae reference has been made to an advisory response from OPW Hydrology Section and Work Package 4.2:

- For catchments between 5 km^2 and 25 km^2 the preferred equation is the 'FSU small catchments' equation. When using the small catchment equation, we generally advocate not using a pivotal site adjustment seeing as there is a very small pool of other small catchments from which to source a pivotal site.
- For catchments less than 25 km^2 we would always say that at least three methods should be explored and that the choice of the flow to be used is up to the practitioner.
- The WP4.2 report is intended to provide a further methodology for small catchment flood estimation. As far as we are concerned, it is the preferred method.
- For catchments less than 5 km^2 there is no FSU method applicable. For such 'small' catchments we would suggest that maybe the rational method or modified rational method could be used.

The catchment associated with the furthest downstream point of the site boundary has an area of 2.00 km^2. The OPW FSU method alone may therefore be deemed unsuitable for the calculation of potential flood flows in this instance.

4.1.1 OPW FSU - 7 Variable Equation

The ungauged method can be used to determine flood flows at the site using catchment characteristics, which are then corrected using a correlation against descriptors for gauged catchments. The median annual maximum flood magnitude (QMED), as outlined in the Flood Studies Update (FSU) (Nicholson & Bree 2013) is now preferred over the mean annual flood flow rate (Q_{bar}) parameter described in the Flood Studies Report (FSR) (NERC 1975). The preferred median method is less sensitive to large extreme floods and to flood measurement error in general. The estimation method for ungauged locations is based on a regression analysis relating observed QMED to physical catchment descriptors (PCDs) at gauged locations in Ireland, given by the following equation:

$$QMED_{rural} = 1.237\text{x}10^{-5} \,.\, AREA^{0.937} \,.\, BFI_{soil}^{-0.922} \,.\, SAAR^{1.306} \,.\, FARL^{2.217} \,.\, DRAIND^{0.341} \,.\, S^{0.185} \,.\, (1 + ARTDRAIN2)^{0.408}$$

The PCDs applicable to the subject site are shown in Table 2.

.

Table 2 - Physical Catchment Descriptors Applicable to the Subject Site

PCD	Description	Units	Value
AREA	Catchment area	km^2	2.00
SAAR	Average annual rainfall	mm	938.91
BFIsoil	Baseflow index derived from soils data		0.6908
FARL	Flood attenuation from reservoirs and lakes		1
DRAIND	Ratio of river network to catchment area	no./km^2	0.212
S_{1085}	Slope of the main stream between the 10 and 85 percentiles	m/km^2	1.034
ARTDRAIN2	Proportion of river network included in drainage schemes		0.9404
URBEXT			0
$QMED_{rural}$		m^3/s	0.198
$QMED_{urban}$		m^3/s	0.198

A principal of the FSU is the concept of a pivotal site, however no pivotal sites were considered suitable for application to such a small catchment. The return-period flood flow (Q_T) is determined by an index flood method, whereby a growth factor as determined from an EV1 distribution plot is applied. In this case:

$$Q_t = QMED \times 2.51$$

$$Q_{100} = 0.198\ m^3/s \times 2.51$$

$$Q_{100} = 0.496\ m^3/s$$

Finally, a climate change growth factor of 20 % is applied:

$$Q_{100} = 0.496 \times 1.2$$

$$\mathbf{Q_{100} = 0.596\ m^3/s}$$

Using the standard OPW FSU approach the climate adjusted Q_{1000} flow in the watercourse as it passes the site is equal to:

$$Q_{1000} = QMED \times 3.33$$

$$Q_{1000} = 0.198\ m^3/s \times 3.33$$

$$Q_{1000} = 0.658\ m^3/s$$

Finally, a climate change growth factor of 20% is applied:

$$Q_{1000} = 0.658 \times 1.2$$

$$\mathbf{Q_{1000} = 0.790\ m^3/s}$$

4.1.2 OPW FSU – Small Catchments

The updated Flood Studies Update (Nicholson and Bree, 2013) presents the formula suited to catchments less than 25 km^2:

$$QMED_{rural} = 2.0951x10^{-5} \ . \ AREA^{0.9245} \ . \ BFIsoil^{-0.9030} \ . \ SAAR^{1.2695} \ . \ FARL^{2.3163} \ . \ S^{0.2513}$$

The same PCDs shown in Table 2 are again applied. This equation yields a Q_{MED} value of 0.328 m^3/s. As per the OPW Guidelines a pivotal site adjustment factor is not being applied to the outcome of the small catchments equation.

In this case the Q_{100} flood flow is determined as follows:

$$QT = QMED \text{ x growth factor}$$

$$Q_{100} = 0.328 \text{ m}^3 \text{ s}^{-1} \text{ x } 2.51$$

$$Q_{100} = 0.823 \text{ m}^3 \text{ s}^{-1}$$

Finally, a climate change growth factor of 20% is applied:

$$Q_{100} = 0.823 \text{ x } 1.2$$

$$\mathbf{Q_{100} = 0.987 \text{ m}^3 \text{ s}^{-1}}$$

In this case the Q_{1000} flood flow is determined as follows:

$$Q_{1000} = QMED \text{ x } 3.33$$

$$Q_{1000} = 0.328 \text{ m}^3/\text{s x } 3.33$$

$$Q_{1000} = 1.091 \text{ m}^3/\text{s}$$

Finally, a climate change growth factor of 20 % is applied:

$$Q_{1000} = 1.091 \text{ x } 1.2$$

$$\mathbf{Q_{1000} = 1.309 \text{ m}^3/\text{s}}$$

4.1.3 OPW FSU – 3 Variable Method

The FSU 3-variable equation was developed as part of the FSU. It was developed as a ‘short cut’ equation for the estimation of flow in ungauged catchments:

$$QMED = 0.000302.AREA^{0.829} \ . \ SAAR^{0.898} \ . \ BFI^{1.539}$$

$$QMED = 0.14 \text{ m}^3/\text{s}$$

Application of the relevant growth factors as per above and 20% climate change adjustment factor results in:

$$\mathbf{Q_{100} = 0.428 \text{ m}^3/\text{s}}$$

$$\mathbf{Q_{1000} = 0.568 \text{ m}^3/\text{s}}$$

4.1.4 Flood Studies Report, FSR (NERC 1974)

This is the original FSR method, with the regression coefficient for Ireland. Estimates from this equation should be treated with extreme caution. Growth factor of 1.96 was applied to determine Q_{100}. It is recommended that these equations should be used only for preliminary flood estimates.

$$QBAR = 0.0172 . AREA^{0.94} . STMFRQ^{0.27} . S1085^{0.16} . SOIL^{1.23} . RSMD^{1.03} . (1 + LAKE)^{-0.85}$$

Table 3 - Calculations of Q_{100} – FSR Ungauged Catchments

Area, km²	STMFRQ, jn/km²	S_{1085}, m/km	SOIL	RSMD	LAKE	Q_{BAR} m³/s	Q_{BAR} x 1.96 gf m³/s	Q_{100} x 1.47 sfe m³/s	Q_{100} x x cc (1.2), m³/s
2.004	0.499	1.034	0.35	35.991	0	0.303	0.594	0.8745	**1.049**

Using a growth factor of 2.6 to convert from Q_{BAR} to Q_{1000}, the resulting Q_{1000} flow which includes a 20% climate change factor is estimated as **1.392** m³/s.

4.1.5 Institute of Hydrology Report (IH)124 (1994)

Report No. 124 derives an equation to estimate flood flows for small rural catchments (less than 25 km²). The equation has a standard factorial error (SFE) of 1.65.

$$Qbar_{rural} = 0.00108 \left(AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}\right)$$

Table 4 - Calculations of Q_{100} – IH124

Area, km²	SAAR	SOIL	Q_{BAR} m³/s	Q_{BAR} x 1.96 gf m³/s	Q_{100} x 1.65 sfe m³/s	Q_{100} x x cc (1.2), m³/s
2.004	938.91	0.35	0.617	1.210	1.997	**2.396**

Without implementing the SFE (1.65), the Q_{100} rate plus 20% climate change factor was:

$$Q_{100} = 1.211 \text{ m}^3/\text{s} \times 1.2 = 1.45 \text{ m}^3/\text{s}.$$

Using a growth factor of 2.59 to convert from Q_{BAR} to Q_{1000}, the resulting Q_{1000} flow which includes a 20% climate change factor is estimated as **3.167** m³/s.

This method was developed for small catchments (< 25 km²) in the UK. Its derivation did not include any Irish catchments. The equation tends to overestimate QBAR for the smallest of the UK catchments used. This value is not comparable to results derived from other formulae.

4.1.6 Modified IH 124 (Cawley & Cunnane 2003)

Irish researchers at NUIG (Cawley & Cunnane 2003) developed a Modified Institute of Hydrology 124 methodology and formula as follows:

$$Qbar_{rural} = 0.000036\ (AREA^{0.94} \times SAAR^{1.58} \times SOIL^{1.87})$$

Table 5 - Calculations of Q_{100} – Modified IH124

Area, km^2	SAAR	SOIL	Q_{BAR} m^3/s	Q_{BAR} x 1.96 gf m^3/s	Q_{100} x 1.65 sfe m^3/s	Q_{100} x x cc (1.2), m^3/s
2.00	938.9	0.35	0.483	0.947	1.563	**1.875**

Using a growth factor of 2.59 to convert from Q_{BAR} to Q_{1000}, the resulting Q_{1000} flow which includes a 20% climate change factor is estimated as **2.47** m^3/s.

4.1.7 Modified Rational Method

FSU Work Package 4.2 shows that the UK only apply the Rational Method to catchments from 2 to 4 km^2. In Ireland this method is more commonly used to determine stormwater attenuation requirements. It is calculated using the formula:

$$QT = 2.78 \times C_v \times C_r \times I \times A$$

where:

Q_T = design peak flow, l s^{-1}

T = return period in years = 100

C_v = runoff coefficient = 0.84 (winter)

C_r = peaking/routing factor = 1.3 (arbitrary value)

A = 2.004 km^2

$I_{tc,\ T}$ = hourly rainfall intensity for design duration of tc (hours) and return period T (years) = 29.2 mm *1.36 = 39.712 mm

t_c= time of concentration defined as the travel time from the furthest point on the catchment to the outlet (mins):

$$t_c = 0.0195 \times L^{0.77} \times S^{-0.385}$$

L = length of stream = 1600 m

S = catchment gradient, m m^{-1} = 0.001

tc = 81.6 minutes = 1.36 hours

Hence:

$$Q_{100} = 2.78 \times 0.84 \times 1.3 \times 0.0292 \times 2.004$$

$$Q_{100} = 0.348\ m^3\ s^{-1}$$

$$Q_{100} + 20\% \text{ cc} = \mathbf{0.417} \text{ m}^3 \text{ s}^{-1}$$

$$Q_{1000} + 20\% \text{ cc} = \mathbf{0.552} \text{ m}^3 \text{ s}^{-1}$$

4.1.8 Summary of Flood Flow Calculations

Results from the various flood estimation methods are summarised below in Table 6. In taking a conservative approach, the flood flow values selected for use in the hydraulic model were those calculated using the IH124 method, as these were the maximum values. The respective Q_{100} and Q_{1000} values being equal to 2.40 m^3/s and 3.16 m^3/s, respectively. These values include a 20% factor for climate change.

Table 6 - Summary of Calculated Flood Flows (includes 20% Climate Change Factor)

Methodology	Q_{100} + 20% cc (m^3/s)	Q_{1000} + 20% cc (m^3/s)
FSU Standard	0.60	0.79
FSU small catchments	0.99	1.09
FSU – 3 variable	0.43	0.57
FSR 6 – including SFE	1.04	1.39
IH124 – including SFE	**2.40**	**3.16**
Modified IH124 – including SFE	1.88	2.48
Modified rational method	0.42	0.55
Minimum	0.42	0.55
Maximum	2.40	3.16
Average (n = 7)	1.11	1.43

5 HYDRAULIC MODEL

5.1 MODEL CONCEPT

A site-specific hydraulic model was constructed using Flood Modeller (version 6.1), an industry standard hydraulic modelling software package for which Envirologic maintains a full license. This software package is designed to perform one dimensional (1D) hydraulic simulations for networks of natural or constructed water channels. In addition to the one-dimensional hydraulic solver the software also utilises a two-dimensional solver (2D) which models water flow and depth in situations where flood levels overtop the bank-full capacity of the surveyed channels and spill onto the adjoining floodplain. Construction of the 1D–2D linked model relies on four primary inputs summarised as follows:

- Geometric Data: Surveyed cross-sectional data of the main channel through the site boundary;
- Geometric Data: A georeferenced digital elevation model of the site and surrounding landscape to cover potential adjoining flood plain upstream and downstream of the site location;
- Upstream Boundary Conditions - Q_{100} & Q_{1000} flood flow volumes for the upstream catchment of the site;

- Inclusion of Manning Roughness Coefficient values, used to calculate frictional forces within the flood model.

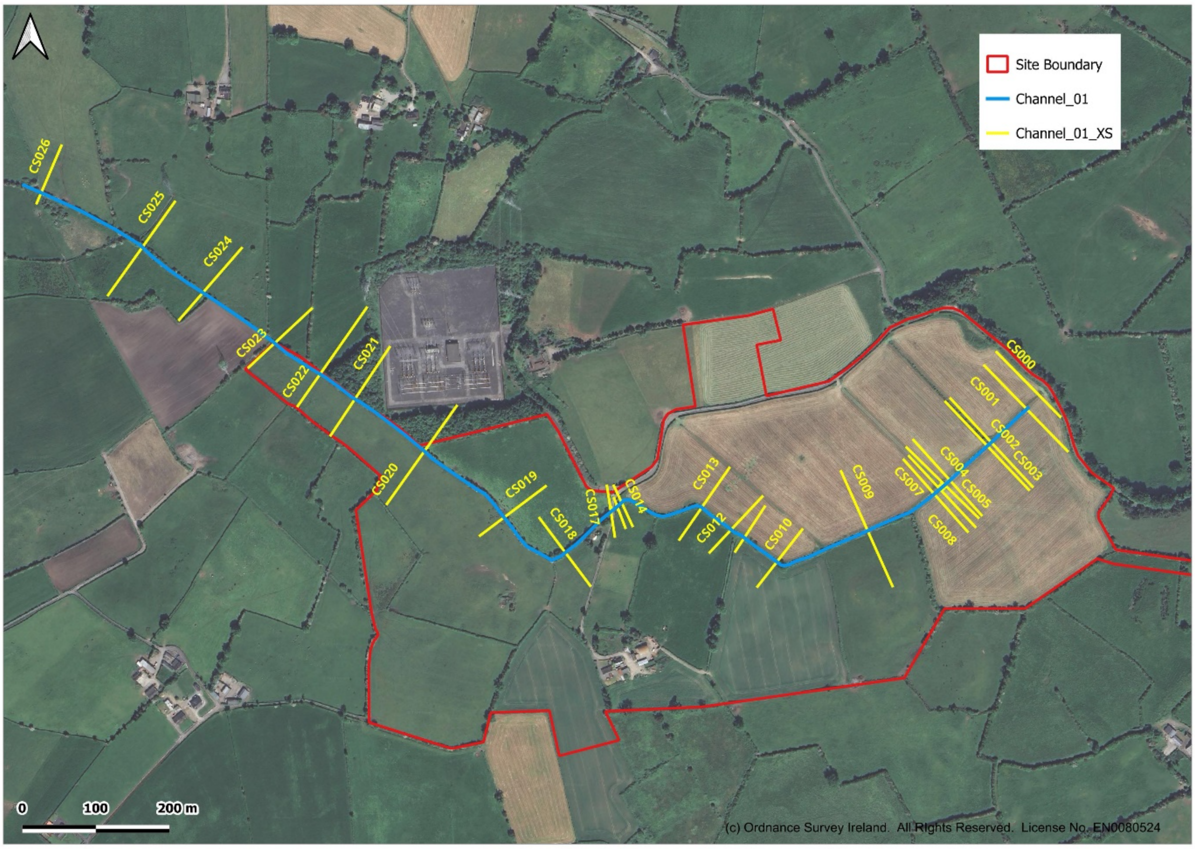
5.2 MODEL BUILD – EXISTING DRAINAGE REGIME

5.2.1 Cross Sections

The 1D model was compiled using evenly spaced cross sections along watercourses within the site boundary. These sections were surveyed manually using Trimble RTK VRS technique. Cross section locations on the central channel are shown in Figure 7. Twenty six sections were surveyed along the central channel. As stated previously the surface water catchment to this central channel as it passes the downgradient site boundary is 2.00 km^2.

A further 19 cross sections were surveyed across drainage ditches that outfall to the central channel within the site. Only one of these was considered as contributing flows high enough that it should be included in the flood model; this being a drainage tributary that extends 950 m south. Nine cross sections were surveyed along this southern drainage tributary. It has a catchment of approximately 0.68 km^2. Accordingly, 34% of the Q_{100} and Q_{1000} flow values were attributed to this southern drainage tributary, based on its proportional area within the overall site catchment.

Figure 7 - Cross Section Locations



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5.2.2 Flow Boundaries

The IH124 $Q_{1000+cc}$ flow value of 3.16 m^3/s was selected as the design flood flow through the entire site. By areal proportion an upstream flow value of 2.09 m^3/s was introduced to the central channel (Channel 01) upstream of cross section CS001 and 1.06 m^3/s (34% of 3.16 m^3/s) was introduced to the southern tributary (Channel 02) upstream of cross section CS100. The combined flow of 3.16 m^3/s is then routed through all remaining downstream cross sections. The same modelling concept approach was applied in relation to the catchment Q_{100} flow value of 2.94 m^3/s.

5.2.3 Roughness Coefficients & Gradients

A Manning's roughness coefficient of 0.03 was applied to open river channel bed sections (noted as silty/gravelly) and a value of 0.045 applied to riverbanks. The central channel (Channel 01) is noted on the OPW drainage network database as being maintained as part of the Killimor arterial drainage district. It was observed during the site visit that the channel profiles generally have steep banks and flat channel beds. Throughout the existing central channel (Channel 01) the hydraulic gradient was generally 0.02%. This steepened to a maximum gradient of 1.18% in the western part of the site.

5.2.4 Existing Structures

There are four culverts in place along the modelled reaches. Culvert specifications are noted as follows:

- CS006 = Culvert field crossing along Channel 01:
    - 1 no. circular concrete culvert with an opening of 900 mm
    - Length = 6.0 m
    - Pipe crown elevation = 52.05 mOD
    - Pipe invert elevation = 51.15 mOD
    - Upstream top of wall elevation = 53.32 mOD
    - Culvert deck level = 53.21 mOD
- CS016 = Culvert crossing on Channel 01 for access road to existing dwelling:
    - 1 no. concrete culvert with an opening of 950 mm
    - Length = 7.5 m
    - Pipe crown elevation = 51.18 mOD
    - Pipe invert elevation = 50.18 mOD
    - Upstream top of wall elevation = 51.70 mOD
    - Culvert deck level = 51.87 mOD
- CS102 = Culvert crossing on Channel 02 for access between fields:

  - 1 no. concrete culvert with an opening of 650 mm
  - Length = 4.0 m
  - Pipe crown elevation = 52.95 mOD
  - Pipe invert elevation = 52.30 mOD
  - Upstream top of wall elevation = 53.31 mOD
  - Culvert deck level = 53.40 mOD
- CS110 = Culvert on Channel 02 immediately upstream of outfall to Channel 01:
  - 1 no. concrete culvert with an opening of 500 mm
  - Length = 0.5 m
  - Pipe crown elevation = 51.95 mOD
  - Pipe invert elevation = 51.45 mOD
  - Upstream top of wall elevation = 52.72 mOD
  - Culvert deck level = 52.72 mOD

5.2.5 Existing Drainage Regime: Simulations

This step of the assessment focussed on the following scenarios:

- Validation of the model build using observed vs modelled water levels
- 1 in 100-year fluvial flood event
- 1 in 1000-year fluvial flood event

5.2.5.1 Simulation: Validation

Surface water levels were recorded on 1st and 2nd May 2024 as part of the topographical survey. These surveyed water levels were compared with water levels modelled by the hydraulic simulation, with results shown in Table 7. A flow of 0.2 m^3/s provided the least amount of error between the surveyed and modelled water levels and were deemed representative of flows observed on the day.

Validation results showed that the model was extremely accurate throughout the modelled reach of the central channel, with the difference generally below 60 mm. There was a slight increase in divergence of up to 200 mm at CS022 and CS023 with this being attributed to the sharp increase in hydraulic gradient towards the end of the model. Another slightly higher difference between observed and predicted water levels of 120 mm occurred immediately upstream of culvert CS016. During surveying it was noted that there was a large amount of silt and vegetation at the culvert inlet which was not accounted for in the model.

The results of the validation exercise confirm that the model is valid and accurate and is appropriate for predicting flood flows through the application site.

Table 7 - Surface Water Levels Validation

Cross Section	Surveyed Surface Water Level (mOD)	Modelled Water Level at 0.2 m^3/s (mOD)	Difference (m)
CS002	51.62	51.64	-0.02
CS003	51.60	51.63	-0.04
CS004	51.58	51.61	-0.03
CS005	51.58	51.61	-0.03
CS007	51.58	51.60	-0.02
CS008	51.58	51.60	-0.02
CS009	51.52	51.54	-0.02
CS010	51.17	51.24	-0.07
CS011	50.81	50.80	0.02
CS012	50.76	50.73	0.03
CS013	50.70	50.66	0.03
CS014	50.40	50.50	-0.12
CS015	50.37	50.48	-0.12
CS017	50.1	50.18	-0.08
CS018	49.78	49.70	0.09
CS019	48.39	48.28	0.11
CS020	45.84	45.90	-0.06
CS021	43.78	43.84	-0.06
CS022	43.18	42.96	0.22
CS023	42.82	42.63	0.19
CS024	42.45	42.45	0.00
CS025	42.31	42.38	-0.08
CS026	42.25	42.26	0.00

5.2.6 Simulation: Flood Flows

The conveyance capacity of all surveyed cross sections along the existing stream were assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. The design flows are as follows:

- Central channel (Channel 01) Q_{100} = 1.59 m^3/s
- Central channel (Channel 01) Q_{1000} = 2.10 m^3/s
- Southern tributary (Channel 02) Q_{100} = 0.80 m^3/s
- Southern tributary (Channel 02) Q_{1000} = 1.06 m^3/s

The predicted surface water elevations from the Flood Modeller 1D simulation under steady-state conditions are presented in Table 8.

The results showed that under flood conditions waters are maintained within the central channel profile. There is surcharging upstream of the culvert at CS016 but these upstream waters remain confined within the channel profile.

Full surcharging occurs at the inlets of both culverts on the southern tributary under Q_{100} flows, these being positioned at CS102 and CS110. As proposed works involve realignment of this channel it was not deemed necessary to construct a full 1D-2D flood simulation to assess of the fate of waters that spill onto the floodplain. The southern tributary (Channel 02) was capable of safely transmitting 0.6 m^3/s with the existing culverts in place.

Table 8 - Hydraulic Model Flow Simulation Outputs for existing hydraulic regime for Central Channel

Cross Section	Channel 01			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
CS001	1.59	52.57	2.10	52.72
CS002	1.59	52.38	2.10	52.56
CS003	1.59	52.39	2.10	52.58
CS004	1.59	52.37	2.10	52.55
CS005	1.59	52.36	2.10	52.55
CS006UP	1.59	52.28	2.10	52.43
CS006DN	1.59	52.29	2.10	52.44
CS007	1.59	52.29	2.10	52.44
CS008	1.59	52.29	2.10	52.44
CS009	1.59	52.20	2.10	52.34
CS010	1.59	51.73	2.10	51.84
CS011	1.59	51.40	2.10	51.56
CS012	2.40	51.64	3.16	51.85
CS013	2.40	51.58	3.16	51.79
CS014	2.40	51.41	3.16	51.64
CS015	2.40	51.40	3.16	51.63
CS016UP	2.40	50.69	3.16	50.81
CS016DN	2.40	50.66	3.16	50.77
CS017	2.40	50.66	3.16	50.77
CS018	2.40	50.18	3.16	50.28
CS019	2.40	48.67	3.16	48.74
CS020	2.40	46.37	3.16	46.47
CS021	2.40	44.32	3.16	44.42
CS022	2.40	43.55	3.16	43.71
CS023	2.40	43.33	3.16	43.49
CS024	2.40	43.14	3.16	43.28

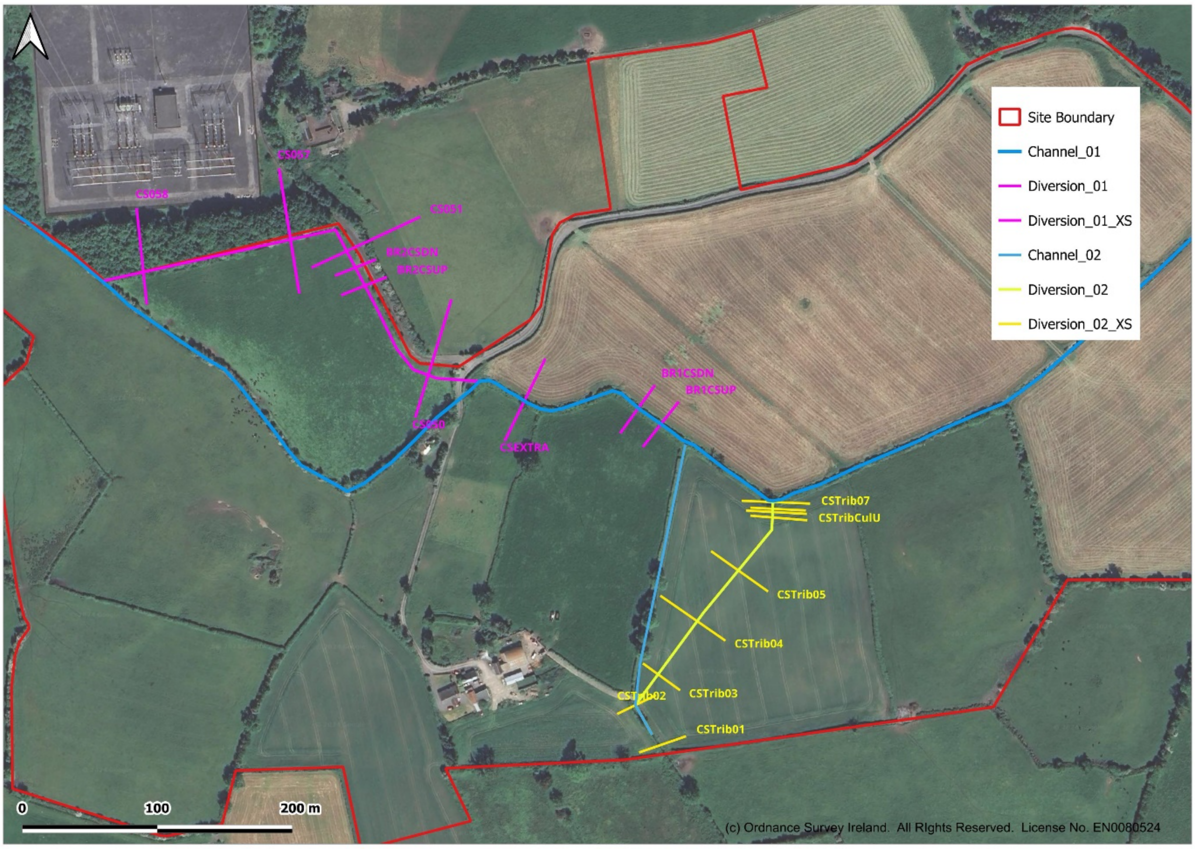
Cross Section	Channel 01			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
CS025	2.40	42.99	3.16	43.10
CS026	2.40	42.48	3.16	42.88

5.3 MODEL BUILD – REALIGNED DRAINAGE REGIME

In order to facilitate efficient site layout design the proposed development works include for the realignment of the local drainage network at two separate channel reaches, as indicated in Figure 8:

1. Realignment 01 – Channel 01. The reach between CS016 and CS020 will be diverted north and then west for 350 m. The culvert currently in place at CS016 shall be decommissioned.
2. Realignment 02 – Channel 02. The southern drainage tributary will be diverted northeastwards from where it currently flows past the on-site dwelling. The culverts currently in place at CS102 and CS110 shall be decommissioned. A new culvert will be installed to facilitate a proposed access road just before the southern tributary outfalls to the central channel.
3. Invert levels along the realigned drainage channels have been derived at the cross sections shown in Figure 8, based on a uniform bed gradient between the start and end of each realigned channel reach.

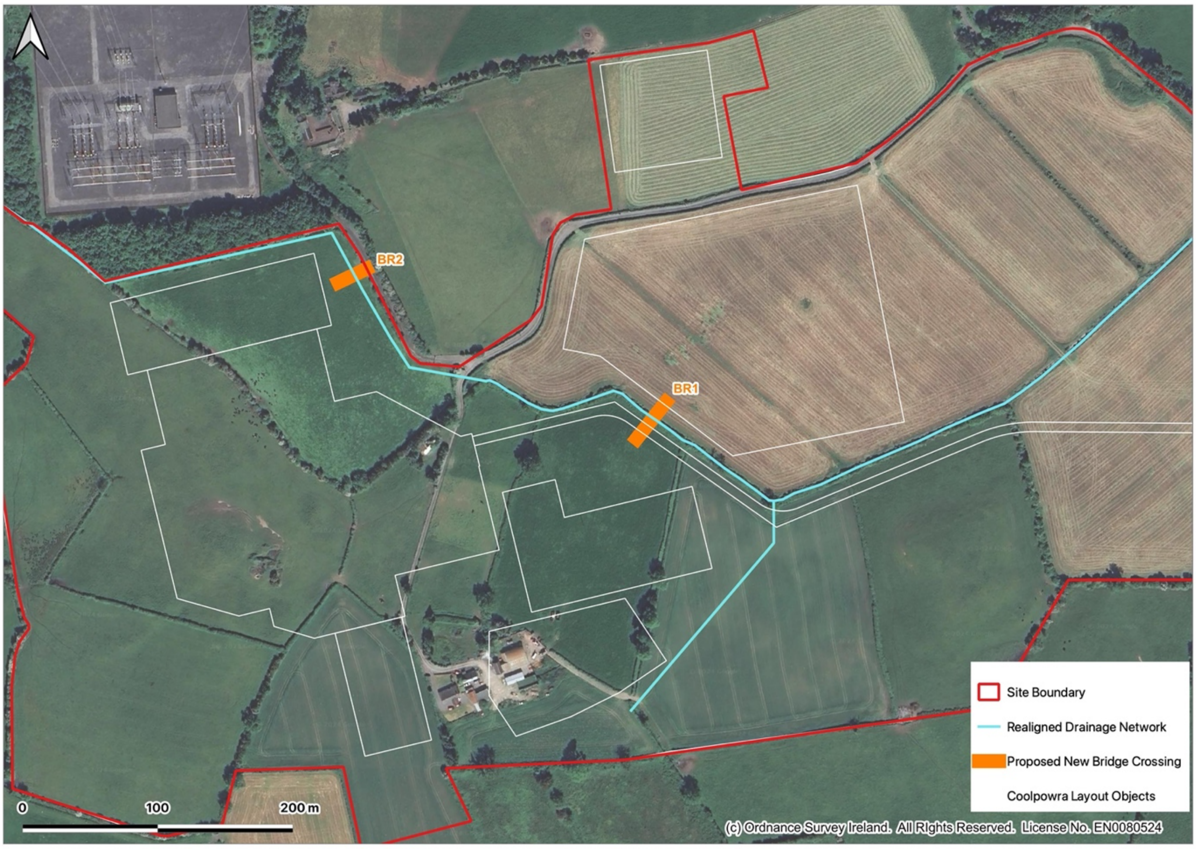
Figure 8 - Location of diverted channels and cross sections



5.3.1 Proposed Structures

In addition to the above, two new bridges are proposed to facilitate new internal access roads, these will be installed (i) on the central channel between CS012 and CS013, and (ii) on the northern limb of Realignment 01. Locations of the proposed bridges are shown in Figure 9.

Figure 9 - Location of Proposed Bridges



The proposed replacement culvert structure will be located on Realigned Channel 02, just upstream of its confluence with Channel 01. It will have the following specifications:

- CSTribCul = New culvert upstream of confluence of Realignment 02 and Channel 01:
  - 1 no. circular concrete culvert with an opening of 1,200 mm
  - Width = 6 m
  - Pipe crown elevation = 52.45 mOD
  - Pipe invert elevation = 51.25 mOD
  - Culvert deck level = new access road elevation

The design specifications for the two new proposed bridges require a freeboard of 300 mm for the water level corresponding to the Q_{1000} + climate change flow. The bridge structure consists of a precast concrete deck. Stone gabions will act as a foundation to the concrete base of the deck level, which will be set back approximately 1m from the top of the channel bank. There will be a minimum clearance of 400mm from the top of the channel bank to the bridge soffit.

- BR1 = Proposed bridge along Channel 01 between CS012 and CS013:
    - Precast concrete bridge deck
    - Length = 6 m
    - Soffit elevation = 53.0 mOD
    - Spring elevation = Ground elevation
    - Bridge deck level = 53.5 mOD
- BR2 = Proposed bridge on northern limb of Realignment 01
    - Precast concrete bridge deck
    - Width = 6 m
    - Soffit elevation = 51.0 mOD
    - Spring elevation = Ground elevation
    - Bridge deck level = 51.5 mOD

5.3.2 Proposed Drainage Regime Flood Scenarios

The conveyance capacity of all surveyed and realigned cross sections along the existing stream and realigned channel reaches were assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. The design flows are as before:

- Central channel (Channel 01) Q_{100} = 1.59 m^3/s
- Central channel (Channel 01) Q_{1000} = 2.10 m^3/s
- Southern tributary (Channel 02) Q_{100} = 0.80 m^3/s
- Southern tributary (Channel 02) Q_{1000} = 1.10 m^3/s

The predicted surface water elevations from the Flood Modeller 1D-model under steady-state conditions are presented in Table 9.

Table 9 - Hydraulic Model Flow Simulation Outputs for Channel 01 with diversions 01 and 02 incorporated

Cross Section	Channel 01 & Channel 02			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
CS001	1.59	52.57	2.10	52.72
CS002	1.59	52.38	2.10	52.56
CS003	1.59	52.39	2.10	52.58
CS004	1.59	52.37	2.10	52.55
CS005	1.59	52.37	2.10	52.55
CS006UP	1.59	52.28	2.10	52.43
CS006DN	1.59	52.29	2.10	52.44
CS007	1.59	52.29	2.10	52.44
CS008	1.59	52.29	2.10	52.44
CS009	1.59	52.20	2.10	52.34
CS010	2.40	51.93	3.16	52.08
CS011	2.40	51.74	3.16	51.90
CS012	2.40	51.75	3.16	51.92
BR1CSUP	2.40	51.70	3.16	51.87
BR1CSDN	2.40	51.69	3.16	51.86
CS013	2.40	51.68	3.16	51.85
CSEXTRA	2.40	51.40	3.16	51.53
CS014	2.40	50.87	3.16	50.98
CS050	2.40	50.80	3.16	50.92
BR2CSUP	2.40	49.66	3.16	49.63
BR2CSDN	2.40	49.81	3.16	49.89
CS051	2.40	49.07	3.16	49.12
CS057	2.40	48.09	3.16	48.19
CS058	2.40	46.89	3.16	46.99
CS020	2.40	46.37	3.16	46.47
CS021	2.40	44.32	3.16	44.42
CS022	2.40	43.55	3.16	43.71
CS023	2.40	43.33	3.16	43.49
CS024	2.40	43.14	3.16	43.28
CS025	2.40	42.99	3.16	43.10
CS026	2.40	42.48	3.16	42.88
CSTrib01	0.80	53.18	1.06	53.24
CSTrib02	0.80	52.85	1.06	52.91
CSTrib03	0.80	52.46	1.06	52.52
CSTrib04	0.80	52.09	1.06	52.26
CSTrib05	0.80	52.04	1.06	52.23
CSTribCulUp	0.80	51.94	1.06	52.09
CSTribCulDn	0.80	51.93	1.06	52.08

Cross Section	Channel 01 & Channel 02			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
CSTrib06	0.80	51.93	1.06	52.08
CSTrib07	0.80	51.93	1.06	52.08

The results showed that under flood conditions waters are maintained within the central channel and the realigned tributary to the south. There is no surcharging upstream of any of the new structures. As the floodwaters were contained within the 1D model it was not necessary to develop a 1D-2D linked hydraulic model.

The longitudinal profiles of Channel 01, including the realignments and proposed bridges, are shown for the Q_{100} and Q_{1000} scenarios in Plate 4 and Plate 5, respectively.

The longitudinal profiles of Channel 02, including the upgraded culvert, are shown for the Q_{100} and Q_{1000} scenarios in Plate 6 and Plate 7, respectively.

Plate 4 – Longitudinal Profile of Channel 01 with Realigned Channel under Q_{100} scenario

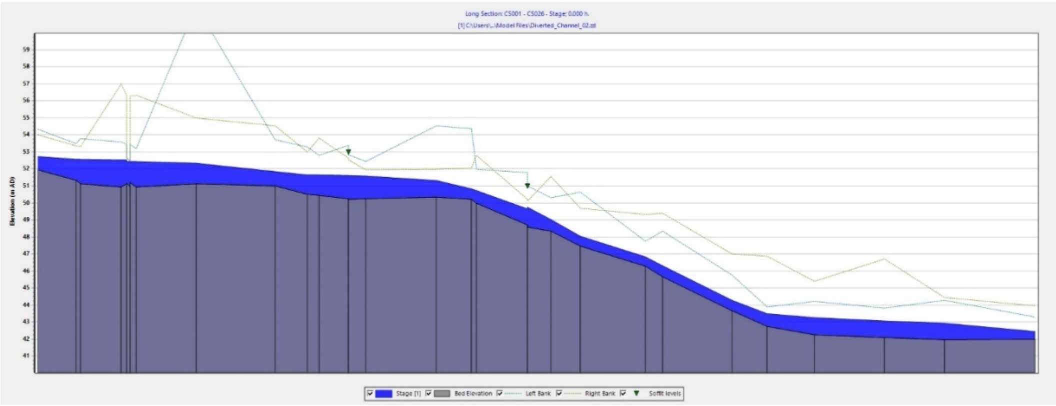


Plate 5 – Longitudinal Profile of Channel 01 with Realigned Channel under Q_{1000} scenario

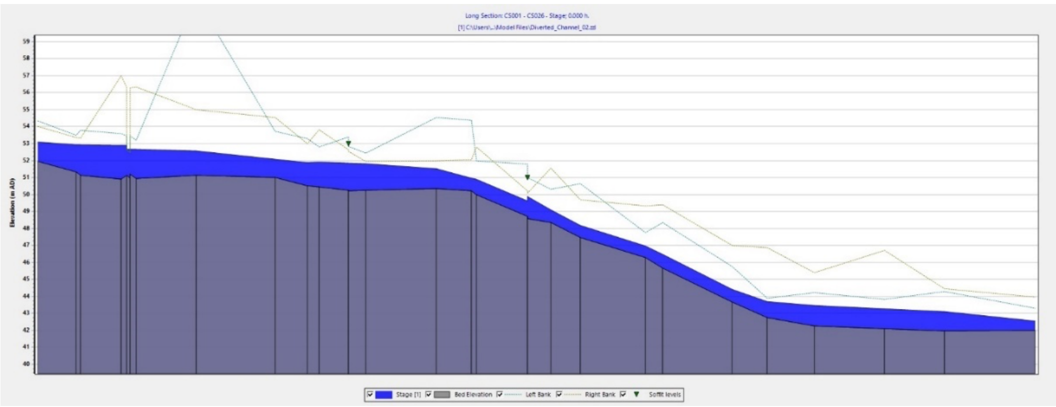


Plate 6 – Longitudinal Profile of Channel 02 with Realigned Channel under Q_{100} scenario

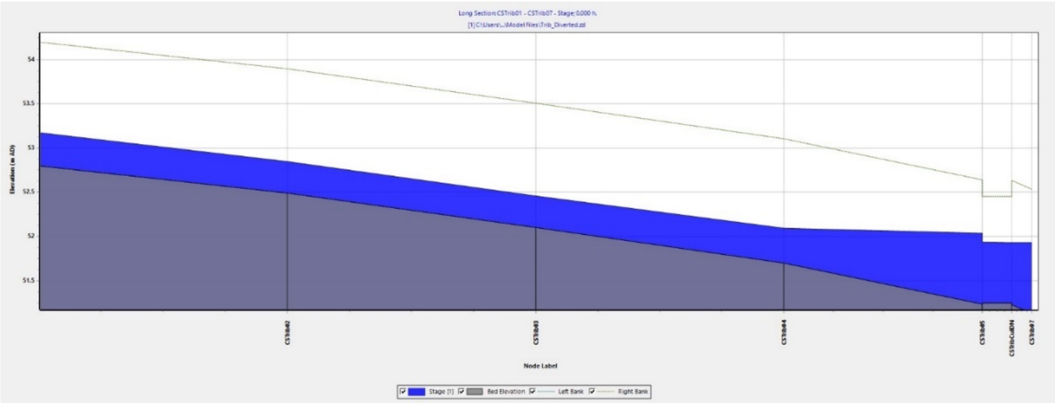
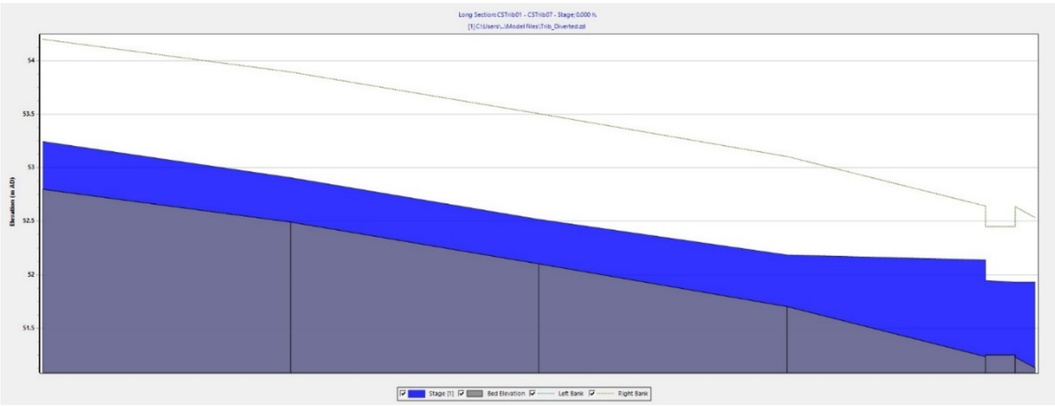


Plate 7 – Longitudinal Profile of Channel 02 with Realigned Channel under Q_{1000} scenario



6 MITIGATION

6.1 OPW SECTION 50

As the two proposed bridges cross a channel that is maintained as part of an arterial drainage scheme permission must be sought from the OPW by way of a Section 50 application. This is typically implied as a Condition of Planning. The proposed bridges have been designed to meet OPW criteria, i.e. that a where a channel is maintained as part of an arterial drainage scheme the opening must be capable of transmitting the Q_{100} with a 1.6 drainage factor applied, plus climate change.

The proposed 1,200 mm diameter culvert along Realignment 02 achieves the required standard of obtaining a 300 mm freeboard under the Q_{100} x 1.6 drainage factor.

6.2 FINISHED FLOOR LEVELS

In order to minimise potential flood risk at the development minimum finished floor level of any new building shall satisfy the 300 mm freeboard requirement above Q_{1000} flood levels, which have been adjusted for climate change.

Finished floor levels of specified proposed structures were assessed to see if this criteria was satisfied, through a comparison with the $Q_{1000 + cc}$ at the nearest adjacent cross section. This analysis is presented in

Table 10 and shows that:

- proposed FFL at structures numbered 3, 4, 5 and 6 needs to be raised 70 mm, from 51.15 mOD to 51.22 mOD;
- proposed FFL at structure numbered 22 needs to be raised 220 mm, from 51.00 mOD to 51.22 mOD.

Proposed FFL at all other structures are appropriate and satisfy the requirements of the Flood Risk Guidelines (2009).

Table 10 – Analysis of Proposed Finished Floor Levels

Item Number	Building/Item	Proposed FFL, mOD	Adjacent Cross Section	Q_{1000} + cc Flood Level	Amend Proposed FFL, mOD
1	400 kV Substation	49.65	CS057	48.19	
2	AIS 400 kV	50.25/53.00	Br2CSUp	49.63	
3	Transformers (OCGT)	51.15	CS050	50.92	51.22
4	House Transformers	51.15	CS050	50.92	51.22
5	OCGT Building	51.15	CS050	50.92	51.22
6	Admin./Control Building	51.15	CS050	50.92	51.22
9	Emergency Generators	51.50	CS050	50.92	
10	Firewater Pumphouse	51.50	CS050	50.92	
11	Fire Water Tanks	51.50	CS050	50.92	
12	Workshop & Storage	51.50	CS050	50.92	
13	Fuel Polishing Unit	51.50	CS050	50.92	
14	Fuel Storage Tanks	51.50	CS050	50.92	
15	Fuel Unloading	51.50	CS050	50.92	
19	IPP Building	53.15	Br1CSDn	51.86	
20	Transformer	53.00	Br1CSDn	51.86	
21	Temporary Construction Compound	53.50	Br1CSUp	51.87	
22	Gas Heater Compound	51.00	CS050	50.92	51.22
24	AGI Compound	54.50	Br1CSDn	51.86	
26	ESB Rural Supply	53.15	CS010	52.08	

6.3 STREAM REALIGNMENT METHOD STATEMENT

6.3.1 Introduction

The following method statement shall be made available to Galway County Council, National Parks and Wildlife Service, and Inland Fisheries Ireland for review prior to works commencing.

The method statement intends to describe programme of works relating to two drainage channel diversions and the subsequent infilling of existing drainage channels, outlining in broad terms the manner in which the different aspects of the work will be undertaken. These works are required to accommodate development works as part of Project Coolpowra.

The aim of this programme of works are as follows:

a. Excavate proposed realignment channels;

b. Decommission redundant stretches and structures;

c. Construction of two bridges along Channel 01

d. Installation of a new culvert on Channel 02;

e. Maximise potential for development of ecological habitat in the recommissioned channels. This will include suitability for fish passage, and provision of areas suitable for spawning;

f. Minimise the amount of damage to existing habitat when diverting flow from channel currently in use to new channel reach.

6.3.2 Cleaning Original Channels

The banks and bed of the original channel are heavily overgrown and require cleaning. This is necessary to ensure the cross-sectional area provides adequate conveyance capacity to transmit flood flows. All vegetation and excess silt in the original channel will be removed using an excavator.

It is acknowledged that there will be a temporary adverse impact to habitat associated with the removal of this vegetation. Once new vegetation is established, the longer-term impact will be positive.

6.3.3 Channel 01 Realigned Section Invert Levels

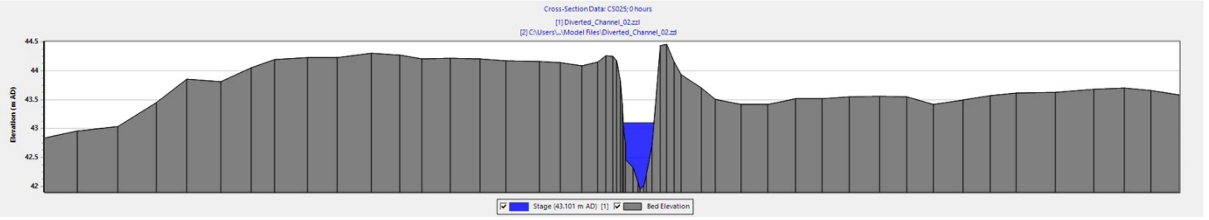
The gradient for the realigned channel in Channel 01 is 1.4%. Proposed inverts for each cross section along this reach are shown in Table 11.

Table 11 – Proposed Invert Levels on Specified Sections on Channel 01 Realigned Reach

Cross Section	Proposed Invert Elevation (mOD)
CS014	53.18
CS050	52.85
BRCSUP	52.46
BR2CSDN	52.09
CS051	52.04
CS057	51.94
CS058	51.93
CS020	51.93

The realigned Channel 01 will have a general cross section profile as shown in Plate 9.

Plate 8 – Proposed cross section dimensions in realigned section of Channel 01



6.3.4 Channel 02 Realigned Section Invert Levels

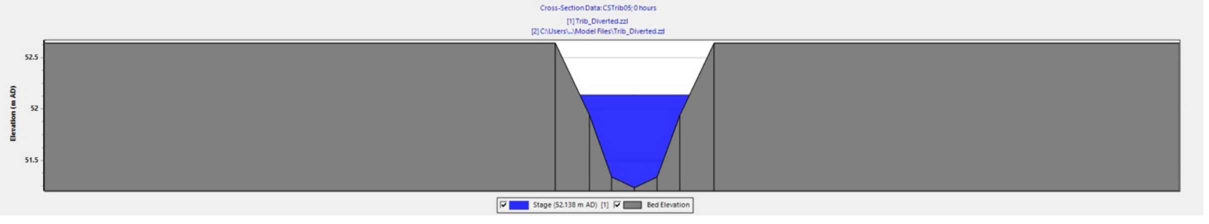
Proposed inverts for each cross section along Channel 02 reach are shown in Table 12.

Table 12 – Proposed Invert Levels on Specified Sections on Channel 01 Realigned Reach

Cross Section	Proposed Invert Elevation (mOD)
CSTrib01	52.80
CSTrib02	52.49
CSTrib03	52.10
CSTrib04	51.70
CSTrib05	51.25
CSTribCulUP	51.25
CSTribCulDN	51.25
CSTrib07	51.24

The realigned Channel 02 will have a general cross section profile as shown in Plate 9.

Plate 9 – Proposed cross section dimensions in realigned section of Channel 02.

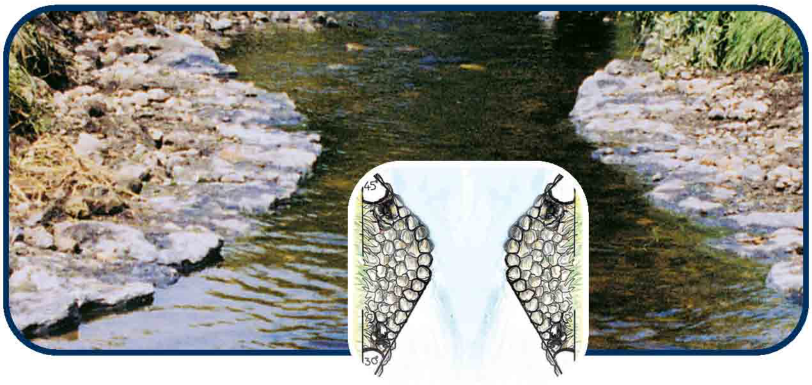


6.3.4.1 General Channel Modifications

The gradient across the Channel 01 route is moderate to high which means there is potential for introducing oxygen to the stream by way of cascades and turbulent zones. Velocity, and turbulence, can be increased slightly at minor narrowed sections in a low flow channel, as per Plate 10.

Rows of larger stones/boulders will be placed on the stream bed in flatter sections to create riffles. Where possible, the channel will be deepened on the outer side of any bends to create pools.

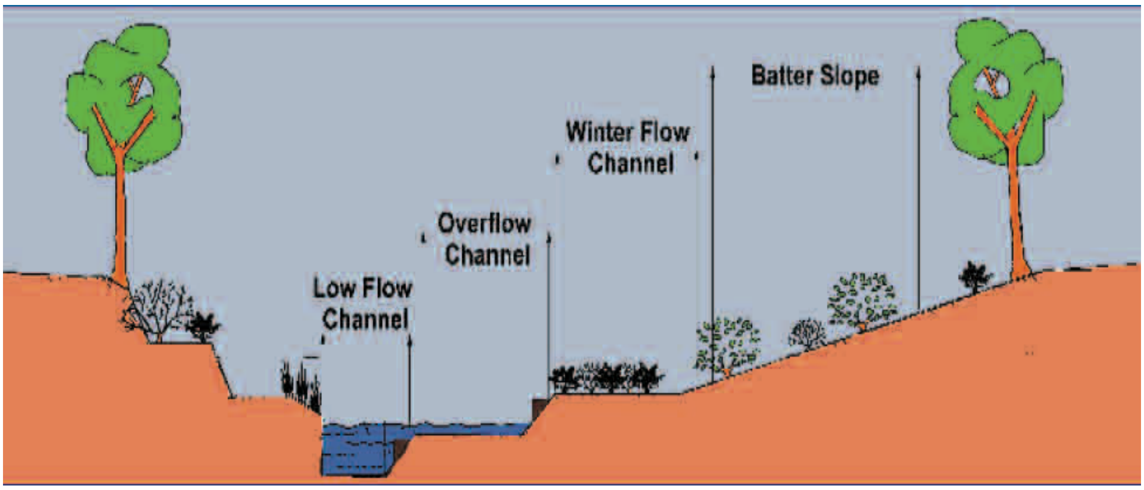
Plate 10 – Narrow river channel in low flow (IFI & OPW, 2010)



6.3.5 Channel Cross Sections

The width of the river channel will be reduced from the river bed to a height of 300 mm. This reduced width will be around 0.5 – 1.0 m. This has the effect of maintaining higher velocities in the wetted channel during normal and low flow regimes. The upper section of the profile will be wider, to provide a conveyance capacity capable of transmitting flood flows. A schematic is presented in Plate 11.

Plate 11 – Schematic of stream cross sectional profile (ERFB, 2011)



The inside of any channel bends will be landscaped with sloping marginal benches, as shown in Plate 12.

Plate 12 – Example of stepped bend of river bend

6.3.6 Channel Bank Vegetation

Any excavated soils will be stockpiled temporarily and used to cap the banks of the rehabilitated channel. This will promote establishment of vegetation.

The rehabilitated channel bank will be planted with native species that can be controlled/maintained to ensure conveyance capacity of channel is not significantly reduced by overgrowth in future. Grass and juvenile, native trees are deemed suitable. Trees will provide cover to pooled sections of the river channel.

Bank gradients should be such that no bank failure or slippages will occur in future.

6.3.7 Channel Opening

Works on the diverted channels will commence from the downstream end. Once the diverted channels and structures are fully complete, the existing channels can then be diverted and sealed off from any flow and infilled. Upon flow entering the diverted channels, a cofferdam should be placed at the downstream end of each diverted channel to trap excess sediment and prevent it entering the watercourses downstream of the site. Straw bales can be placed at increments along each diverted channel to trap sediment. Sediment removal can occur periodically over the first number of weeks following flow entering the diverted channels.

6.3.8 Hydrocarbons

Hydrocarbon spill kits will be on-site during works. Any fuels and lubricants will be stored in bunded compounds. Refuelling will be carried out safely and securely away from the river environs. Machinery will be fully inspected prior to, and during, the course of works for suitability. Support vehicles will remain on the tarmac / hard-core roadway.

6.3.9 Timing of Works

All works within the river channel shall be carried out between the months of August to September, to coincide with low stream flows and to avoid interference with spawning runs.

Bank maintenance works on existing sections, primarily involving the removal of scrub, should take place between October and March.

Following opening of the diverted channels, water flow will be maintained in the existing channels for a minimum period of 24 hours, to facilitate downstream migration of any insects/fish.

6.3.10 Invasive Species

Standard precautionary measures to be practiced for protection against risk of invasive species. Any machinery, including excavator and dumper will be cleaned with a pressure washer prior to arriving on site, and upon leaving site.

7 SUMMARY

Development works are proposed at a site in Coolpowra, Portumna, Co.Galway. The development consists of an upgrade and replacement of the existing 500kV AIS substation with a 400kV GIS substation, a reserve Gas-Fired Generator comprised of three OCGT Units and various alternative technology infrastructure.

Following groundtruthing it was confirmed that the proposed development site lies within a catchment that drains westwards to the Kilcrow River. A central channel runs through the site from the eastern to the western boundary. This channel is maintained as part of the Killimor Arterial Drainage Scheme with the result that many of the cross sections are deep and narrow. The surface water catchment to the downstream site boundary has an area of 2.0 km^2. Multiple field boundary drainage channels are present throughout the site, with one in particular noted as having a significant flow contribution to the overall site run-off.

A thorough desktop study confirmed that there are no indicators of historical flooding at the site nor is the site deemed to be within an area at risk of fluvial, pluvial or groundwater flooding.

Given the small catchment size the IH124 method was selected to estimate flood flows in the central channel as it flows through the site. Suitable adjustment factors, growth factors and climate change factors (+20%) were applied and the resultant Q_{100} and Q_{1000} flows at the downstream site boundary were calculated as 2.4 m^3/s and 3.16 m^3/s respectively.

A 1D-hydraulic model was compiled using site-specific data. Evenly spaced cross sections were surveyed along the central channel throughout the site and a tributary which extends to the south. The surveyed cross sections extended approximately 400 m downstream of the application site boundary.

The conveyance capacity of all surveyed cross sections along the central stream (Channel 01) and southerly drainage tributary (Channel 02) were assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. The simulation output showed that under Q_{1000} conditions the existing culverts at CS006 and CS016 are vulnerable to surcharge, but floodwaters are maintained within the upstream bank profile. Under the proposed development works, the culvert at CS016 is to be decommissioned following the proposed channel diversion upstream of the CS016 culvert.

Two culverts on the southern tributary surcharged, resulting in bank overtopping. The more southerly culvert is to be decommissioned while the culvert at the northern end of Channel 02 shall be upgraded.

The modelled reaches are to be re-aligned in two locations to facilitate efficient site layout. Two new bridge crossings are also proposed. Detailed design specifications are included for new bridge structures and the cross sections and longitudinal profiles of the realigned channel reaches. Additional mitigation measures are outlined to enhance habitat quality and biodiversity in the new channel reaches.

Following incorporation of the culvert upgrade, two channel realignments, and two new bridge structures modelling showed that that there will be no surcharge of flood water outside of the stream channel under Q_{1000} conditions, with a climate change factor included. Therefore, it can be confirmed that the application site is currently in Flood Zone C and will remain in Flood Zone C following proposed works (i.e. not at risk of flooding). The proposed works will not result in an increased flood risk within the site or downstream.

Subject to the proposed works being carried out in accordance with the specifications presented in this assessment, it can be concluded that the proposed development will not have a negative impact, in terms of flood risk, on the local drainage network, on local private property, or to the surrounding environment and human health.

Permission for the proposed bridges shall be sought from the OPW by way of Section 50 license applications.

8 REFERENCES

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The Planning System and Flood Risk Management. Department of Environment, Heritage and Local Government, Dublin.

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OPW, 2009. Report of the Flood Policy Review Group. Office of Public Works, Dublin.

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This report refers, within the limitations stated, to the condition of the site(s) at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the sites(s). The report is based on a visual site inspection and the physical investigation as detailed. Envirologic take no responsibility for conditions that have not been revealed due to lack of access. Whilst every effort has been made to interpret the conditions observed, such information is only indicative, and liability cannot be accepted for its lack of accuracy in representing geological/hydrological/hydrogeological conditions.

APPENDIX 9.1

AMBIENT AIR QUALITY SURVEY DATA – PASSIVE

Appendix 9.1

Diffusion Tube Air Quality Monitoring Surveys at Coolpowra Site

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information		**passive samplers**		**analysis**		**test report**	
customer:	Halston	date received:	12.03.2024	method:	SP12-S photometer, Salzmann	created on:	15.03.2024
customer ID:	ICH	type:	tube (Palms)	analyte:	[NO]-	created by:	K. Bodei
contact person:	Colm Staunton	pollutant:	NOx (NO+NO2)	date:	14.03.2024	checked on:	18.03.2024
project:		protective filter:	yes	place:	passam ag	checked by:	T. Hangartner
reference:	two weeks	limit of detection:	NO: 2.5 ug/m3 (14 days)			file name:	ICH12-S-2401
			NO2: 0.7 ug/m3 (14 days)			pages:	1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-1	IHC-1	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-102	2	2	45287	45301	08/02/2024		336.0	< 0.05	0.03	< 0.05	< 2.5	1.8	< 3.2	
AS-103	3	3	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-104	4	4	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-105	5	5	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement ICH12-S-2401

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	IHC-1	08/02/2024		22/02/2024		10		NA
AS-102	2	2	08/02/2024		22/02/2024		10		NA
AS-103	3	3	08/02/2024		22/02/2024		10		NA
AS-104	4	4	08/02/2024		22/02/2024		10		NA
AS-105	5	5	08/02/2024		22/02/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers

date received: 12.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis

method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report

created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102401
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-1	45306-4	08/02/2024	15:30	22/02/2024	09:00	329.5	0.251	-	0.253	< 0.72	< 2	
AS-102	2	45306-4	08/02/2024	16:00	22/02/2024	09:15	329.3	0.251	-	0.270	< 0.72	< 2	
AS-103	3	45306-4	08/02/2024	16:15	22/02/2024	09:30	329.3	0.251	-	0.250	< 0.72	< 2	
AS-104	4	45306-4	08/02/2024	16:30	22/02/2024	09:45	329.3	0.251	-	0.260	< 0.72	< 2	
AS-105	5	45306-4	08/02/2024	17:15	22/02/2024	10:00	328.8	0.251	-	0.262	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102401

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information Temp [°C]	Optional information air pressure [hPa]	Optional information Comment on sampling
AS-101	IHC-1	08/02/2024	15:30	22/02/2024	09:00	4		NA
AS-102	2	08/02/2024	16:00	22/02/2024	09:15	4		NA
AS-103	3	08/02/2024	16:15	22/02/2024	09:30	4		NA
AS-104	4	08/02/2024	16:30	22/02/2024	09:45	4		NA
AS-105	5	08/02/2024	17:15	22/02/2024	10:00	4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112401
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement	sample		result		Comment on the analysis
			start		end		exp. time	blank			m analyte/ sampler	C NH3	
	label	lot no.	date	time	date	time	[h]	[ABS]	dilution	value [ABS]	[ug]	[ug/m3]	
AS-101	IHC-1	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.133	0.55	0.8	
AS-102	IHC-2	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.416	2.47	3.7	sampler uncapped
AS-103	IHC-3	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.124	0.49	0.7	
AS-104	IHC-4	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.147	0.65	1.0	
AS-105	IHC-5	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.164	0.76	1.1	

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	08/02/2024		22/02/2024		4		NA
AS-102	IHC-2	08/02/2024		22/02/2024		4		NA
AS-103	IHC-3	08/02/2024		22/02/2024		4		NA
AS-104	IHC-4	08/02/2024		22/02/2024		4		NA
AS-105	IHC-5	08/02/2024		22/02/2024		4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers

date received: 14.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis

method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 22.03.2024
place: passam ag

test report

created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC12-S-2402
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
	NO2	NOx	NO2	NOx	date	time	h	NO ug	NO2 ug	NOx ug	NO ug/m3	NO2 ug/m3	NOx ug/m3	
AS-101	IHC-6	IHC-6	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.1	< 3.2	
AS-102	IHC-7	IHC-7	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-103	IHC-8	IHC-8	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-104	IHC-9	IHC-9	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-105	IHC-10	IHC-10	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2402

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers

date received: 14.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis

method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report

created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102402
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-6	45306-4	22/02/2024	09:00	07/03/2024	10:00	337.0	0.251	-	0.250	< 0.72	< 2	
AS-102	7	45306-4	22/02/2024	09:15	07/03/2024	10:15	337.0	0.251	-	0.256	< 0.72	< 2	
AS-103	8	45306-4	22/02/2024	09:30	07/03/2024	10:30	337.0	0.251	-	0.260	< 0.72	< 2	
AS-104	9	45306-4	22/02/2024	09:45	07/03/2024	10:45	337.0	0.251	-	0.264	< 0.72	< 2	
AS-105	10	45306-4	22/02/2024	10:00	07/03/2024	11:00	337.0	0.251	-	0.254	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102402

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information Temp [°C]	Optional information air pressure [hPa]	Optional information Comment on sampling
AS-101	IHC-6	22/02/2024	09:00	07/03/2024	10:00	10		NA
AS-102	7	22/02/2024	09:15	07/03/2024	10:15	10		NA
AS-103	8	22/02/2024	09:30	07/03/2024	10:30	10		NA
AS-104	9	22/02/2024	09:45	07/03/2024	10:45	10		NA
AS-105	10	22/02/2024	10:00	07/03/2024	11:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Mr.Colm Staunton
project:
reference: two weeks

passive samplers

date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis

method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report

created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112402
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ABS]	sample dilution	sample value [ABS]	m analyte/ sampler [ug]	C NH3 [ug/m3]	
AS-101	IHC-6	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.137	0.58	0.9	
AS-102	IHC-7	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.136	0.57	0.9	
AS-103	IHC-8	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.099	< 0.34	< 0.5	
AS-104	IHC-9	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.145	0.64	0.9	
AS-105	IHC-10	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.117	0.45	0.7	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112402

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 28.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 11.04.2024
place: passam ag

test report
created on: 11.04.2024
created by: U. Kunz
checked on: 11.04.2024
checked by: T. Hangartner
file name: IHC12-S-2403
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-11	IHC-11	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-102	IHC-12	IHC-12	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-103	IHC-13	IHC-13	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	Back with green membrane, uncapped!
AS-104	IHC-14	IHC-14	45287	45301	07/03/2024	11:00	358.0	0.09	0.02	0.12	4.5	1.4	6.0	Back with green membrane, uncapped!
AS-105	IHC-15	IHC-15	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2403

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers
date received: 28.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis
method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report
created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102403
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-11	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.263	< 0.72	< 1.9	
AS-102	12	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.264	< 0.72	< 1.9	
AS-103	13	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.262	< 0.72	< 1.9	
AS-104	14	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.265	< 0.72	< 1.9	
AS-105	15	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.268	< 0.72	< 1.9	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102403

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information Temp [°C]	Optional information air pressure [hPa]	Optional information Comment on sampling
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers

date received: 28.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis

method: SP11 photometer
analyte: Ammonium
date: 04.04.2024
place: passam ag

test report

created on: 04.04.2024
created by: U. Kunz
checked on: 04.04.2024
checked by: T. Hangartner
file name: IHC112403
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ABS]	sample dilution	sample value [ABS]	m analyte/ sampler [ug]	C NH3 [ug/m3]	
AS-101	IHC-11	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.337	1.95	2.7	
AS-102	IHC-12	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.189	0.94	1.3	
AS-103	IHC-13	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.173	0.83	1.2	
AS-104	IHC-14	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.150	0.68	0.9	
AS-105	IHC-15	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.192	0.96	1.3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112403

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	start time	end date	end time	Optional information Temp [°C]	air pressure [hPa]	Comment on sampling
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

APPENDIX 9.2

AMBIENT AIR QUALITY SURVEY DATA – ACTIVE

Appendix 9.2

Continuous Ambient Air Quality Monitoring Surveys at Coolpowra Site

Figure A9.2.1 Continuous monitoring results NO_2

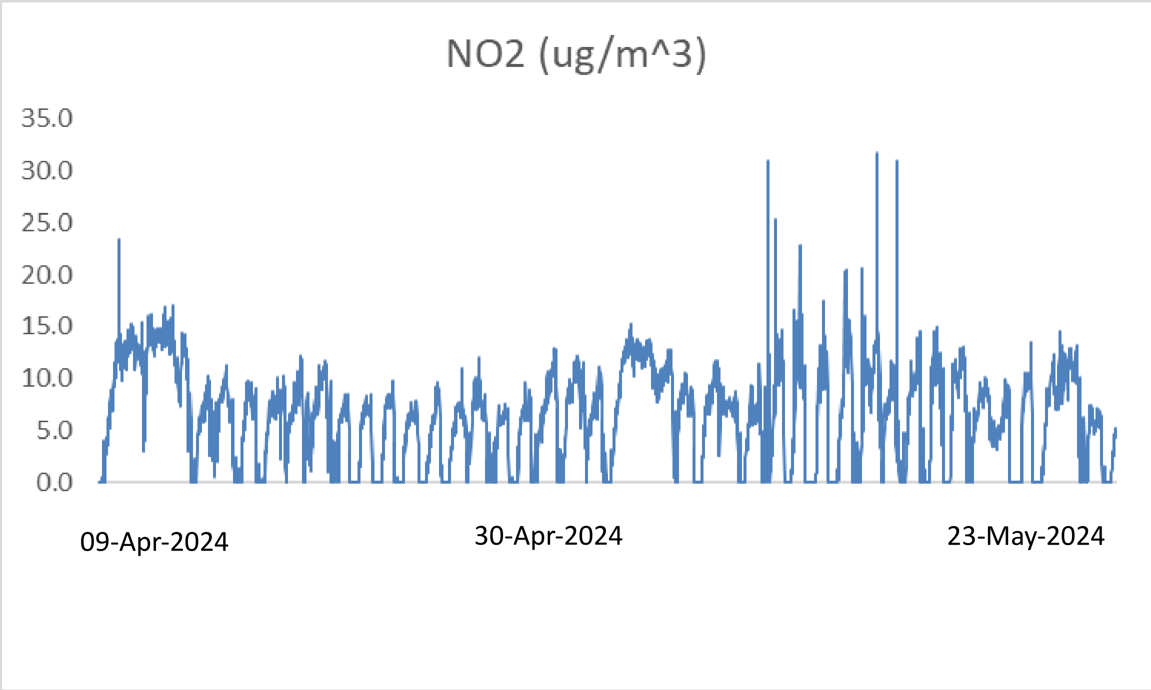


Figure A9.2.2 Continuous monitoring results NO

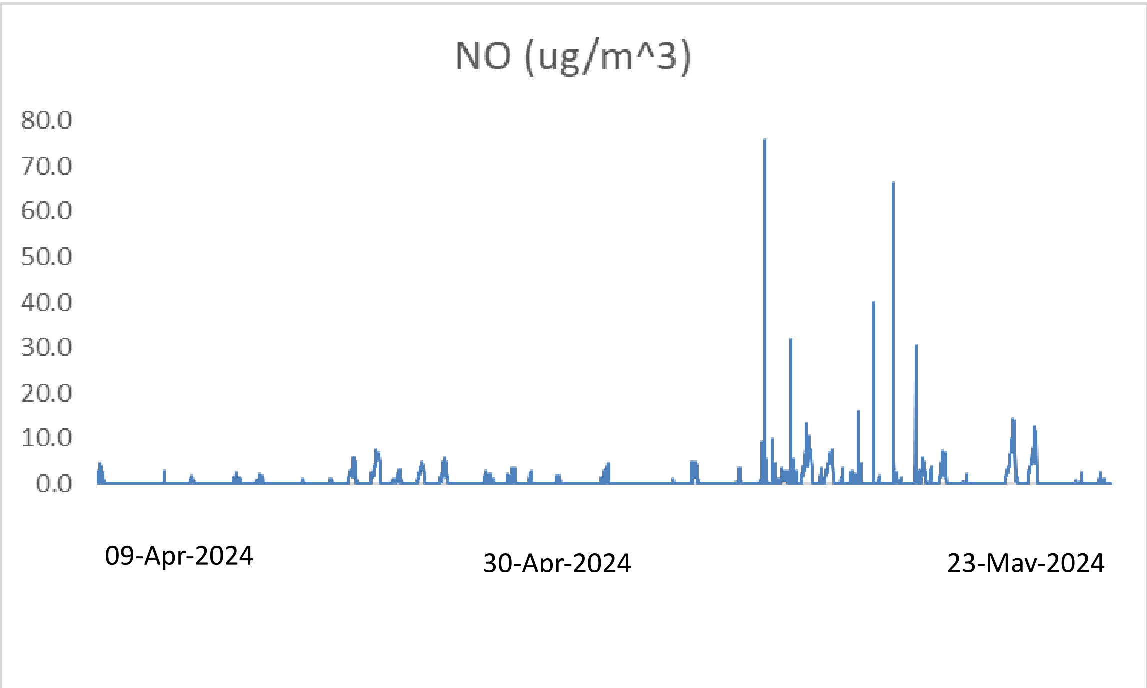
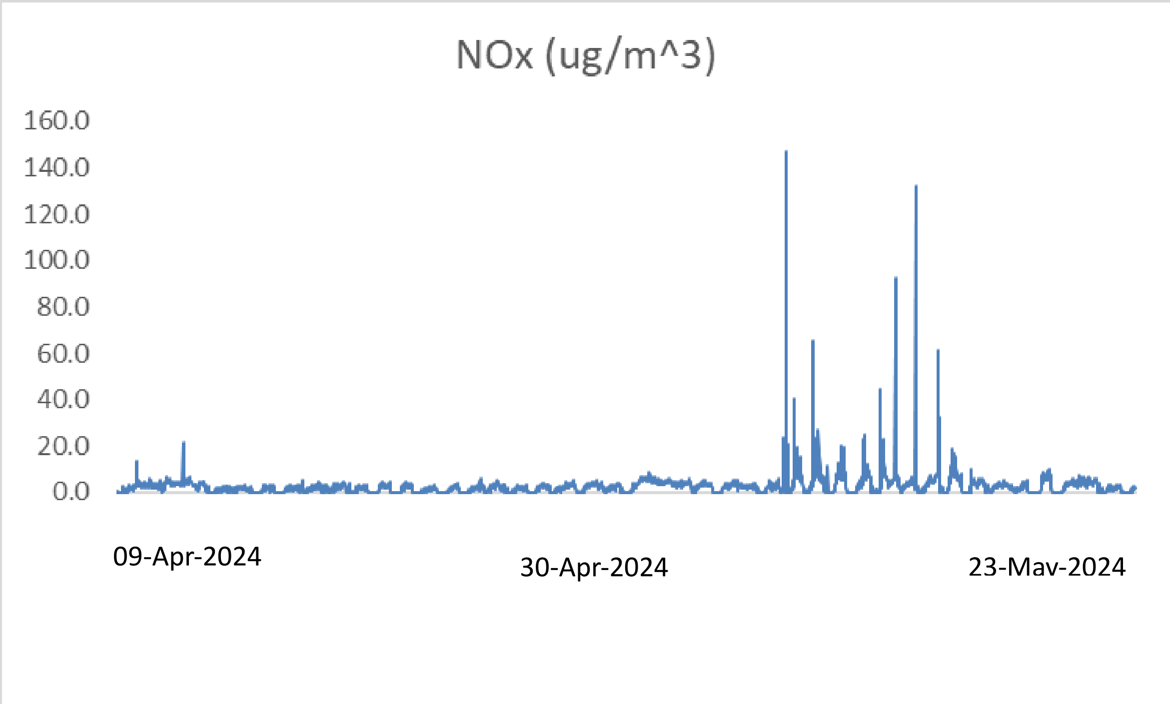


Figure A9.2.3 Continuous monitoring results NO_x



Date	PM10	PM1	PM2.5
09/04/2024	3.56	1.68	3.5
10/04/2024	2.18	1.31	2.15
11/04/2024	6.86	4.4	6.85
12/04/2024	1.76	0.93	1.65
13/04/2024	4.56	2.38	4.51
14/04/2024	4.92	2.45	4.88
15/04/2024	6.48	3.54	6.47
16/04/2024	4.67	2.47	4.66
17/04/2024	4.37	2.07	4.31
18/04/2024	4.41	2.39	4.39
19/04/2024	1.66	0.89	1.63
20/04/2024	2.92	1.87	2.87
21/04/2024	3.85	2.68	3.81
22/04/2024	2.8	1.69	2.71
23/04/2024	2.08	1.06	2.04
24/04/2024	4.73	2.39	4.67
25/04/2024	3.14	1.69	3.12
26/04/2024	2.16	1.44	2.13
27/04/2024	2.1	1.46	2.03
28/04/2024	2.04	1.25	1.93
29/04/2024	1.51	0.77	1.45
30/04/2024	1.78	0.9	1.66
01/05/2024	1.88	0.97	1.84
02/05/2024	2.38	1.62	2.32
03/05/2024	1.66	0.75	1.52
04/05/2024	1.94	1.01	1.89
05/05/2024	1.88	1.1	1.75
06/05/2024	2.66	1.7	2.58
07/05/2024	4.27	2.28	4.2
08/05/2024	3.44	2.16	3.33
09/05/2024	2.93	2.11	2.83
10/05/2024	3.45	2.49	3.39
11/05/2024	5.18	4.1	5.17
12/05/2024	5.61	4.44	5.53
13/05/2024	1.36	0.74	1.25
14/05/2024	2.63	1.58	2.54
15/05/2024	1.66	1.04	1.64
16/05/2024	3.64	2.66	3.45
17/05/2024	3.75	2.49	3.68
18/05/2024	2.91	1.93	2.88
19/05/2024	1.85	1	1.65
20/05/2024	3.09	2	3
21/05/2024	2.57	1.96	2.44
22/05/2024	1	1.87	1.69
23/05/2024	1.58	3.18	3.05
Average 24-hr	***3.1***	***2.2***	***3.0***

APPENDIX 9.3

AIR QUALITY DISPERSION MODELLING REPORT

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monitoring and
environmental consultancy

25
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Fax: +353-1-4626714
Web: www.tmsenv.ie

DISPERSION MODELLING ASSESSMENT OF AIR QUALITY IMPACTS OF PROPOSED RESERVE GAS FIRED POWER GENERATION PLANT AT COOLPOWRA, CO. GALWAY

Report Ref. 33186-1

TMS Environment Ltd.

Revised 01 June 2024

Approved By: Imelda Shanahan

Dr Imelda Shanahan

Technical Manager

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1.0 INTRODUCTION AND SCOPE

This report deals with an assessment of the potential impacts on air quality of emissions to atmosphere from the proposed Reserve Power plant at Coolpowra The purpose of the report is to provide information in relation to the quantitative assessment of air quality impacts associated with the emissions from the facility. The report presents the results of air quality dispersion modelling to evaluate the impact of potential emissions from the facility on ambient air quality, human health and ecosystems.

2.0 DESCRIPTION OF PROCESS AND SOURCES OF EMISSIONS TO ATMOSPHERE

2.1 Site location and layout

The facility is located on lands at Kiltotan, Collinstown Oldtown, Co. Westmeath as shown in Figure 2.1. The layout of the site and primary elements of each area are shown in Figure 2.2.

Figure 2.1 Site location

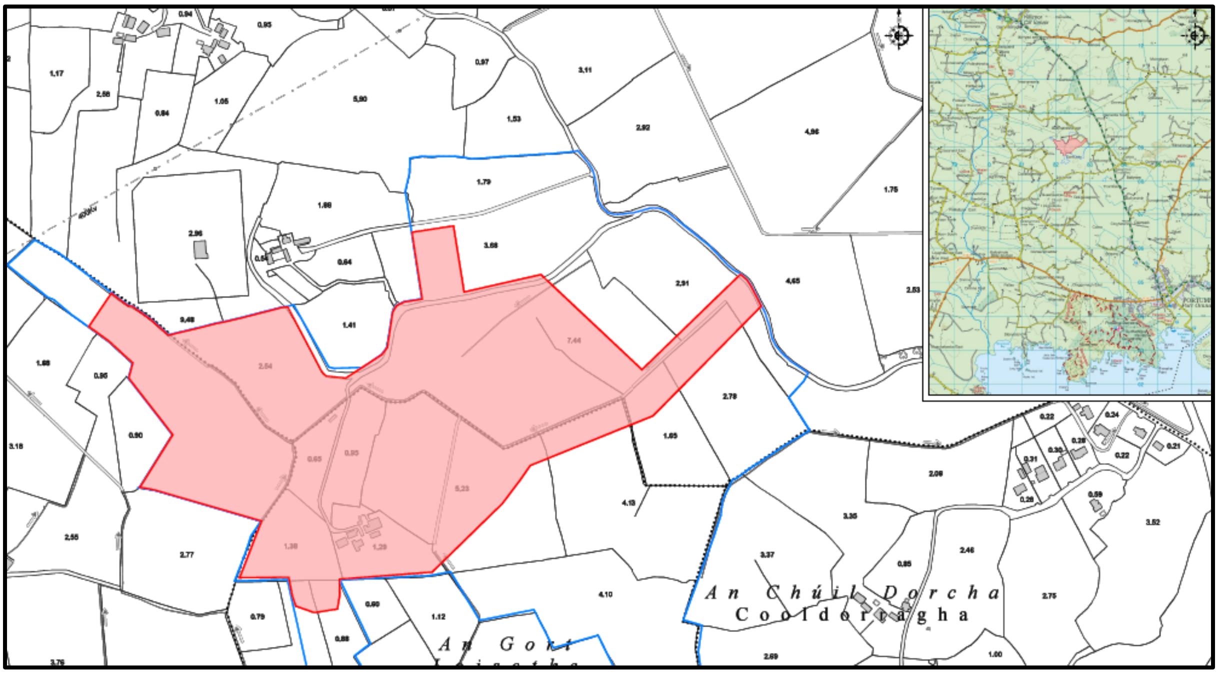
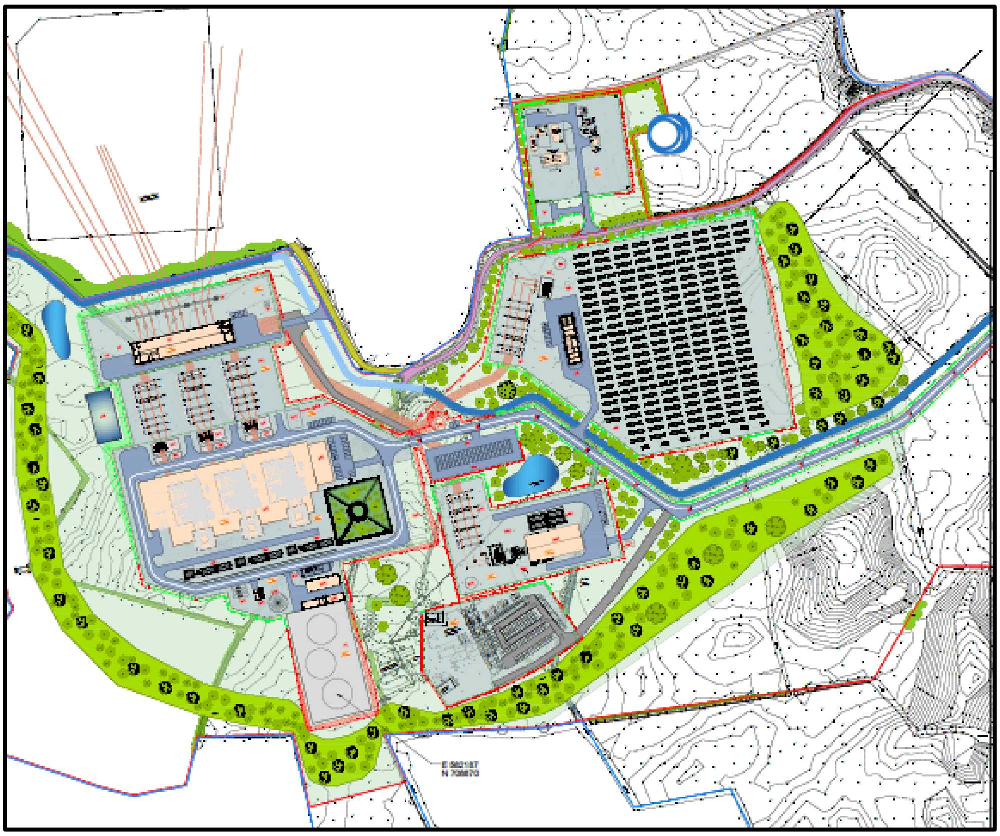


Figure 2.2 Outline of Proposed Development



2.2 Process Description

The overall proposed development for which planning permission is sought comprises three elements – the Reserve Gas-Fired Generator, the GIS Electrical Substation and the proposed Energy Storage System (ESS) using long duration energy storage (LDES) battery technology and synchronous condenser technology. A single Environmental Impact Assessment Report (EIAR) has been prepared for all three projects proposed as part of the development. The potential environmental impacts from each project are assessed individually and cumulatively (with each other and with any other identified projects) within the EIAR.

The Reserve Gas-Fired Generator project will combust natural gas supplied from the Gas Networks Ireland (GNI) transmission system in three (3 No.) open-cycle gas turbines (OCGT) and associated infrastructure. GNI will separately manage the process of managing and delivering the underground natural gas pipeline to the proposed site. In accordance with the requirements of the Commission for Regulation of Utilities (CRU), the proposed OCGT units are dual fuel units. Natural gas will be the primary combustion fuel to each of the OCGT units when operating, with gas oil as the secondary fuel. In order to ensure compliance with the requirements set by the CRU in the event of interruptions to the natural gas supply, the Reserve Gas-Fired Generator is capable of running continuously for 72 hours using secondary fuel.

The Electrical Substation project will enhance and upgrade the existing Oldstreet AIS 400kV substation and will provide for the connection of the Reserve Gas Fired Power Generator and Energy Storage System to the electricity transmission network. The GIS substation itself includes a two storey building and associated ancillary site development works.

The proposed Energy Storage System (ESS) facility comprises a Long Duration Energy Storage (LDES) static battery positioned within a secure outdoor compound, and a Synchronous Condenser which will operate within a building in a separately secured compound. The LDES will provide peaking, active power and back start capability services to the electricity grid.

The potential emissions to atmosphere during operation are limited to those from the Reserve Gas Fired Generator since there are no operation phase emissions associated with either the GIS or ESS projects.

2.2 Sources and characteristics of emissions to atmosphere

The most significant potential impacts are emissions of combustion gases such as CO, SO_2, PM_{10} and NO_2 from the gas turbines and associated back up and emergency units.

Sulfur dioxide emissions originate from the sulfur in the fuel used in the combustion process. Since natural gas is the principal fuel to be used sulfur dioxide emissions will be negligible for normal operating conditions. Nitrogen oxides are also present in the emission stream as a result of the combustion process. Much of the emissions are in the form of nitrogen oxide (NO) which is expected to be substantially oxidised to nitrogen dioxide in the atmosphere. Nitrogen oxide emissions from sources using natural gas as fuel are significantly lower than the emissions associated with other fuels. For the Reserve

Power plant project, low emission DLE burners will be employed which reduces the nitrogen oxide emissions.

Particulate matter and carbon monoxide may also arise from the combustion process in the emission stream but only in minor amounts. Again, natural gas is a very clean fuel and particulate emissions are predicted to be very low.

There is the potential for a number of greenhouse gas emissions to atmosphere which may give rise to CO_2 emissions.

There is a requirement to run the turbines using gas oil to ensure that there is always a guaranteed energy supply and substances released in the emissions to atmosphere from the use of gas oil are the same as those associated with natural gas combustion. Emissions when using gas oil will be slightly higher for sulfur dioxide since there is a higher sulfur content in the fuel.

In addition to considering the actual or expected emissions that are released to atmosphere, the requirements of the Large Combustion Plant Regulations, European Union (Large Combustion Plants) Regulations are also considered. The relevant Emission Limit Values from the Regulations are the maximum emissions that will be permitted from the proposed facility and therefore these represent the worst case emissions scenario for the assessment.

The potential emissions to atmosphere include particulates (including fine particulate matter PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), water vapour. The pollutants of particular concern include NO_2 and NO_x, and SO_2 all of which have specific standards to be achieved, and it is these pollutants that are modelled to assess the impact of emissions from the combustion plant on air quality in the vicinity of the development.

3.0 AIR QUALITY IMPACT ASSESSMENT METHODOLOGY

3.1 Impact assessment methodology

The impact of emissions to atmosphere on air quality is assessed using a dispersion modelling assessment approach. This approach involves computation of predicted incremental contributions to ground level concentrations of pollutants over defined averaging intervals as a result of emissions from the combustion plant. The predictions are then compared with relevant Air Quality Standards to determine whether the impact on air quality meets the requirements of the Standards. The general approach is summarised as follows:

- Review of local air quality data in the area surrounding the site;
- Review of the nearest building arrangements and locations of human receptors in the area;
- Identification of non-statutory ecological receptors within 2 km of the site and statutory ecological receptors within 15 km of the site;
- Dispersion modelling of combustion plant emissions to predict process contributions (PCs) at identified sensitive receptors for comparison against relevant Air Quality Standards;

Guidance on air emissions risk assessments was published by the UK Government for developments which require an environmental permit under the Environmental Permitting (as Amended) Regulations 2016 (EPR). For those emissions that cannot be screened out the guidance states that detailed modelling must be carried out of the emissions. The screening assessment screened out emissions of particulate matter (including PM_{10} and $PM_{2.5}$) as insignificant. Nitrogen oxides, carbon monoxide and sulfur dioxide were considered relevant as they are regulated pollutants and a detailed dispersion modelling assessment was carried out for those pollutants. Particulate matter (including PM_{10} and $PM_{2.5}$) was included in the assessment when gas oil is used as fuel.

Guidance has also been issued by the EPA in the AG4 Guidance Note and this Guidance was followed in the assessment.

3.2 Impact assessment criteria

The assessment of impact significance is based on a comparison of predicted impacts with air quality standards and guidelines, and consideration of the magnitude and duration of the potential impact.

Air Quality Standards in Ireland have been defined to ensure compliance with EC Directives; they are developed at different levels for different purposes. European legislation on air quality has been framed in terms of two categories, limit values and guide values. Limit values are concentrations that cannot be exceeded and are based on WHO guidelines for the protection of human health. Guide values are set as a long-term precautionary measure for the protection of human health and the environment. The WHO guidelines differ from EU air quality standards in that they are primarily set to protect public health from the effects of air pollution, whereas Air Quality Standards are recommended by governments, and other factors such as socio-economic factors, may be considered in setting the standards.

The Clean Air for Europe (CAFE) Directive (Council Directive 2008/50/EC) is an amalgamation of the Air Quality Framework Directive and its subsequent daughter Directives and sets out limit and target values for named air quality parameters. The fourth daughter Directive (European Parliament 2004) also sets out limit values to be met for certain air quality parameters. The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2022 (S.I. No. 739 of 2022).

The air quality standards and guidelines referenced in this report are summarized in Table 3.1. The Clean Air for Europe (CAFE) Directive (Council Directive 2008/50/EC) was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). This Directive and the Irish Regulations set out the main standards against which the potential impact of the development on air quality are assessed.

In addition to the Air Quality Standards Regulations and the Directive Standards, it is also appropriate to consider the World Health Organisation (WHO) Guidelines. These guidelines were developed by the WHO to provide appropriate air quality targets worldwide, based on the latest health information available. The air quality guidelines for particulate matter (PM_{10}), nitrogen dioxide and sulfur dioxide, and $PM_{2.5}$ are considered in this report (WHO, 2005; updated in 2008 and in 2021). While the WHO Guidelines are not mandatory, they represent current informed opinion on the levels to which we should be aspiring in order to minimise adverse health impacts of air pollution. The WHO guidelines referenced in this report are summarized in Table 3.2.

The potential impact of the emissions on ecosystems is considered using the gaseous nitrogen oxides concentration. An Air Quality Standard expressed in concentration terms has been defined for the protection of vegetation and this standard is one of the benchmarks against which the impact of the facility is assessed.

The potential impact of nitrogen deposition in sensitive ecosystems was evaluated by comparing the modelled nitrogen deposition rate with the critical loads for the relevant habitat. The most sensitive habitat for this purpose is bog ecosystems and a recommendation of 5kg N ha-1 year-1 has been made as the critical load for habitat protection [UNECE 5 – 10 kg N ha-1 year-1 and EPA Research Report 390: Nitrogen–Sulfur Critical Loads: Assessment of the Impacts of Air Pollution on Habitats (2016-CCRP-MS.43) 5kg N ha-1 year-1].

3.3 Dispersion Model Selection

Computerised mathematical dispersion models are used to predict the incremental additions to ground level concentrations of relevant criteria pollutants as a result of emissions from a given development. A detailed modelling assessment was undertaken using the US EPA Model AERMOD Prime, AERMOD Version 23132, which is the current regulatory version of this Model. AERMOD is currently the most widely used air quality modelling tool and has been widely used in studies of this type in relation to regulated facilities.

The model computes average ground-level concentrations of pollutants emitted from either elevated or ground-level emission sources. Separate utilities associated with the dispersion modelling software allow computation of ground-level concentrations of pollutants over defined statistical averaging periods, and additional features permit suitable consideration to be given to building downwash effects and the effects of elevated terrain in the vicinity of the plant.

Table 3.1 Air Quality Standards Regulations 2011 (based on EU Clean Air For Europe [CAFE] Directive 2008/50/EC)

Pollutant	EU Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	None	200 $\mu g/m^3$ NO_2
		Annual limit for protection of human health	None	40 $\mu g/m^3$ NO_2
		Annual limit for protection of vegetation	None	30 $\mu g/m^3$ $NO + NO_2$
Sulfur Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 $\mu g/m^3$	350 $\mu g/m^3$
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 $\mu g/m^3$
		Annual & Winter limit for the protection of human health and ecosystems	None	20 $\mu g/m^3$
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 $\mu g/m^3$
		Annual limit for protection of human health	20%	40 $\mu g/m^3$
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health (Stage 1)	20% from June 2008. Decreasing linearly to 0% by 2015	25 $\mu g/m^3$
		Annual limit for protection of human health (Stage 2)	None To be achieved by 2020	20 $\mu g/m^3$
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m^3 (8.6 ppm)

NOTE
The Air Quality Standards Regulations 2022 (SI 739 of 2022) transposed EU Directive 2008/50/EC (CAFE) into Irish law.

Table 3.2 WHO Air Quality Standards

Pollutant	Averaging time	Interim target				2021 Guidelines
		1	2	3	4	
Particulate matter (as $PM_{2.5}$), µg/m^3	Annual limit for protection of human health	35	25	15	10	5
	24-hour limit for protection of human health Note [1]	75	50	37.5	25	15
Particulate matter (as PM_{10}), µg/m^3	Annual limit for protection of human health	70	50	30	20	15
	24-hour limit for protection of human health Note [1]	150	100	75	50	45
Ozone, µg/m^3	Peak season Notes [2]	100	70	NA	NA	60
	8-hour Note [1]	160	120	NA	NA	100
Nitrogen Dioxide, µg/m^3	Annual limit for protection of human health	40	30	20	NA	10
	24-hour limit for protection of human health Note [1]	120	50	NA	NA	25
Sulfur Dioxide, µg/m^3	24-hour limit for protection of human health Note [1]	125	50	NA	NA	40
Carbon Monoxide, mg/m^3	24-hour limit for protection of human health Note [1]	7	NA	NA	NA	4

Note [1] Expressed as the 99th percentile

Note [2] Average of daily maximum 8-hour mean O_3 concentration in the six consecutive months with the highest six-month running-average O_3 concentration.

3.4 Dispersion Model Assumptions and Limitations

The inherent assumptions of the dispersion Model and associated limitations are summarised as follows.

- The model is based on a five-year meteorological dataset collected from the nearest meteorological stations. Since the meteorological data are not collected at the specific facility location being assessed, this is a limitation of the Model. This is not a significant factor for the current study as the data was sourced from a nearby recording station which is considered representative of the site.
- The model assumes steady-state meteorological conditions that are invariant over the entire model space for each hour modelled, and as such, has reduced accuracy in areas where significant variations in meteorological conditions exist. For instance, AERMOD cannot be used to incorporate highly variable wind patterns caused by changes in terrain elevations, and modelling across complex terrains may result in over-predictions. This is not a significant factor for the current study.
- AERMOD is the Gaussian model recommended by the US EPA for short-range transport of pollutants, up to 50 km from the source. At distances beyond 50 km, steady-state Gaussian plume models like AERMOD tend to over-estimate pollutant ground concentrations, because the model maintains constant wind patterns that are unlikely to persist over long distances. This is not considered significant for the current study due to the relatively low stack height and emission rates and the anticipated dispersion pattern.
- The model cannot be used to model reactive pollutants (e.g., ozone). This is not significant for the current study.

An evaluation of the impact of these limitations concluded that there is no significant adverse impact on the reliability of the Model for the current study.

3.5 Dispersion Modelling Protocol

3.5.1 Dispersion Model Inputs

Evaluation of the impact of a proposed development on air quality using dispersion modelling requires information on the following:

- Emissions characteristics
- Site layout and topography
- Meteorological data
- Averaging intervals
- Receptor locations

Of these, the most significant input parameters are the emissions characteristics and the site layout and topography and surrounding terrain features.

3.5.2 Emissions Characteristics and special treatments

Emission characteristics predicted for the emission sources are summarised in Table 3.3. Information on dimensions and physical characteristics of the main emission sources was obtained from the developer and from a consideration of the nature and scale of the processes that will be carried out at the plant, the chemical composition of the fuels, information supplied by the manufacturers of the plant, and consideration of the levels of emissions that would normally be expected from a plant of this type.

The worst possible emissions scenario is one where the maximum permissible emission rates from the plant occur. For the purposes of modelling and air quality impact assessment, the maximum possible emission values were used in accordance with relevant Guidance. The maximum permissible emission limits are the Large Combustion Plant Emission Limit Values for nitrogen oxides (Section 2.2), carbon monoxide, sulfur dioxide and PM_{10}. The maximum potential sulfur dioxide (SO_2) emission rates are derived from the fuel usage rate and permissible sulfur content. Best practice guidance requires that the impact assessment must represent a worst-case emissions scenario, thereby determining the maximum potential impact of plant emissions on ground level concentrations of pollutants in the vicinity of the plant.

The emissions to atmosphere arise due to the combustion process. The three (No.) Open

Cycle Gas Turbines (OCGT) are intended to run on natural gas but provision is made to use Gas oil as a back-up fuel for emergencies. Consequently both scenarios are considered in the assessment. In addition, the Emergency Generators may be required in emergency situations to start the turbines in which case they would be used to start the first turbine which will then be used for the remaining starts; their operation is therefore very limited.

The dispersion model considered a number of possible operating scenarios as follows.

(i) OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500hours)

A conservative assumption of 1500 operating hours per year was made with units expected to run for much shorter times. An assumption of 2 hours operation per day during the morning (06:00 – 08:00) and evening (16:00 – 19:00) peak demand periods was made. The turbines start very quickly and reach steady state normal operation in approximately 10 minutes. The assessment assumes that 30% of the operating hours are start-up or shut down for the purpose of modelling. The use of gas oil fuel is tested every month and a run time of 2 hours per month is assumed for the testing. The Emergency Generators are tested for 8 hours every month and this has been included in all model runs.

(ii) OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation)

A conservative assumption of full time operation using natural gas as fuel was made to ensure that all worst case meteorological conditions were investigated. This is an unrealistic scenario and is not expected to occur. However the test is a useful sensitivity test to test the sensitivity of the model predictions to the meteorological conditions for the short term one-hour averaging periods. The Emergency Generators are tested for 8 hours every month and this has been included in all model runs.

(iii) OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation)

A conservative assumption of full time operation of the turbines using gas oil as fuel was made to consider what would occur in the event of a national gas distribution network outage and to ensure that all worst case meteorological conditions were investigated. This is an unrealistic scenario and is not expected to occur. However the test is a sensitivity test to test the sensitivity of the model predictions to the meteorological conditions for the short term one-hour averaging periods and to the use of diesel instead of natural gas. The Emergency

Generators are tested for 8 hours every month and this has been included in all model runs.

(iv) OCGT Operating Scenario #4: Gas Oil fuel (500 hours per annum)

An assumption of 500 operating hours per year was made. The units are required to be capable of operating on gas oil and a 72-hour gas oil fuel reserve has been specified by the Commission for Regulation of Utilities. This operating scenario was assessed on an assumption that the operating hours would run continuously and separately as an average across the entire year and the worst case outcome was reported for evaluation. The use of gas oil fuel is tested every month and a run time of 2 hours per month is assumed for the testing. The Emergency Generators are tested for 8 hours every month and this has been included in all model runs.

(v) Emergency Generators

These units will run in emergencies and will be tested once every month. For the purpose of this assessment a Model run was executed with the units operating every month for 8 hours. This run was assimilated into all of the main operating scenarios.

These operating scenarios represent conservative approaches and will lead to an overestimate of the predicted ambient concentrations beyond the site boundary. The stack height for the assessment was determined to be 45m and the detailed assessment as reported in Appendix 9.3 also considered alternative stack heights as discussed below.

In most combustion processes, NO_x is emitted almost totally in the form of nitric oxide (NO). Nitrogen oxides are very reactive and also contribute, due to the formation of nitrogen dioxide from nitric oxide, to the phenomenon of photochemical ozone formation. These transformations are generally of greatest concern in the areas where the highest ozone concentrations occur – for example, in rural areas in late afternoon in summer time. Unless photochemical dispersion models are used for the assessment of impacts associated with the release of nitrogen oxides from point emissions sources, then assumptions must be made regarding the rate and extent of conversion of NO to NO_2. For the current study, Guidance from the EPA taken from the Air Dispersion Modelling Guidance Note AG4 was followed whereby a default annual ratio of 1.00 and a default 1-hour NO_2/NO_X ratio of 0.50 was used for the conversion of NO_X to NO_2.

The EPA Guidance notes that a site-specific ratio at the point of maximum concentration may be used if extensive continuous monitoring data (one-year or greater) is available at this location, but the site-specific ratio will only be valid for locations which are a similar distance from the source as the monitoring station. The limited on-site data suggests a ratio close to 1 for the long term data which is consistent with the EPA default values.

Table 3.3 OCGT Stack and emission characteristics

Emission Point	Stack Co-ordinates		Stack Height, m	Exit Diameter, m	Exit Area, m^2
OCGT #1	5489774	5887146	45	6.8	36.31
OCGT #2	549017	5887156	45	6.8	36.31
OCGT #3	549056	5887164	45	6.8	36.31
Emergency Generator #1	549010	5887111	4.755	0.5	0.196
Emergency Generator #2	549011	5887108	4.755	0.5	0.196
Emergency Generator #3	549012	5887104	4.755	0.5	0.196

UTM Coordinate system

Table 3.4a Process emissions data for proposed Reserve Power plant (Natural Gas Fuel)

Emission Point	Fuel Type	Temperature K	Flow Nm^3/hour	Exit velocity m/sec	NO_x Emission		CO Emission		SO_2 Emission		PM_{10} Emission	
					mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec
OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500 hours per annum); maximum daily emission rate												
OCGT #1-#3	Natural gas (1500 hr pa)	883.15	7,498,800	57.36	50	104.15	100	208.30	Note 3	Note 3	Note 3	Note 3
OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500 hours per annum); annual average emission rate												
OCGT #1-#3	Natural gas (1500 hr pa)	883.15	7,498,800	57.36	35	72.91	40	83.32	Note 3	Note 3	Note 3	Note 3
OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation); maximum daily emission rate												
OCGT #1-#3	Natural gas (Full time)	883.15	7,498,800	57.36	50	104.15	100	208.30	Note 3	Note 3	Note 3	Note 3
OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation); annual average emission rate												
OCGT #1-#3	Natural gas (Full time)	883.15	7,498,800	57.36	35	72.91	40	83.32	Note 3	Note 3	Note 3	Note 3

Notes:
1. Emissions are stated at STP.
2. Start up duration 10 minutes; model conservatively assumes 0.33 hr duration.
3. SO_2 and PM_{10} emissions are negligible for natural gas combustion and are therefore screened out of assessment
4. The dispersion model ran the maximum permissible daily emission rates as worst case scenario for full time operation on natural gas; the annual average emissions were assessed separately

Table 3.4b Process emissions data for proposed Reserve Power plant (Gas Oil fuel) for full time operation

Emission Point	Fuel Type	Temperature K	Flow Nm^3/hour	Exit velocity m/sec	NO_x Emission		CO Emission		SO_2 Emission		PM_{10} Emission	
					mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec
OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation) Maximum daily emissions												
OCGT #1-#3	Gas oil (Full time)	808.15	6,732,000	51.49	50	93.5	100	187.0	66	123.42	10	18.70
OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation) Annual average emissions												
OCGT #1-#3	Gas oil (Full time)	808.15	6,732,000	51.49	NS	NS	NS	NS	60	112.20	5	9.35

Notes:

1. An assumption of full time operation on Gas oil is run due to the potential scenario of an interruption to the availability of natural gas.
2. The dispersion model ran the highest daily emission rates listed as worst case scenario for full time operation on gas oil; the annual average emissions were assessed separately
3. NS means None Specified

Table 3.4c Process emissions data for proposed Reserve Power plant (Gas Oil fuel), < 500 hours per year)

Emission Point	Fuel Type	Temperature K	Flow Nm^3/hour	Exit velocity m/sec	NO_x Emission		CO Emission		SO_2 Emission		PM_{10} Emission	
					mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec	mg/Nm^3	g/sec
OCGT Operating Scenario #4: Gas Oil fuel (500 hours per annum) **Maximum daily emissions**												
OCGT #1-#3	Gas oil (< 500 hr pa)	808.15	6,732,000	51.49	250	467.50	100	187.00	66	123.42	10	18.70
Annual average emissions												
OCGT #1-#3	Gas oil (< 500hr pa)	808.15	6,732,000	51.49	NS	NS	NS	NS	60	112.20	5	9.35

Notes:
1. The dispersion model ran the highest daily emission rates listed as worst case scenario for operation on gas oil when operating less than 500 hours per year; the annual average emissions were assessed separately
2. Where the gas turbines operate on gas oil less than 500 hours per year , the emission limit for nitrogen oxides is 250mg/Nm^3 and no emission limit for CO applies.

3.5.3 Site Layout and Topography

The layout and area of the site and the dimensions of the various buildings on site were taken from the drawings of the site. Topographical information was obtained from a site survey and from Ordnance Survey maps and from digital terrain data. Building downwash effects might be expected as a result of the proximity of the buildings on site to the plant stack. These effects were modelled using the modelling facility, BPIP, which is part of the AERMOD modelling suite.

The presence of complex terrain features can lead to significantly higher ambient concentrations than would occur in the absence of terrain features, especially if there is a significant relative difference in elevation between the source and off-site receptors. International Guidance suggests that when modelling in a region of flat terrain, no digital mapping of terrain will be necessary. General guidance is that digital mapping of terrain should be conducted where terrain features are greater than 10% of the effective stack height within 5km of the stack (for effective stack heights of 100m or less). From a review it is concluded that digital terrain data is required to ensure that a reliable assessment is completed. This data was acquired and used in the dispersion model.

3.5.4 Meteorological Data

The magnitude of potential impacts of the proposed development on air quality will largely be influenced by the local meteorological conditions, in particular by wind speed and direction and by precipitation rates. An evaluation of the climatic conditions at the site is therefore useful for an assessment of the type required for this study.

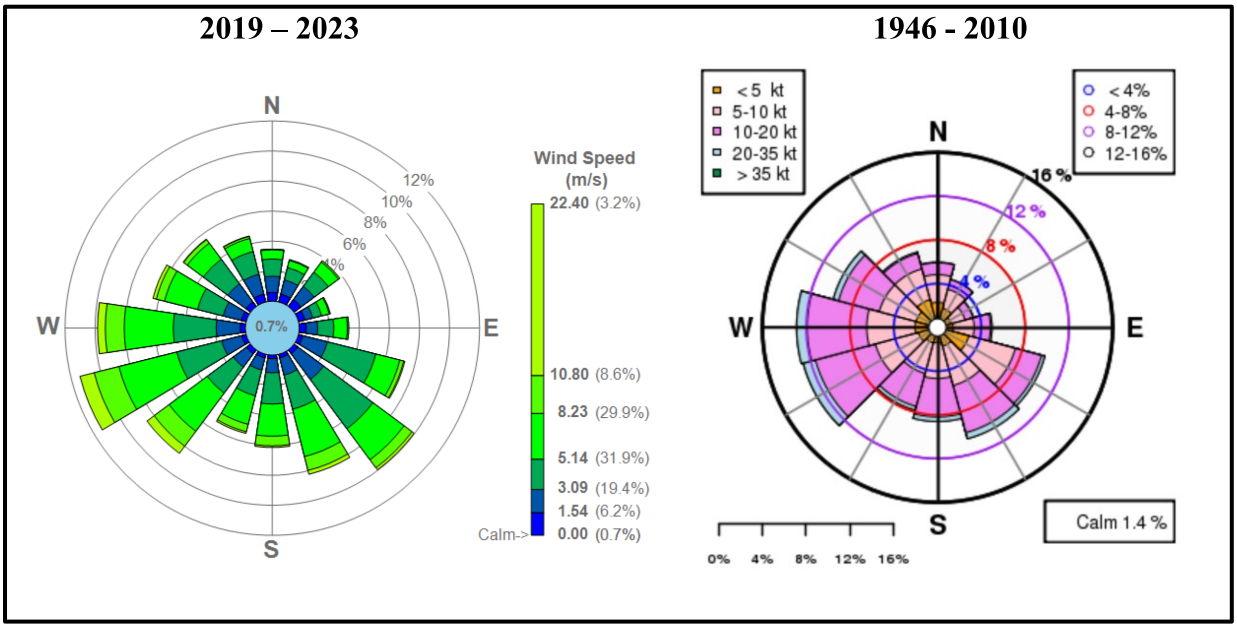
Met Éireann operate a Synoptic Network of weather stations at Belmullet, Malin Head, Rosslare (closed since 2008), Johnstown Castle, Birr, Clones, Kilkenny and Mullingar while the Aviation Division of Met Éireann maintains observing stations at Shannon Airport, Knock Airport, Casement Aerodrome, Dublin Airport and Cork Airport. There is no continuous meteorological monitoring on the subject site but the general guidance on selection of meteorological data for air quality impact assessments is to choose representative data, recently acquired, which best represents conditions at the site. At least three years of recently acquired data is preferred.

Comprehensive monitoring data is available for Shannon Airport (located 92km southwest of the subject site) which would be indicative of the meteorological conditions that are experienced at the proposed site. Therefore, for the purpose of obtaining reliable information about the climatological conditions at the site of the proposed development, a full set of meteorological data for the period 2019 – 2023 recorded at Shannon Airport was analysed. This is considered an appropriate data set for the study because of the close proximity of the station to the site and the similarity in topography in the immediate area and at the site of the proposed development. Comprehensive data for Mullingar (located 80km northeast) and Casement Aerodrome (located 120km northeast) are also available and were considered for the purpose of testing the sensitivity of the modelling predictions to the input meteorological data.

Wind speed and direction in particular is important in determining how emissions associated with the activity are dispersed. The prevailing wind direction determines which areas are most significantly affected by the emissions from the activity and wind speed determines in part the effectiveness of the dispersion of the emissions.

The windrose for Shannon is presented in Figure 3.1 for the years 2019 – 2023 together with the long term average windrose for 1946 – 2010. The dominant wind direction for Shannon is from the southwest quadrant with wind blowing from this quadrant for more than 40% of the time. The average long-term wind speed over the period 1991 to 2020 is 4.7m/s.

Figure 3.1 Windrose for Shannon Airport



9.5.2 Influences on Ambient Air Quality

The existing activities at and in the vicinity of the site have the potential to exert an influence on ambient air quality by release of emissions to atmosphere as follows:

- emissions of fine particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO) from domestic, commercial and industrial heating;
- emissions of particulate matter (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO and benzene from traffic on adjoining roads;
- emissions of ammonia, dust and PM from agricultural activities.

Overall the contribution of traffic travelling on the surrounding road network, agriculture and heating sources in the area are considered to be the dominating influence on air quality in the immediate vicinity of the site.

The main substances which are of interest in terms of existing air quality are sulfur dioxide, nitrogen oxides, particulate dusts including PM_{10} and $PM_{2.5}$ which could originate from combustion sources and traffic. There are no new substances expected to be present in emissions released from the proposed development. A description of existing levels of the various substances in ambient air is required to allow completion of the evaluation of air quality impacts associated with the development and is presented in section 3.6.

3.5.5 Averaging Intervals

The dispersion model was used to predict the incremental additions to ground level concentrations of the main pollutants emitted from the plant over defined averaging periods. These averaging periods were chosen to allow direct comparison of predicted ground level concentrations with the relevant assessment criteria as outlined in Table 3.1. In particular, 1-hour, 24-hour and annual average ground level concentrations (GLCs) of various pollutants were calculated at various distances from the site; percentiles of these average GLCs were also computed for comparison with the relevant Air Quality Standards.

3.5.6 Receptor Locations

Two nested uniform cartesian receptor grids centred on the site were used for the modelling domain as follows:

- A coarse outer grid of 15km x 15km of 3721 receptors with a spacing of 250 meters was used to cover the whole study area;
- A fine inner grid of 2km x 2km of 1681 receptors (41 x 41 receptors with a spacing of 50 meters) was used to better characterise the zones where the maximum predicted air quality impact from the Project emissions are expected.

In line with expectations, the highest predicted ground level concentrations occur at the receptors closer to the source.

Sensitive receptors in the vicinity of the plant were also input to the Model to evaluate the impact on air quality at those sensitive locations. These sensitive receptors are shown in Appendix I as well as maps showing the nested receptor grids.

3.6 Background ambient air quality

The dominant influences on air quality in the area are emissions from domestic heating, agriculture and traffic. Emissions from traffic sources are expected to be the principal contributors to ambient air quality in the vicinity of the site.

The main substances which are of interest in terms of existing air quality are sulfur dioxide, nitrogen oxides (nitric oxide, NO and nitrogen dioxide NO_2, collectively referred to as NO_x), fine particulate matter including PM_{10} and $PM_{2.5}$ which could originate from combustion sources and traffic. Carbon monoxide is also potentially of interest, and benzene may also be of interest from traffic sources. There are no significant new substances expected to be present in emissions released from the proposed development relative to the existing situation.

Particulate matter is made up of tiny particles in the atmosphere that can be solid or liquid and is produced by a wide variety of natural and manmade sources. Particulate matter includes dust, dirt, soot, smoke and tiny particles of pollutants. Particulate matter of 10 micrometers in aerodynamic diameter or less are also referred to as PM_{10} or more strictly, particles which pass through a size selective inlet with a 50% efficiency cut-off at 10 µm aerodynamic diameter. Similarly, $PM_{2.5}$ refers to particulate matter of 2.5 micrometers or less in aerodynamic diameter. In the past domestic coal burning was a major source of particulate matter in Irish cities during winter months. Levels of particles have decreased significantly since then following the introduction of abatement strategies including Special Control Areas and other Regulations regarding the use, marketing, sale and distribution of certain fuels. The significance of particulate matter is predominantly related to human health and respiratory effects.

Nitrogen oxides (NO_x, which is the sum of NO and NO_2), are generated primarily by combustion processes. The main anthropogenic sources are mobile combustion sources (road, air and traffic) and stationary combustion sources (including industrial combustion). The main source of nitrogen oxides in the vicinity of the site is traffic. The significance is health-related for nitrogen dioxide (NO_2) and ecological for nitrogen oxides (NO_x).

Sulfur dioxide also originates from combustion but predominantly from heating sources and not traffic. The trend in ambient SO_2 concentrations in Ireland is very clearly downward and this pollutant is not a matter for concern in Ireland. This reduction can be attributed to fuel switching from high-sulfur fuels, such as coal and oil, to natural gas and to decreases in the sulfur content of oil.

Carbon Monoxide (CO) is a colourless and odourless gas, formed when carbon in fuel is not burned completely. It is a component of motor-vehicle exhaust, which accounts for most of the CO emissions nationwide. Consequently, CO concentrations are generally higher in areas with heavy traffic congestion.

A description of existing levels of the various substances in ambient air is required to allow for the evaluation of air quality impacts associated with the development. The available data from the National Ambient Air Quality Network is a reliable data set for consideration in this study.

The Environmental Protection Agency (EPA) and local authorities maintain and operate a number of ambient air quality monitoring stations throughout Ireland in order to implement EU Directives and to assess the country's compliance with national air quality standards. Ireland's small population and generally good air quality means that a relatively small number of monitoring stations are sufficient across the country for the purposes of implementing the EU Air Directives. For ambient air quality management and monitoring in Ireland, four zones, A, B, C and D are defined in the Air Quality Standards (AQS) Regulations (S.I. No. 739 of 2022) and are defined as follows:

- Zone A: Dublin Conurbation.
- Zone B: Cork Conurbation.
- Zone C: 24 cities and large towns. Includes Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Newbridge, Mullingar, Letterkenny, Celbridge and Balbriggan, Portlaoise, Greystones and Leixlip.
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B &C.

The subject site is considered to be located in Zone D and is considered a rural location site for assessment purposes. Air Quality Data from representative air monitoring stations in Zone D are therefore considered representative of air quality at the subject site. The EPA publishes Ambient Air Quality Reports every year which details the air quality in each of the four zones. The most recent report, published by the EPA in 2023, is the Air Quality in Ireland 2022 report, which contains monitoring data collected during 2022.

The EPA maintains monitoring stations in a number of rural locations including Castlebar, Claremorris, Emo, Enniscorthy, Kilkitt and Longford to monitor rural background air quality. Other monitoring stations have operated at various times and some new stations have been added to the network, but long-term data is available for the above stations. Data from the most recent published Air Quality Monitoring Annual reports for 2020 - 2022 was reviewed and a summary of the data for representative stations for the three most recent years is presented for each parameter of interest in Table 3.5.

The approach taken is to take the average of the three most recent years for each of the Zone D rural stations detailed above and the averages of the values for the stations are reported in Table 3.5. This is the data set which is used in the assessment of the potential impact of the proposed development on air quality. A graphical comparison of the data with the relevant Air Quality Standards is given in Figure 3.2.

It is noted from the data that existing ambient air quality is good for all health-related pollutants. All concentration levels are well within the EU Standards for all parameters of interest.

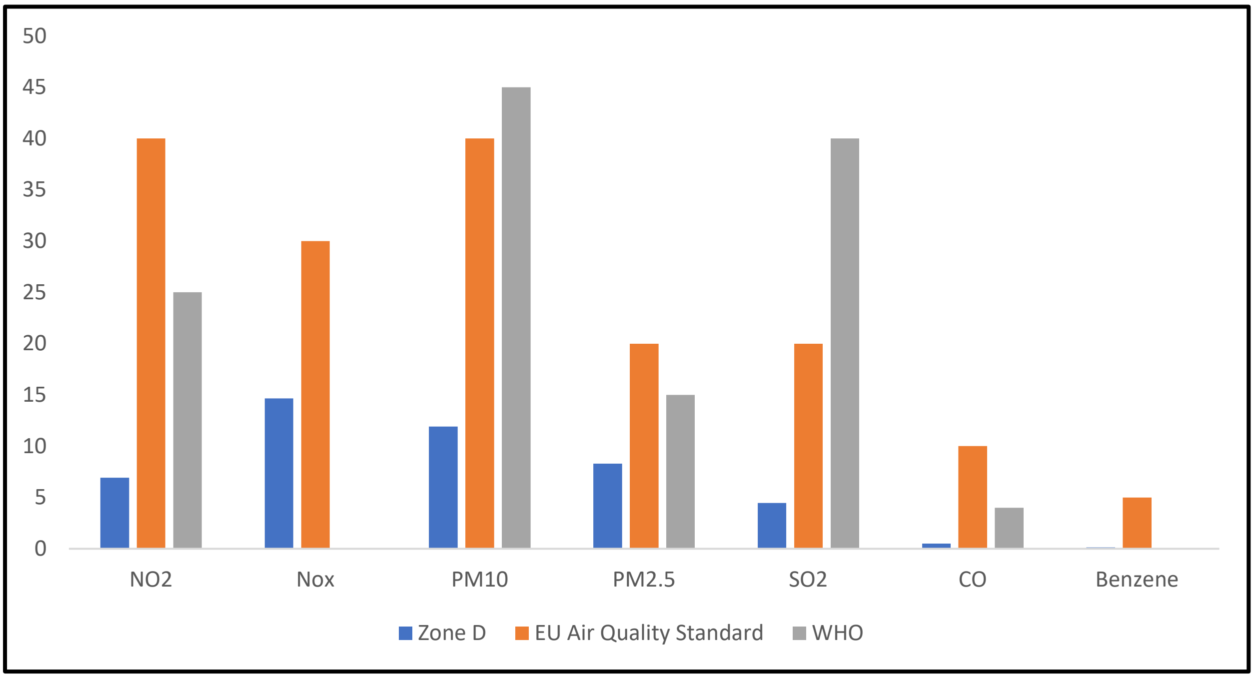
Table 3.5 Summary baseline air quality data (2020-2022)

Data set	**Parameter and averaging interval**		**Concentration µg/m³**
Rural background	Nitrogen dioxide NO_2	*Annual Mean, µg/m³*	6.9
Rural background	Nitrogen oxides, NO_x	*Annual Mean, µg/m³*	14.7
Rural background	Particulate Matter PM_{10}	*Annual Mean, µg/m³*	11.9
Rural background	Particulate Matter $PM_{2.5}$	*Annual Mean, µg/m³*	8.3
Rural background	Sulfur dioxide, SO_2	*Annual Mean, µg/m³*	4.5
Rural background	Carbon Monoxide CO	*Annual Mean 8-hour, mg/m³*	0.5
Rural background	Benzene	*Annual Mean, µg/m³*	0.1

NOTE

1. Data summarised from the EPA Annual Ambient Air Quality Monitoring Reports 2020 to 2022
2. No Zone D measurements recorded during this interval but a value of 0.1 m*g/m³ was recorded for Zone C.*

Figure 3.2 Comparison of Zone D Background Air Quality and Ambient Air Quality Standards



3.7 Site specific ambient air quality monitoring

A survey of air quality in the area of the site was carried out during the period February to May 2024. The survey consisted of deployment of a series of diffusion tubes to measure ambient levels of nitric oxide (NO), nitrogen dioxide (NO_2), nitrogen oxides (NO_x), sulfur dioxide (SO_2) and ammonia (NH_3) levels at 5 locations at and in the vicinity of the site. A continuous monitoring survey of nitrogen oxides (NO, NO_2 and NO_x) and PM_{10} was also undertaken at one of these locations. The detailed results of the surveys are presented in Appendix II. A summary of the results is presented in Table 3.6 to Table 3.11.

The results of the ambient air quality survey are consistent with expectations in that the levels are generally low and are clearly influenced by emissions from traffic on the surrounding road network. All of the monitoring results are compliant with the annual mean air quality standard for nitrogen oxides and sulfur dioxide and the results are consistent with the longer term EPA monitoring data for rural locations. Levels of nitric oxide are extremely low which indicates that the main sources of NO_x in the area are removed from the site and are likely to be traffic on the surrounding roads. Peaks in NO detected occasionally during the monitoring period were attributed to machinery working on site for intensive investigations, while the ammonia originates from agricultural activity in the area. The site specific monitoring data are generally lower than the longer term EPA data which is not surprising given the limited duration of this survey. In the absence of a longer site-specific monitoring data set, the longer term EPA data is likely to be more representative of the annual average concentrations and is therefore selected for use in this assessment. The data from the continuous monitoring survey is a useful benchmark, it confirms the dominant influence of traffic emissions on air quality at the site. Using the higher long term monitoring data from the EPA is a conservative approach and may overestimate the impact of the proposed development on ambient air quality in the area.

Table 3.6 Diffusion tube NO_2 survey results

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	1.5	1.1	1.6	1.4
AS-102	1.8	1.4	1.6	1.6
AS-103	1.5	1.2	1.6	1.4
AS-104	1.4	1.2	1.4	1.3
AS-105	1.5	1.2	1.6	1.4

Table 3.7 Diffusion tube NOx survey

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	< 3.2	< 3.2	< 3	< 3.1
AS-102	< 3.2	< 3.2	< 3	< 3.1
AS-103	< 3.2	< 3.2	< 3	< 3.1
AS-104	< 3.2	< 3.2	6.0	4.1
AS-105	< 3.2	< 3.2	< 3	< 3.1

Table 3.8 Diffusion tube SO_2 survey

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	< 2	< 2	< 1.9	< 2
AS-102	< 2	< 2	< 1.9	< 2
AS-103	< 2	< 2	< 1.9	< 2
AS-104	< 2	< 2	< 1.9	< 2
AS-105	< 2	< 2	< 1.9	< 2

Table 3.9 Diffusion tube NH_3 survey

Location	08 – 22 Feb 2024	22 Feb– 07 Mar 2024	07 – 22 Mar 2024	Average
AS-101	0.8	0.9	2.7	1.5
AS-102	3.7	0.9	1.3	2.0
AS-103	0.7	< 0.5	1.2	0.8
AS-104	1.0	0.9	0.9	0.9
AS-105	1.1	0.7	1.3	1.0

Table 3.10 Continuous monitoring survey for NOx

Location	09 April to 23 May 2024		
	NO_2, µg/m^3	NO, µg/m^3	NOx, µg/m^3
AS-105 Survey average	6.4	0.6	2.8

Table 3.11 Continuous monitoring survey for PM_{10}

Location	09 April to 23 May 2024		
	PM_{10}, µg/m^3	PM_1, µg/m^3	$PM_{2.5}$, µg/m^3
AS-105 Survey average	3.1	2.2	3.0

4.0 DISPERSION MODELLING PREDICTIONS

4.1 Modelling predictions

Model executions were completed to assess the incremental additions to ground level concentrations of NO_2, NO_x, CO, PM_{10} and SO_2 over specified averaging intervals to allow comparison of the predictions with the relevant Air Quality Standards, which have been defined for all of these pollutants as set out in Table 3.1. These pollutants have been selected as a screening analysis identified these as the most sensitive parameters for assessing the impact on air quality of the emissions.

The detailed modelling predictions (using meteorological data for 2019 – 2023) are presented in Appendix III. In each case, the maximum predicted Process Contribution to ground level concentrations is shown in the Tables. In addition, the predicted impact on air quality taking account of the existing background levels is also assessed with the calculation of the Predicted Environmental Concentration (PEC). Representative isopleths showing the distribution of emissions from the plant are shown in Appendix III to show the outputs from the model in a map format.

4.2 Assessment of air quality impact on human health

4.2.1 Introduction

A summary of the dispersion modelling results for the maximum predicted Process Contributions for the worst case meteorological year is presented in Table 4.1a – Table 4.4f. The results are presented for a number of operating scenarios as described in section 3.5.2 and summarised as follows:

- **OCGT Operating Scenario #1: Natural gas (Normal Operation, 1500hours);** this scenario considered 1500 operating hours per year on natural gas;
- **OCGT Operating Scenario #2: Natural gas fuel (Worst Case, full time operation);** this scenario considered full time operation on natural gas;
- **OCGT Operating Scenario #3: Gas Oil fuel (Worst Case, full time operation);** this scenario considered full time operation on gas oil;
- **OCGT Operating Scenario #4: Gas Oil fuel (500 hours per annum);** this scenario considered < 500 operating hours per year on gas oil;

4.2.1 Impact Assessment for Normal Operation on Natural Gas

OCGT Operating Scenario #1 considered 1500 operating hours for the proposed Reserve Power plant per year using natural gas as fuel.

The most sensitive pollutant is nitrogen dioxide so the detailed discussion presented here is for nitrogen dioxide; results for carbon monoxide are also presented as this is also a regulated pollutant under the Large Combustion Plant Directive. All other substances are emitted at lower concentrations and the impacts are less significant. The results of the model runs are presented in Table 4.1a for NO_2 and in Table 4.1b for CO for the annual average emissions scenario with 1500 operating hours per year.

The modelling predictions show that the predicted concentrations are all significantly lower than the relevant air quality standard. For the most sensitive pollutant, nitrogen dioxide, the predicted ambient concentrations expressed as the Process Contribution for the 99.8-percentile of 1-hour concentrations will not exceed 19.1% of the air quality standard.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards. As is evident from the contour plot presented in the representative isopleth shown in Figure 4.1 for the normal operating scenario on natural gas, the highest predicted Process Contributions (PCs) are close to the facility with concentrations reducing with distance from the source as expected.

Results are also presented for an operating scenario that assumes maximum daily emission rates will occur continuously throughout the operating period. Results are presented in Table 4.1a and Table 4.1b. The modelling predictions show that the predicted concentrations are all significantly lower than the relevant air quality standards.

Table 4.1a Predicted NO_2 concentrations for Normal Operation on Natural Gas

OCGT Operating Scenario #1: Natural gas (Normal Operation)

1500 operating hours per year

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.1	13.8	51.9	200	19.1
	Annual mean	0.28	6.9	7.2	40	0.7
Annual average emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.5	13.8	52.3	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.1b Predicted CO concentrations for Normal Operation on Natural Gas

OCGT Operating Scenario #1: Natural gas (Normal Operation)

1500 operating hours per year

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	Maximum 8-hour mean	143	500	643	10,000	1.4
Annual average emission rate						
2019 - 2023	Maximum 8-hour mean	196	500	696	10,000	2.0

NOTE

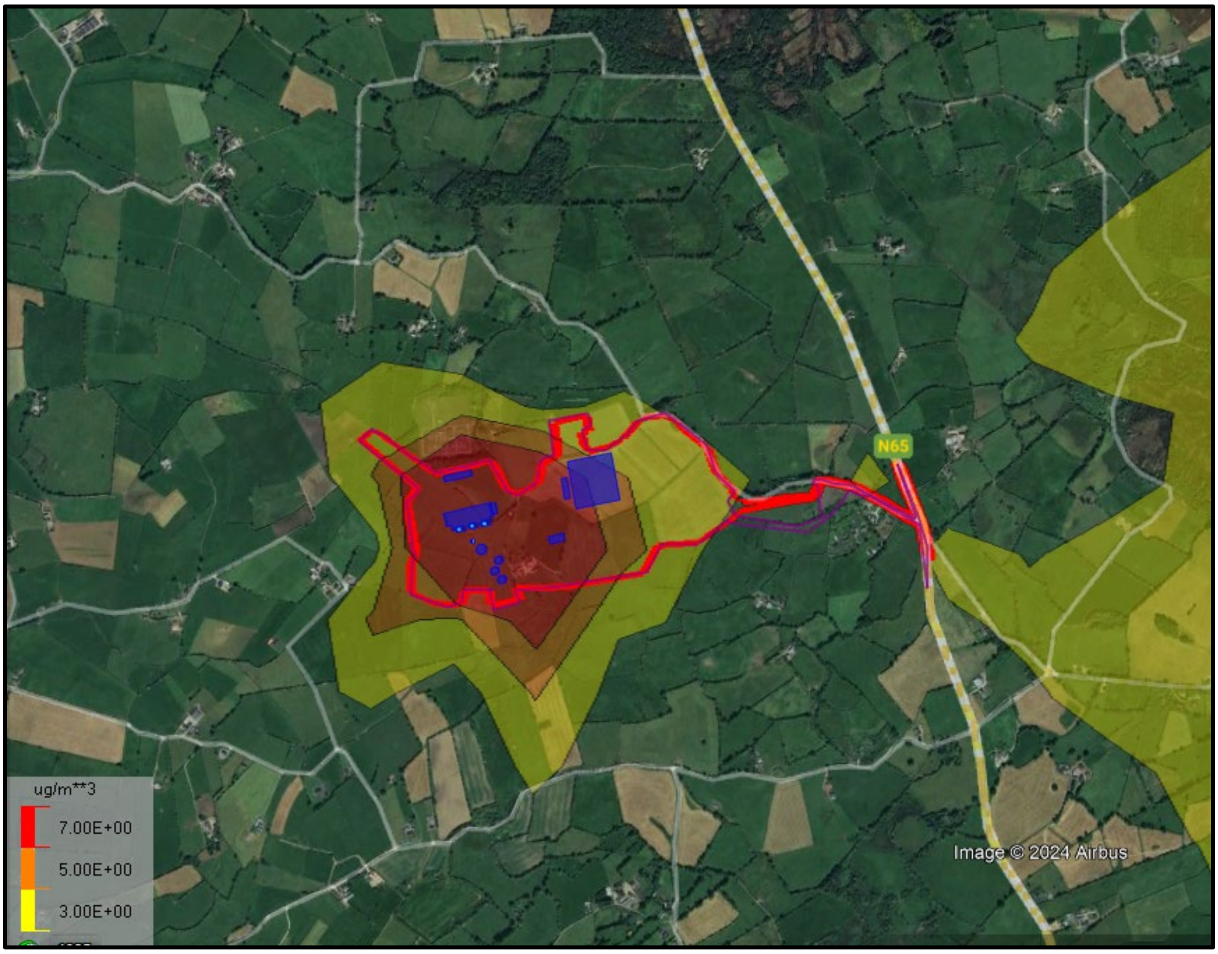
The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Figure 4.1 Isopleth showing predicted ground level concentrations of NO2 expressed as the 99.8-percentile of 1-hour NO_2 for the normal operation of the facility on natural gas

OCGT Operating Scenario #1: Natural gas (Normal Operation)

1500 operating hours per year

Table 3.4a Annual average emissions



4.2.2 Impact Assessment for Worst Case Operation on Natural Gas

OCGT Operating Scenario #2 considers the unlikely scenario of full time operation on natural gas.

Results are presented for nitrogen dioxide and carbon monoxide as both are regulated pollutants under the Large Combustion Plant Directive. All other substances are emitted at lower concentrations and the impacts are less significant. The results of the runs are presented in Table 4.2a and Table 4.2b for NO_2 and CO for full time operation on natural gas. Modelling predictions based on annual average emission rates as well as maximum daily emissions assumed to run continuously are presented.

The modelling results show that even if the plant were to run full time on natural gas, the predicted ambient concentrations for the most sensitive pollutant, nitrogen dioxide, expressed as the Process Contribution will not exceed 19.3% of the air quality standard for the 99.8 percentile of one-hour concentrations.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards. As is evident from the contour plot presented in Figure 4.2, the highest predicted Process Contributions (PCs) are close to the facility with concentrations reducing with distance from the source as expected.

A conservative assumption that the maximum daily emission rate would apply for the entire year was modelled to specifically assess potential impacts for shorter averaging intervals as shown in Table 4.2a and Table 4.2b. This is an ultra-conservative approach and overestimates the potential impacts. Even for this unrealistic scenario, the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

Table 4.2a Predicted NO_2 concentrations for Worst Case Operation on Natural Gas

OCGT Operating Scenario #2: Natural gas fuel (Worst Case)

Full time operation on natural gas

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.6	13.8	52.3	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7
Annual average emission rate						
2019 - 2023	99.8th %ile of 1-hour means	38.5	13.8	52.3	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.2b Predicted CO concentrations for Worst Case Operation on Natural Gas

OCGT Operating Scenario #2: Natural gas fuel (Worst Case)

Full time operation on natural gas

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
Maximum daily emission rate						
2019 - 2023	Maximum 8-hour mean	426	500	926	10,000	4.3
Annual average emission rate						
2019 - 2023	Maximum 8-hour mean	196	500	696	10,000	2.0

NOTE

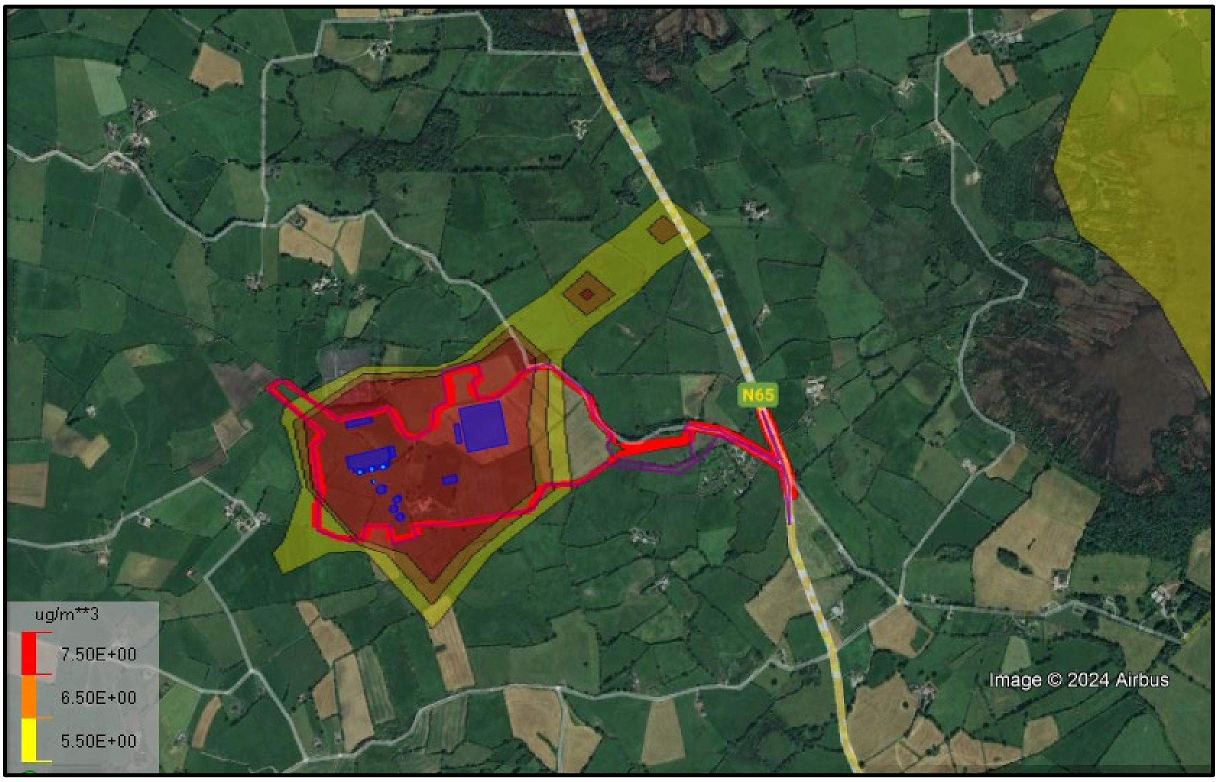
The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Figure 4.2 Isopleth showing predicted ground level concentrations of NO2 expressed as the 99.8-percentile of 1-hour NO_2 for the full time operation of the facility on natural gas

OCGT Operating Scenario #2: Natural gas fuel (Worst Case)

Full time operation on natural gas

Table 3.4a Annual average emissions



4.2.3 Impact Assessment for Worst Case Operation on Gas oil

OCGT Operating Scenario #3 considered full time operation on gas oil. This scenario is highly unlikely to occur given the logistical difficulties of fuel delivery and storage but the assessment is included to ensure that all meteorological conditions are considered.
Results are presented for nitrogen dioxide, carbon monoxide, sulfur dioxide and PM_{10} as all are regulated pollutants under the Large Combustion Plant Directive. The results of the runs are presented in Table 4.3a to 4.3f for full time operation on gas oil. Modelling predictions based on annual average emission rates are presented in Tables 4.3a to Table 4.3b for SO_2 and PM_{10}, respectively, while predictions based on maximum daily emissions are presented in Tables 4.3c to 4.3f.

The modelling results show that even if the plant were to run full time on Gas oil, which could arise only in the event of an interruption to the national supply of natural gas, the predicted ambient concentrations for the most sensitive pollutant, sulfur dioxide, expressed as the Process Contribution will not exceed 47% of the air quality standard for the 99.7 percentile of one-hour concentrations.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

A conservative assumption that the maximum daily emission rate would apply for the entire year was modelled to specifically assess potential impacts for shorter averaging intervals as shown in Table 4.3c to Table 4.3d. This is an ultra-conservative approach and overestimates the potential impacts. Even for this unrealistic scenario, the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

Table 4.3a Predicted SO_2 concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	164,1	9.0	173.1	350	46.9
	99.2 %ile of 24-hour means	33.5	4.5	38.0	125	26.8
	Annual mean	1.3	4.5	5.8	20	6.5

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3b Predicted PM_{10} concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	0.23	11.9	12.1	50	0.4
	Annual mean	0.32	11.9	12.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3c Predicted NO_2 concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
2019 - 2023	99.8th %ile of 1-hour means	38.6	13.8	52.4	200	19.3
	Annual mean	0.29	6.9	7.2	40	0.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3d Predicted CO concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
2019 - 2023	Maximum 8-hour mean	511	500	1011	10,000	5.1

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3e Predicted SO_2 concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	180.6	9.0	189.6	350	51.6
	99.2 %ile of 24-hour means	36.8	4.5	41.3	125	29.4
	Annual mean	1.4	4.5	5.9	20	7.0

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.3f Predicted PM_{10} concentrations for Worst Case Operation on Gas oil

OCGT Operating Scenario #3: Gas oil fuel (Worst case)

Full time operation on gas oil

Table 3.4b Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	0.39	11.9	12.3	50	0.8
	Annual mean	0.33	11.9	12.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

4.2.4 Impact Assessment for Normal Operation on Gas oil

OCGT Operating Scenario #4 considered < 500 operating hours per year on gas oil. This is the expected operating regime for the Reserve Power plant.

Results are presented for nitrogen dioxide, carbon monoxide, SO_2 and PM_{10} as all are regulated pollutants under the Large Combustion Plant Directive. The results of the runs are presented in Table 4.4a to 4.4b for operation on gas oil for 500 hours per year. Modelling predictions based on annual average emission rates are presented in Tables 4.4a to Table 4.4b for SO_2 and PM_{10}, respectively. Modelling predictions are also presented based on maximum daily emission rates in Table 4.4c to Table 4.4f.

The modelling results show that during normal operation for 500 hours on Gas oil, the predicted ambient concentrations for the most sensitive pollutant, nitrogen dioxide, expressed as the Process Contribution will not exceed the air quality standard for the 99.8 percentile of one-hour concentrations.

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area and the incremental contribution to ambient concentrations from the proposed process. The modelling predictions indicate that the cumulative impact of the operation of the turbines with existing activities will not exceed the Air Quality Standards.

Table 4.4a Predicted SO_2 concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	38.4	9.0	47.4	350	11.0
	99.2 %ile of 24-hour means	15.6	4.5	20.1	125	12.5
	Annual mean	0.32	4.5	4.8	20	1.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4b Predicted PM_{10} concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	28.9	11.9	41.8	50	57.8
	Annual mean	0.32	11.9	12.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4c Predicted NO_2 concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.8th %ile of 1-hour means	38.3	13.8	52.1	200	19.2
	Annual mean	0.31	6.9	7.2	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4d Predicted CO concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	Maximum 8-hour mean	57	500	557	10,000	0.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4e Predicted SO_2 concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	99.7th %ile of 1-hour means	38.4	9.0	47.4	350	11.0
	99.2 %ile of 24-hour means	15.6	4.5	20.1	125	12.5
	Annual mean	0.32	4.5	4.8	20	1.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

Table 4.4f Predicted PM_{10} concentrations for Normal Operation on Gas oil

OCGT Operating Scenario #4: Gas oil fuel (Normal operation)

<500 hours per year operation on gas oil

Table 3.4c Maximum daily emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m³	Background concentration µg/m³	Predicted Environmental Concentration (PEC) µg/m³	Air Quality Standard µg/m³	PC as % of Air Quality Standard
2019 - 2023	90.4th %ile of 24-hour means	28.9	11.9	40.8	50	57.8
	Annual mean	0.32	11.9	12.3	40	0.8

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions. The background concentration is twice the annual mean when evaluating hourly predictions.

4.3 Impact of emissions to atmosphere on ecosystems

4.3.1 Introduction

This element of the assessment considers the following scenarios which are representative of potential worst case operating scenarios:

- OCGT Operating Scenario #2: Natural gas fuel (Worst Case full time operation); annual average emissions
- OCGT Operating Scenario #3: Gas oil fuel (Worst Case full time operation); maximum daily emissions

Any other operating scenarios such as shorter operating times represent less significant emissions scenarios with reduced air quality impact relative to the scenarios assessed.

The assessment of impact is based on consideration of the predicted ground level airborne concentration of nitrogen oxides on the environment and on designated ecological sites as well as considering the impact of nitrogen and sulfur dioxide deposition on the environment and on designated ecological sites. One element of the assessment considered all receptors outside the site boundary regardless of designated status, and the second element of the assessment considered the designated sites specifically.

Designated ecological sites within 15km of the site were identified and included in the assessment. There were 37 designated ecological sites selected for inclusion in the assessment as shown in Table 4.5 and in Figure 4.3.

Receptors within these designated sites were included in the dispersion modelling assessments and detailed modelling predictions are contained in Appendix III.

Table 4.5 Ecological Receptors within the Study Area for assessment

Receptor	Identification and designation
E1	Lough Derg, North-east Shore SAC (002241)
E2	Barroughter Bog SAC (000231)
E3	Rosturra Wood SAC (001313)
E4	Cloonmoylan Bog SAC (000248)
E5	Kilcarren-Firville Bog SAC (000647)
E6	Redwood Bog SAC (002353)
E7	Derrycrag Wood Nature Reserve SAC (000261)
E8	Pollnaknockaun Wood Nature Reserve SAC (00319)
E9	River Shannon Callows SAC (000216)
E10	Ardgraigue Bog SAC (002356)
E11	River Little Brosna Callows SPA (004086) & NHA (000564)
E12	Middle Shannon Callows SPA (004096)
E13	Slieve Aughty Mountains SPA (004168)
E14	Lough Derg (Shannon) SPA (004058)
E15	River Little Brosna Callows SPA (004086) & NHA (000564)
E16	Lorrha Bog NHA (001684)
E17	Derryoober Bog NHA (002379)
E18	Ballymacegan Bog NHA (000642)
E19	Meeneen Bog NHA (000310)
E20	Slieve Aughty Bog NHA (001229)
E21	Capira/Derrew Bog NHA (001240)
E22	Moorfield Bog NHA (001303)
E23	Cloonoolish Bog NHA (000249)
E24	Eskerboy Bog NHA (001264)
E25	Ardgraigue Bog pNHA (001224)
E26	Pollnaknockaun Wood Nature Reserve pNHA (000319)
E27	Derrycrag Wood Nature Reserve pNHA (000261)
E28	River Shannon Callows pNHA (000216)
E29	Cloonmoylan Bog pNHA (000248)
E30	Lough Derg pNHA (000011)
E31	Barroughter Bog pNHA (000231)
E32	Rosturra Wood pNHA (001313)
E33	Friar's Lough pNHA (000933)
E34	Redwood Bog pNHA (000654)
E35	Kilcarren-Firville Bog pNHA (000647)
E36	Spring Park Wetlands pNHA (000941)
E37	Lough Avan pNHA (001995)

Figure 4.3a Ecological receptors for detailed study (SAC)

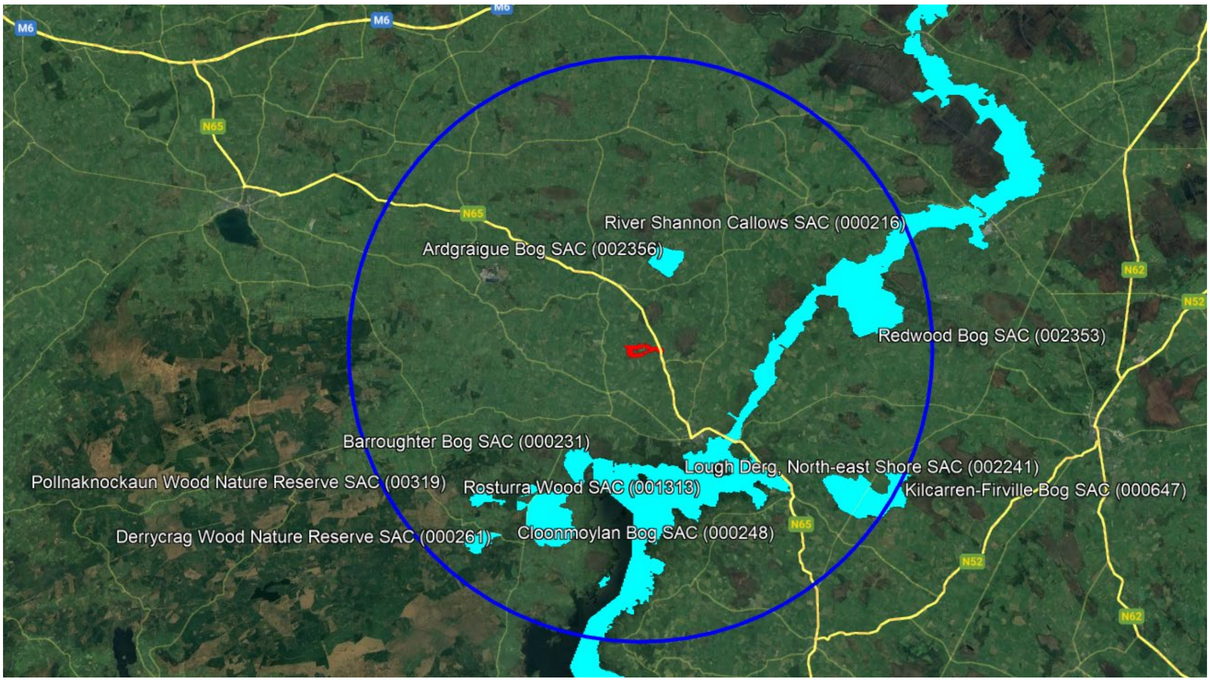


Figure 4.3b Ecological receptors for detailed study (SPA)

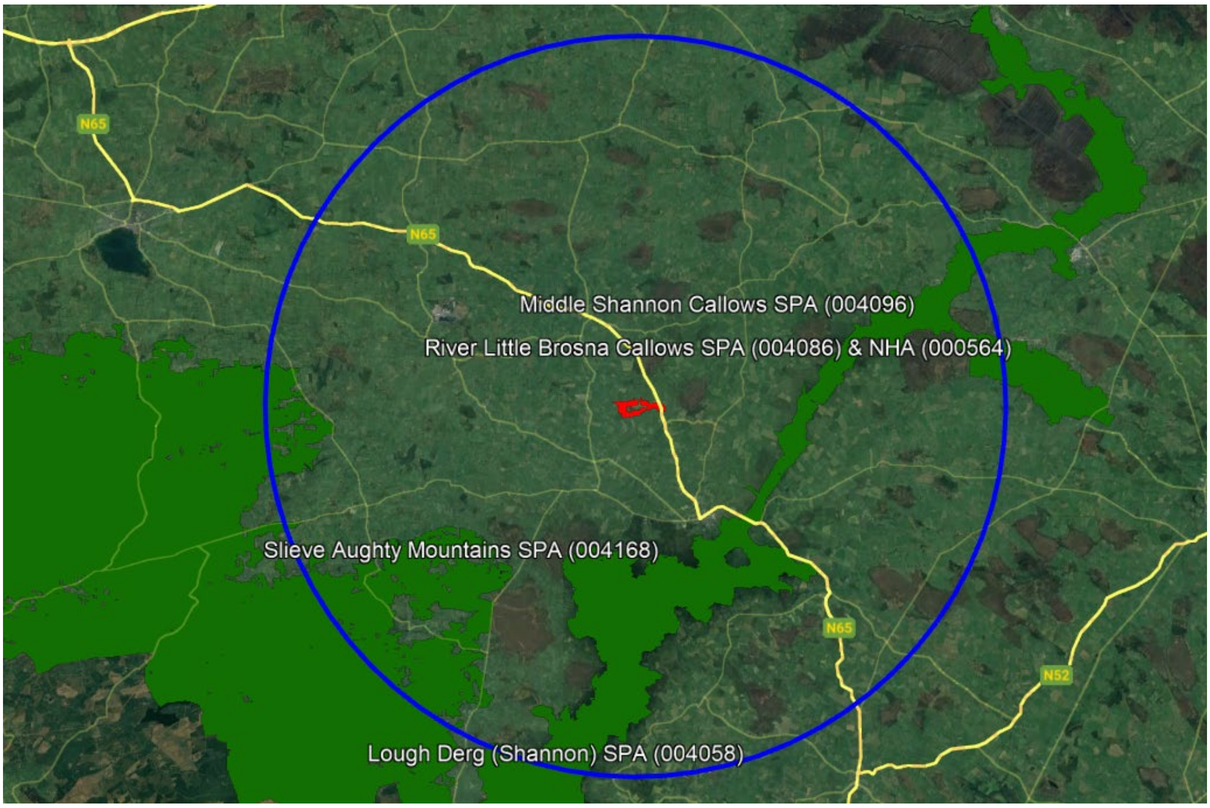


Figure 4.3c Ecological receptors for detailed study (NHA)

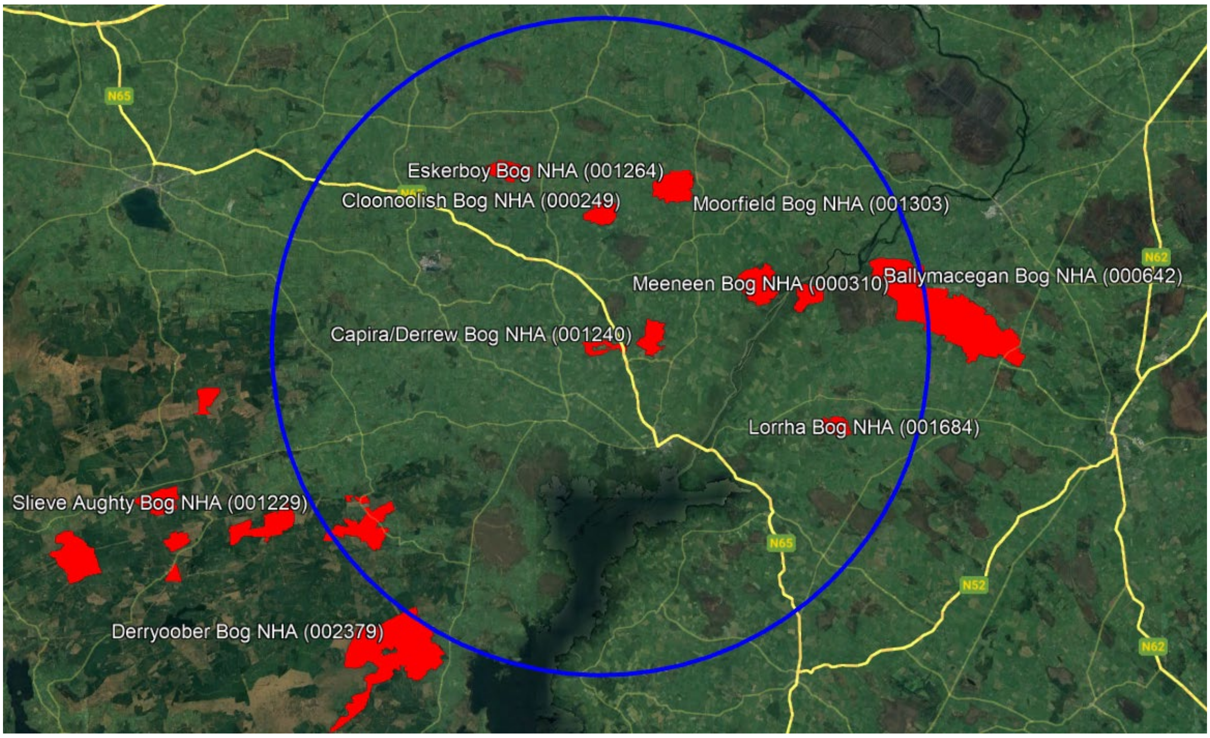
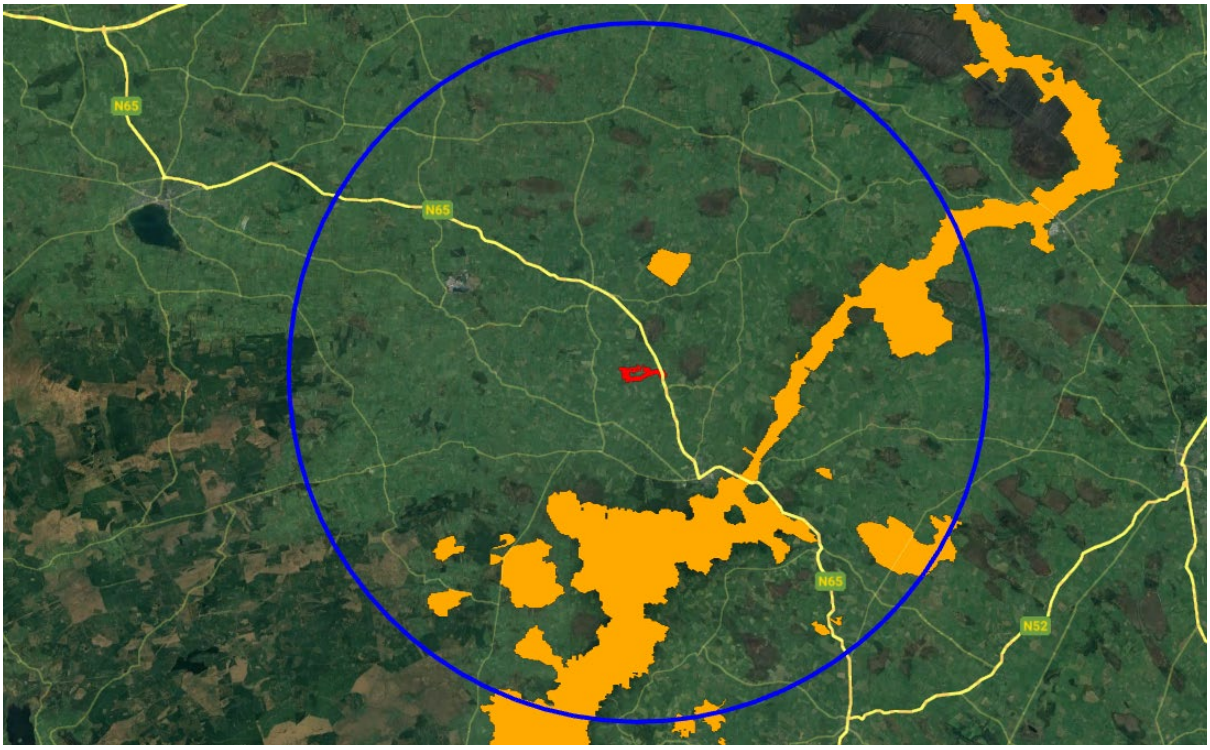


Figure 4.3d Ecological receptors for detailed study (pNHA)



4.3.2 Impact of Fulltime operation on natural gas fuel on ecosystems

The impact of nitrogen oxides (NOx) emissions on sensitive ecosystems was assessed by modelling the NOx emissions from the worst case scenario with the turbines operating full time on natural gas. This is not the most likely operating scenario for the facility but it represents maximum potential impact on ecosystems and was therefore considered as a conservative approach to the assessment. The assessment considers all locations outside the site boundary and receptors located in the designated ecological sites.

The impact predictions for the concentration of nitrogen oxides in air at ground level are presented in Table 4.6. The predictions presented in Table 4.6 are the highest concentrations predicted at the designated ecological sites.

Table 4.6 Predicted NO_x concentrations for Worst Case Operation on Natural Gas (Ecological sites)

Highest concentrations predicted at any designated ecological site for full time operation on natural gas, annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) µg/m^3	Background concentration µg/m^3	Predicted Environmental Concentration (PEC) µg/m^3	Air Quality Standard µg/m^3	PC as % of Air Quality Standard
2019 - 2023	Annual mean	0.18	14.7	14.9	30	0.6

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions.

The maximum predicted Process Contributions are considered with the background concentrations to arrive at a Predicted Environmental Concentration (PEC). The background concentration selected is for the areas closest to the site where maximum predicted Process Contributions (PCs) arise which is likely to be conservative given the surrounding land uses and the dominating influence of traffic from the road network on ambient air quality. Areas removed from the road network would be expected to show lower concentrations of traffic-related pollutants such as NO_2 and NO_x. The background concentrations of NOx as determined from the long term EPA monitoring data for rural Ireland (Table 3.5) compare well with the site specific data presented in Tables 3.6, Table 3.7 and Table 3.10, although the site specific data is lower than the level chosen as background for the area in this study.

The results indicate that the cumulative impact of the proposed development with existing activities will not exceed the air quality standard of 30 µg/m^3 expressed as an annual mean for ground level concentration of NO_x. The results therefore indicate that the emissions from the facility will not exert a significant adverse impact on any receptor outside the site boundary or, specifically, any designated ecosystems. The maximum predicted process contribution to ground level concentration as a result of the proposed development is less than 1% of the Air Quality Standard for full time operation on natural gas at designated ecological sites. The results indicate that the cumulative impact of the proposed development with existing activities will not exceed the air quality standard.

4.3.3 Impact of Fulltime operation on Gas oil fuel on ecosystems

The impact of nitrogen oxides (NOx) emissions on sensitive ecosystems was assessed by modelling the NOx emissions from the worst case scenario with the turbines operating full time on Gas oil. This is an unlikely operating scenario for the facility, but inclusion of the scenario in this assessment is considered prudent. The assessment considers all locations outside the site boundary and separately receptors located in the designated ecological sites.

The impact predictions for the concentration of nitrogen oxides in air at ground level are presented in Table 4.7 for maximum ground level concentrations predicted at the designated ecological sites.

The maximum predicted Process Contributions are considered with the background concentrations to arrive at a Predicted Environmental Concentration (PEC). The background concentration selected is for the areas closest to the site where maximum predicted Process Contributions (PCs) arise which is likely to be conservative given the surrounding land uses and the dominating influence of traffic from the road network on ambient air quality.

The results indicate that the cumulative impact of the proposed development with existing activities will not exceed the air quality standard of 30 µg/m^3 expressed as an annual mean for ground level concentration of NO_x. The results therefore indicate that the emissions from the facility will not exert a significant adverse impact on any designated ecosystems. The maximum predicted process contribution to ground level concentration as a result of the proposed development is 3.7% of the Air Quality Standard for full time operation on Gas oil at any designated ecological site for full time operation on gas oil.

Table 4.7 Predicted NO_x concentrations for Worst Case Operation on Gas oil (Ecological sites)

Highest concentrations predicted at any designated ecological site for full time operation on gas oil, annual average emissions

Meteorological data	Averaging interval	Process Contribution (PC) μg/m^3	Background concentration μg/m^3	Predicted Environmental Concentration (PEC) μg/m^3	Air Quality Standard μg/m^3	PC as % of Air Quality Standard
2019 - 2023	Annual mean	1.1	14.7	15.8	30	3.7

NOTE

The background concentration is the annual mean when evaluating annual or daily predictions.

4.3.4 Impact of nitrogen deposition from the proposed facility on ecosystems

The potential impact of the emissions on ecosystems is also considered using the projected nitrogen deposition rate which is derived from the gaseous nitrogen oxides concentration. The most sensitive habitat for this purpose is bog ecosystems and a recommendation of 5kg N ha^{-1} year^{-1} has been made [UNECE 5 – 10 kg N ha^{-1} year^{-1} and EPA *Research Report 390: Nitrogen–Sulfur Critical Loads: Assessment of the Impacts of Air Pollution on Habitats (2016-CCRP-MS.43)* 5kg N ha^{-1} year^{-1}] as the critical load for habitat protection. The maximum rate of deposition of total nitrogen at any of the designated ecological receptors within 15km of the proposed site was determined from dispersion modelling as follows with data provided for the highest concentration predicted from the five years of meteorological data for any receptor at the designated ecological sites represented by E1 – E37.

The predicted deposition rates for the worst case operating scenario are well within the critical loads. The contribution from the process to the nitrogen deposition rate is less than 7% of the recommended level under maximum adverse conditions. The levels may also be considered in the context of measured nitrogen deposition rates at Valentia Observatory [EPA *Research Report 390: Nitrogen–Sulfur Critical Loads: Assessment of the Impacts of Air Pollution on Habitats (2016-CCRP-MS.43)*]. This study estimated deposition rates of 8.3 kg N ha−1 y−1 for 2006 - 2015, with a maximum deposition of 19.3 kg N ha−1 y−1 during 2009. The Research Report found that dry deposition made up 40% of total deposition, which was dominated by reduced species (56%), that is, wet ammonium, dry particulate ammonium and dry gaseous ammonia. None of these species are significant in the current study but it is useful to note that nitrogen oxides are not the dominant contributor to nitrogen deposition in Ireland. Agricultural emissions are a much more significant source of deposition in rural environments than traffic or any facility of the type proposed here.

When these concentrations are converted to nitrogen deposition rates following the methodology outlined in the EPA Guidance Note AG4, and using the specified deposition velocities of 0.0015 (grassland) or 0.003 (forest), the assessment predicted a maximum potential nitrogen deposition rate at ecological sites as shown in Table 4.8. The data presented in Table 4.8 shows that even if the plant runs continuously on either gas or Gas oil, with Gas oil being the worst case scenario, the maximum potential impact at any location in the protected ecological sites, is significantly lower than the relevant critical loads as set out above.

Table 4.8 Total Nitrogen deposition at designated ecological sites as a result of emissions from the proposed Reserve Power plant: worst case operating scenario (Gas oil full time operation, maximum daily emissions)

Maximum impacted Ecological Receptor	**Maximum Total nitrogen deposition, kg N ha^{-1} year^{-1}**	
	Deposition velocity 0.0015m/sec	**Deposition velocity 0.003m/sec**
Process Contribution	0.158	0.316
Contribution from background	2.11	4.23
Total environmental contribution	2.26	4.54

Note

This data is for Site E19 Meneen Bog NHA where maximum impact is observed. Data for all sites is presented in Appendix III.

4.3.5 Impact of SO_2 deposition from the proposed facility on ecosystems

Nitrogen oxide emissions are significant in the emissions and the principal pollutant with potential to impact ecosystems is nitrogen oxides which are assessed in the report. Emissions to atmosphere of SO_2 are negligible when burning natural gas as fuel. As a result the potential impact on ecosystems is negligible and is not further considered. Emissions of SO_2 when using gas oil as fuel are higher than when using natural gas due to the higher sulfur content in the fuel. But the emission rates are still extremely low and unlikely to exert a measurable impact on ecosystems. Although SO_2 emissions are not expected to exert a measurable impact when burning gas oil as fuel, this section of the report considers the impact of sulfur dioxide on ecosystems. There are no other emissions, and specifically no ammonia or acid gases (HCl, H_2SO_4, HNO_3) in the emission stream so no further emissions require assessment.

The potential impact of SO_2 emissions on ecosystems is assessed using (a) the predicted ground level concentration of SO_2 and (b) the projected SO_2 deposition rate which is derived from the gaseous sulfur dioxide concentration. The predicted ground level concentrations of SO_2 as a result of emissions during the worst case scenario of operating full time on gas oil are presented in Table 4.4a and Table 4.4e where it is shown that the maximum annual mean predicted ground level concentration of SO_2 is 1.6% of the Air Quality Standard from the Process emissions with background levels more than 10 times higher. The overall predicted environmental concentration from the small Process contribution combined with the background contribution does not exceed the relevant Air Quality Standard for protection of ecosystems.

The maximum rate of deposition of total SO_2 at any of the designated ecological receptors within 15km of the proposed site was determined from dispersion modelling as follows with data provided for the highest concentration predicted from the five years of meteorological data for any receptor at the designated ecological sites represented by E1 – E37.

Table 4.9 Total SO_2 deposition at designated ecological sites as a result of emissions from the proposed Reserve Power plant: worst case operating scenario (Gas oil full time operation, annual average emissions)

Maximum impacted Ecological Receptor	**Maximum Total SO_2 deposition, keq ha^{-1} year^{-1}**	
	Deposition velocity 0.012m/sec Grassland	**Deposition velocity 0.024m/sec Forest**
Process Contribution	0.0567	0.1134
Contribution from background	0.5196	1.039
Total environmental contribution	0.5763	1.1524

There are no universal critical loads for habitat protection for SO_2 deposition. Critical Levels for SO_2 are set in the UK according to the Publication *UKCLAG, 1996. Critical levels of air pollutants for the United Kingdom*. UK Critical Loads Advisory Group, Institute of Terrestrial Ecology, Edinburgh. The Critical Level for forestry and natural vegetation as a winter mean concentration, 15 ug m^{-3}, is set for the critical level in areas with colder winter climates, because SO_2 is known to be more damaging under these conditions. This low temperature area is mainly confined to Scotland and northern England. The limit would not be relevant in Ireland but if it were applicable, the highest level of SO_2 predicted to occur as a result of the Process is 0.32ug./m^3 which is less than 2% of this advisory limit. Certain groups of lichen are the most sensitive known organisms to SO_2; so a critical level of an annual mean of 10 ug m^{-3} has been set to protect the most sensitive of these organisms. The highest level of SO_2 predicted to occur as a result of the Process is 0.32 ug./m^3 which is just 3% of this advisory limit. The background concentration of SO_2 is nearly four times higher than the Process contribution but the combined concentrations still do not exceed the advisory limits of 10 and 15mg/m3. There is therefore no adverse impact from the deposition of SO_2 from the Process on agriculture or ecosystems.

4.4 Assessment of cumulative impact Predicted Environmental Concentrations (PEC)

The cumulative air quality impact expressed in terms of the Predicted Environmental Concentration (PEC) is assessed by considering the background air quality in the area. The background concentration is the annual mean when evaluating annual or daily predictions and is taken as twice the annual mean when evaluating hourly or daily predictions.

The results are presented in Tables 4.1 to 4.4 for the potential operating scenarios. The modelling predictions for these potential operating scenarios indicate that the cumulative impact of the operation of the sources with existing activities will not exceed the Air Quality Standards. As is evident from the contour plots presented in Appendix II, the highest predicted PCs are close to the facility with concentrations reducing with distance from the source as expected.

4.5 Sensitivity analysis

Sensitivity checks on the modelling assumptions were checked as follows:

- Meteorological data selection
- Stack height
- Influence of terrain

The detailed results of those assessments are presented with the detailed modelling results in Appendix III. A summary of the principal findings is given here.

(i) The sensitivity of the modelling predictions to the choice of meteorological data was evaluated by comparing the results o modelling using meteorological data from Shannon Airport, Knock, Mullingar and Casement Aerodrome. Predictions for the 99.8%ile of 1-hour GLC for nitrogen dioxide were lower using the alternative data sets than those obtained using the Shannon meteorological data set. The assessment therefore presents a conservative assessment of air quality impacts of the proposed development.

(ii) Stack heights of 35m to 55m were investigated. As shown in Table 4.10 there is very little difference between the predictions. The minimum height of 35m represents the lowest stack height consistent with best practice as it is 3m above the height of the roof. The relatively high exit temperature and exit gas velocity results in very effective dispersion of emissions once the best practice height of 3m above the roof height is reached.

Table 4.10 Influence of stack height on model predictions

Parameter	**Averaging Interval**	**Stack height, m**	**Predicted Process Contribution to GLC, ug/m^3**
NO_2	99.8 %ile of 1-hour average	35	39.4
		40	38.9
		45	38.5
		50	38.4
		55	38.3

(iii) The influence of terrain was investigated by completing model runs with and without detailed terrain data. There was very little difference between the two sets of predictions indicating that terrain is not the dominant influence on dispersion of emissions for the project.

5.0 CONCLUSIONS

The impact of emissions to atmosphere has been investigated using a dispersion modelling approach. The assessment considered a stack height of 45m and demonstrated that this stack height is adequate to ensure the effective dispersion of the emissions. The assessment shows that the predicted concentrations are not predicted to exceed the Air Quality Standards for the normal and conservative worst-case operating scenarios assessed. There is therefore predicted to be no significant adverse impact on human health or on ecosystems as a result of the emissions.

Appendix 9.1

Diffusion Tube Air Quality Monitoring Surveys at Coolpowra Site

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: ICH
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 14.03.2024
place: passam ag

test report
created on: 15.03.2024
created by: K. Bodei
checked on: 18.03.2024
checked by: T. Hangartner
file name: ICH12-S-2401
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-1	IHC-1	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-102	2	2	45287	45301	08/02/2024		336.0	< 0.05	0.03	< 0.05	< 2.5	1.8	< 3.2	
AS-103	3	3	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	
AS-104	4	4	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-105	5	5	45287	45301	08/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.5	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement ICH12-S-2401

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	IHC-1	08/02/2024		22/02/2024		10		NA
AS-102	2	2	08/02/2024		22/02/2024		10		NA
AS-103	3	3	08/02/2024		22/02/2024		10		NA
AS-104	4	4	08/02/2024		22/02/2024		10		NA
AS-105	5	5	08/02/2024		22/02/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers
date received: 12.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis
method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report
created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102401
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-1	45306-4	08/02/2024	15:30	22/02/2024	09:00	329.5	0.251	-	0.253	< 0.72	< 2	
AS-102	2	45306-4	08/02/2024	16:00	22/02/2024	09:15	329.3	0.251	-	0.270	< 0.72	< 2	
AS-103	3	45306-4	08/02/2024	16:15	22/02/2024	09:30	329.3	0.251	-	0.250	< 0.72	< 2	
AS-104	4	45306-4	08/02/2024	16:30	22/02/2024	09:45	329.3	0.251	-	0.260	< 0.72	< 2	
AS-105	5	45306-4	08/02/2024	17:15	22/02/2024	10:00	328.8	0.251	-	0.262	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102401

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-1	08/02/2024	15:30	22/02/2024	09:00	4		NA
AS-102	2	08/02/2024	16:00	22/02/2024	09:15	4		NA
AS-103	3	08/02/2024	16:15	22/02/2024	09:30	4		NA
AS-104	4	08/02/2024	16:30	22/02/2024	09:45	4		NA
AS-105	5	08/02/2024	17:15	22/02/2024	10:00	4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112401
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
			start		end		exp. time	blank	sample		m analyte/ sampler	C NH3	
	label	lot no.	date	time	date	time	[h]	[ABS]	dilution	value [ABS]	[ug]	[ug/m3]	
AS-101	IHC-1	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.133	0.55	0.8	
AS-102	IHC-2	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.416	2.47	3.7	sampler uncapped
AS-103	IHC-3	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.124	0.49	0.7	
AS-104	IHC-4	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.147	0.65	1.0	
AS-105	IHC-5	45308	08/02/2024		22/02/2024		336.0	0.051	1	0.164	0.76	1.1	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112401

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	measuring period start time	measuring period end date	measuring period end time	Optional information: Temp [°C]	Optional information: air pressure [hPa]	Optional information: Comment on sampling
AS-101	IHC-1	08/02/2024		22/02/2024		4		NA
AS-102	IHC-2	08/02/2024		22/02/2024		4		NA
AS-103	IHC-3	08/02/2024		22/02/2024		4		NA
AS-104	IHC-4	08/02/2024		22/02/2024		4		NA
AS-105	IHC-5	08/02/2024		22/02/2024		4		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 14.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 22.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC12-S-2402
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
	NO2	NOx	NO2	NOx	date	time	h	NO ug	NO2 ug	NOx ug	NO ug/m3	NO2 ug/m3	NOx ug/m3	
AS-101	IHC-6	IHC-6	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.1	< 3.2	
AS-102	IHC-7	IHC-7	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.4	< 3.2	
AS-103	IHC-8	IHC-8	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-104	IHC-9	IHC-9	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	
AS-105	IHC-10	IHC-10	45287	45301	22/02/2024		336.0	< 0.05	0.02	< 0.05	< 2.5	1.2	< 3.2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2402

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers
date received: 14.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis
method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report
created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102402
pages: 1

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-6	45306-4	22/02/2024	09:00	07/03/2024	10:00	337.0	0.251	-	0.250	< 0.72	< 2	
AS-102	7	45306-4	22/02/2024	09:15	07/03/2024	10:15	337.0	0.251	-	0.256	< 0.72	< 2	
AS-103	8	45306-4	22/02/2024	09:30	07/03/2024	10:30	337.0	0.251	-	0.260	< 0.72	< 2	
AS-104	9	45306-4	22/02/2024	09:45	07/03/2024	10:45	337.0	0.251	-	0.264	< 0.72	< 2	
AS-105	10	45306-4	22/02/2024	10:00	07/03/2024	11:00	337.0	0.251	-	0.254	< 0.72	< 2	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102402

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-6	22/02/2024	09:00	07/03/2024	10:00	10		NA
AS-102	7	22/02/2024	09:15	07/03/2024	10:15	10		NA
AS-103	8	22/02/2024	09:30	07/03/2024	10:30	10		NA
AS-104	9	22/02/2024	09:45	07/03/2024	10:45	10		NA
AS-105	10	22/02/2024	10:00	07/03/2024	11:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Mr.Colm Staunton
project:
reference: two weeks

passive samplers
date received: 12.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis
method: SP11 photometer
analyte: Ammonium
date: 17.03.2024
place: passam ag

test report
created on: 22.03.2024
created by: U. Kunz
checked on: 22.03.2024
checked by: T. Hangartner
file name: IHC112402
pages: 1

SWISS ACCREDITATION
sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ABS]	sample dilution	sample value [ABS]	m analyte/ sampler [ug]	C NH3 [ug/m3]	
AS-101	IHC-6	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.137	0.58	0.9	
AS-102	IHC-7	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.136	0.57	0.9	
AS-103	IHC-8	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.099	< 0.34	< 0.5	
AS-104	IHC-9	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.145	0.64	0.9	
AS-105	IHC-10	45308	22/02/2024		07/03/2024		336.0	0.051	1	0.117	0.45	0.7	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112402

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period start date	start time	end date	end time	Optional information Temp [°C]	air pressure [hPa]	Comment on sampling
AS-101	IHC-6	22/02/2024		07/03/2024		10		NA
AS-102	IHC-7	22/02/2024		07/03/2024		10		NA
AS-103	IHC-8	22/02/2024		07/03/2024		10		NA
AS-104	IHC-9	22/02/2024		07/03/2024		10		NA
AS-105	IHC-10	22/02/2024		07/03/2024		10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers
date received: 28.03.2024
type: tube (Palms)
pollutant: NOx (NO+NO2)
protective filter: yes
limit of detection: NO: 2.5 ug/m3 (14 days)
NO2: 0.7 ug/m3 (14 days)

analysis
method: SP12-S photometer, Salzmann
analyte: [NO]-
date: 11.04.2024
place: passam ag

test report
created on: 11.04.2024
created by: U. Kunz
checked on: 11.04.2024
checked by: T. Hangartner
file name: IHC12-S-2403
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025 measurement uncertainty <30%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler				measuring period			result						Comment on the analysis
	label		lot no.		start		exp. time	m / sampler			Conc			
								NO	NO2	NOx	NO	NO2	NOx	
	NO2	NOx	NO2	NOx	date	time	h	ug	ug	ug	ug/m3	ug/m3	ug/m3	
AS-101	IHC-11	IHC-11	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-102	IHC-12	IHC-12	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	
AS-103	IHC-13	IHC-13	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	Back with green membrane, uncapped!
AS-104	IHC-14	IHC-14	45287	45301	07/03/2024	11:00	358.0	0.09	0.02	0.12	4.5	1.4	6.0	Back with green membrane, uncapped!
AS-105	IHC-15	IHC-15	45287	45301	07/03/2024	11:00	358.0	< 0.05	0.02	< 0.05	< 2.3	1.6	< 3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC12-S-2403

passam ag

air quality monitoring

NOx (NO+NO2) Nitrogen oxides measurement by means of passive sampler

measuring site	passive sampler		measuring period				Optional information		
	label	label	start		end		Temp	air pressure	Comment on sampling
	NO2	NOx	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

SO2 Sulfur dioxide measurement by means of passive sampler

customer information
customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference:

passive samplers
date received: 28.03.2024
type: badge
pollutant: SO2
limit of detection: 2 ug/m3 (14 days)
sampling rate: 11.9 [ml/min]

analysis
method: SP10 ion chromatography
analyte: Sulfate
date: 02.04.2024
place: passam ag

test report
created on: 03.04.2024
created by: N. Spichtig
checked on: 03.04.2024
checked by: T. Hangartner
file name: IHC102403
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ppm]	sample dilution	sample value [ppm]	m analyte/ sampler [ug]	C SO2 [ug/m3]	
AS-101	IHC-11	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.263	< 0.72	< 1.9	
AS-102	12	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.264	< 0.72	< 1.9	
AS-103	13	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.262	< 0.72	< 1.9	
AS-104	14	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.265	< 0.72	< 1.9	
AS-105	15	45306-4	07/03/2024	11:00	22/03/2024	09:00	358.0	0.251	-	0.268	< 0.72	< 1.9	

Sampling information

Annex: Test Report Air Pollution Measurement IHC102403

passam ag

air quality monitoring

SO_2 Sulfur dioxide measurement by means of passive sampler

measuring site	passive sampler	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
	label	date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Test Report Air Pollution Measurement

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

customer information

customer: Halston
customer ID: IHC
contact person: Colm Staunton
project:
reference: two weeks

passive samplers

date received: 28.03.2024
type: badge
pollutant: NH3
limit of detection: 0.5 ug/m3 (14 days)
sampling rate: 31.5 [ml/min]

analysis

method: SP11 photometer
analyte: Ammonium
date: 04.04.2024
place: passam ag

test report

created on: 04.04.2024
created by: U. Kunz
checked on: 04.04.2024
checked by: T. Hangartner
file name: IHC112403
pages: 1

SWISS ACCREDITATION sas.admin.ch STS 0149

note: applies to the sample as received; results below the detection limit are indicated with "<" and the associated value; this method is accredited to ISO/IEC 17025
measurement uncertainty <25%; sampling rate related to 20 °C; further information at www.passam.ch

measuring site	passive sampler		measuring period					measurement			result		Comment on the analysis
	label	lot no.	start date	start time	end date	end time	exp. time [h]	blank [ABS]	sample dilution	sample value [ABS]	m analyte/ sampler [ug]	C NH3 [ug/m3]	
AS-101	IHC-11	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.337	1.95	2.7	
AS-102	IHC-12	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.189	0.94	1.3	
AS-103	IHC-13	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.173	0.83	1.2	
AS-104	IHC-14	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.150	0.68	0.9	
AS-105	IHC-15	45308	07/03/2024	11:00	22/03/2024	09:00	358.0	0.051	1	0.192	0.96	1.3	

Sampling information

Annex: Test Report Air Pollution Measurement IHC112403

passam ag

air quality monitoring

NH3 Ammonia measurement by means of passive sampler

measuring site	passive sampler label	measuring period				Optional information		
		start		end		Temp	air pressure	Comment on sampling
		date	time	date	time	[°C]	[hPa]	
AS-101	IHC-11	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-102	IHC-12	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-103	IHC-13	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-104	IHC-14	07/03/2024	11:00	22/03/2024	09:00	10		NA
AS-105	IHC-15	07/03/2024	11:00	22/03/2024	09:00	10		NA

Appendix 9.2

Continuous Ambient Air Quality Monitoring Surveys at Coolpowra Site

Figure A9.2.1 Continuous monitoring results NO_2

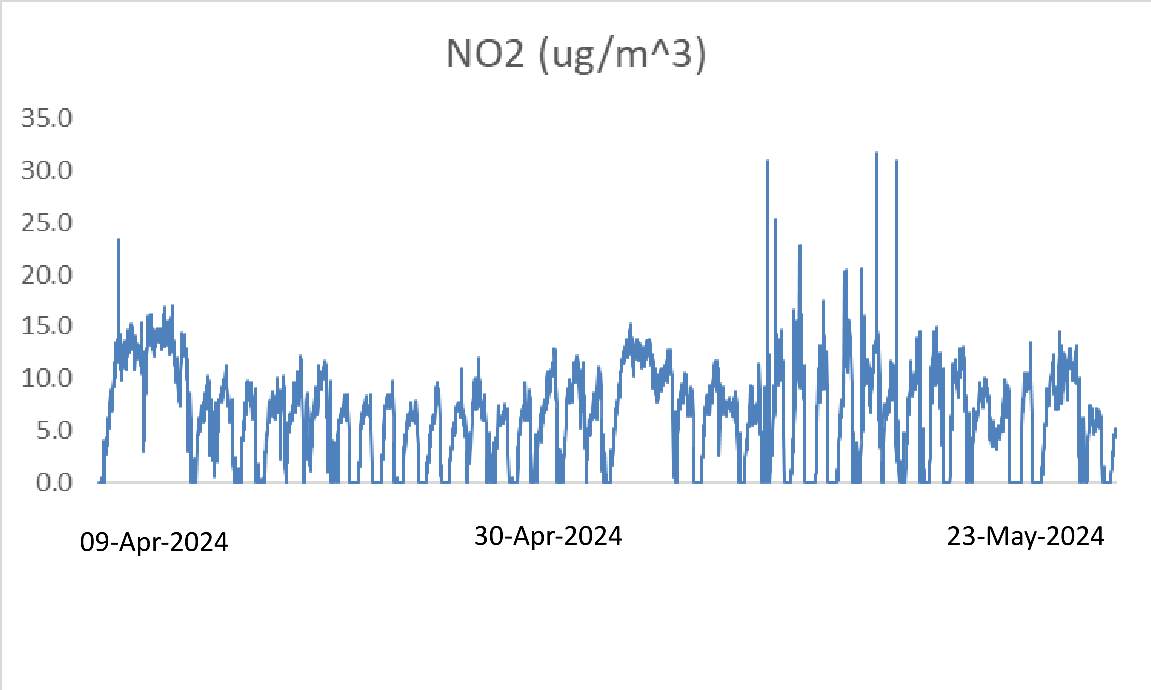


Figure A9.2.2 Continuous monitoring results NO

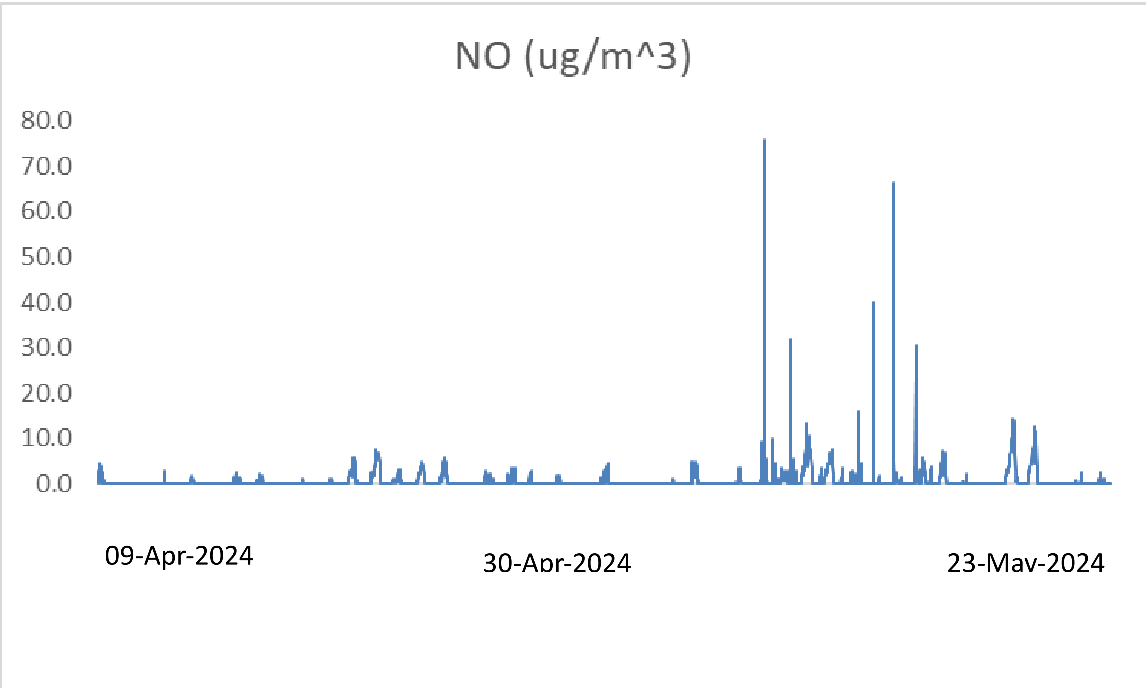
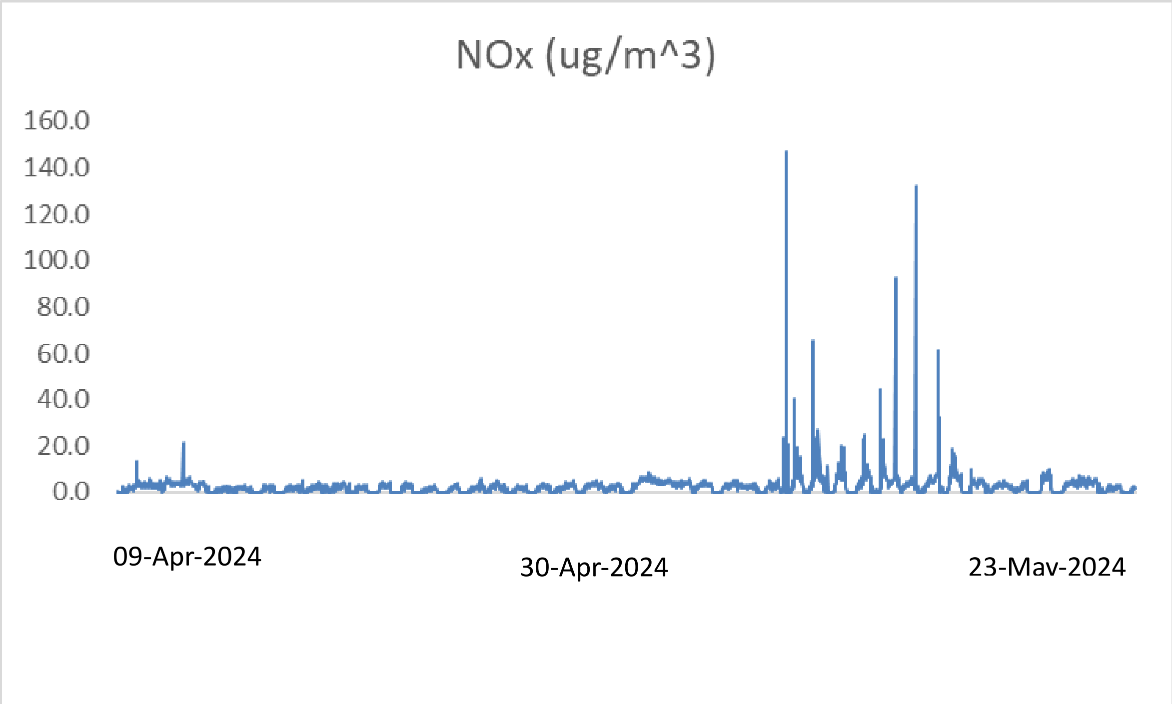


Figure A9.2.3 Continuous monitoring results NO_x



Date	PM10	PM1	PM2.5
09/04/2024	3.56	1.68	3.5
10/04/2024	2.18	1.31	2.15
11/04/2024	6.86	4.4	6.85
12/04/2024	1.76	0.93	1.65
13/04/2024	4.56	2.38	4.51
14/04/2024	4.92	2.45	4.88
15/04/2024	6.48	3.54	6.47
16/04/2024	4.67	2.47	4.66
17/04/2024	4.37	2.07	4.31
18/04/2024	4.41	2.39	4.39
19/04/2024	1.66	0.89	1.63
20/04/2024	2.92	1.87	2.87
21/04/2024	3.85	2.68	3.81
22/04/2024	2.8	1.69	2.71
23/04/2024	2.08	1.06	2.04
24/04/2024	4.73	2.39	4.67
25/04/2024	3.14	1.69	3.12
26/04/2024	2.16	1.44	2.13
27/04/2024	2.1	1.46	2.03
28/04/2024	2.04	1.25	1.93
29/04/2024	1.51	0.77	1.45
30/04/2024	1.78	0.9	1.66
01/05/2024	1.88	0.97	1.84
02/05/2024	2.38	1.62	2.32
03/05/2024	1.66	0.75	1.52
04/05/2024	1.94	1.01	1.89
05/05/2024	1.88	1.1	1.75
06/05/2024	2.66	1.7	2.58
07/05/2024	4.27	2.28	4.2
08/05/2024	3.44	2.16	3.33
09/05/2024	2.93	2.11	2.83
10/05/2024	3.45	2.49	3.39
11/05/2024	5.18	4.1	5.17
12/05/2024	5.61	4.44	5.53
13/05/2024	1.36	0.74	1.25
14/05/2024	2.63	1.58	2.54
15/05/2024	1.66	1.04	1.64
16/05/2024	3.64	2.66	3.45
17/05/2024	3.75	2.49	3.68
18/05/2024	2.91	1.93	2.88
19/05/2024	1.85	1	1.65
20/05/2024	3.09	2	3
21/05/2024	2.57	1.96	2.44
22/05/2024	1	1.87	1.69
23/05/2024	1.58	3.18	3.05
Average 24-hr	***3.1***	***2.2***	***3.0***

Appendix I

Gridded and sensitive receptors

Table 1 Ecological and Human Sensitive Receptor locations

1	D1	Sensitive	550238.28	5887215.5
2	D2	Sensitive	550259.78	5887188.74
3	D3	Sensitive	550315.72	5887186.07
4	D4	Sensitive	550228.9	5887156.05
5	D5	Sensitive	550198.29	5887140.41
6	D6	Sensitive	550173.32	5887117.96
7	D7	Sensitive	550139.9	5887100.77
8	D8	Sensitive	550252.96	5887074.96
9	D9	Sensitive	549976	5886926.63
10	D10	Sensitive	549975.11	5886743.88
11	D11	Sensitive	550090.75	5886606.65
12	D12	Sensitive	550217.14	5886434.61
13	D13	Sensitive	550415.62	5886524.65
14	D14	Sensitive	549969.78	5886405.1
15	D15	Sensitive	549642.04	5885990.65
16	D16	Sensitive	549637.06	5885902.72
17	D17	Sensitive	549668.23	5885874.46
18	D18	Sensitive	549515.59	5885967.26
19	D19	Sensitive	549409.58	5885985.75
20	D20	Sensitive	549239.55	5885787.96
21	D21	Sensitive	549647.2	5885541.19
22	D22	Sensitive	549468	5885232.28
23	D23	Sensitive	549449.16	5885192.76
24	D24	Sensitive	549506.84	5885125.68
25	D25	Sensitive	549381.61	5885042.53
26	D26	Sensitive	549288.83	5884982.25
27	D27	Sensitive	549289.38	5885040.19
28	D28	Sensitive	549213.42	5885009.48
29	D29	Sensitive	550934.39	5885652.77
30	D30	Sensitive	550862.18	5885572.12

31	D31	Sensitive	550872.23	5885540.31
32	D32	Sensitive	550875.79	5885513.42
33	D33	Sensitive	550898.13	5885356.16
34	D34	Sensitive	551082.74	5885439.72
35	D35	Sensitive	551320.11	5885271.64
36	D36	Sensitive	551184.04	5885776.36
37	D37	Sensitive	551584.91	5885633.73
38	D38	Sensitive	550863.42	5885940.68
39	D39	Sensitive	550782.09	5886031.32
40	D40	Sensitive	550882.07	5886428.66
41	D41	Sensitive	550857.02	5886416.68
42	D42	Sensitive	550657.17	5886484.87
43	D43	Sensitive	550610.9	5886647.37
44	D44	Sensitive	550906.12	5886729.95
45	D45	Sensitive	550988.18	5886666.87
46	D46	Sensitive	551267.33	5886629.4
47	D47	Sensitive	551308.41	5886695.15
48	D48	Sensitive	551415.31	5886687.73
49	D49	Sensitive	551526.34	5886722.7
50	D50	Sensitive	551734.06	5886685.02
51	D51	Sensitive	552258.1	5887366.04
52	D52	Sensitive	552222.94	5887437.15
53	D53	Sensitive	551054.48	5887185.25
54	D54	Sensitive	551040.38	5887196.43
55	D55	Sensitive	551036.9	5887170.04
56	D56	Sensitive	551022.12	5887181.79
57	D57	Sensitive	550942.67	5888292.65
58	D58	Sensitive	550861.78	5888534.33
59	D59	Sensitive	551044.59	5888606.9
60	D60	Sensitive	551106.44	5888623.22
61	D61	Sensitive	551129.34	5888700.34

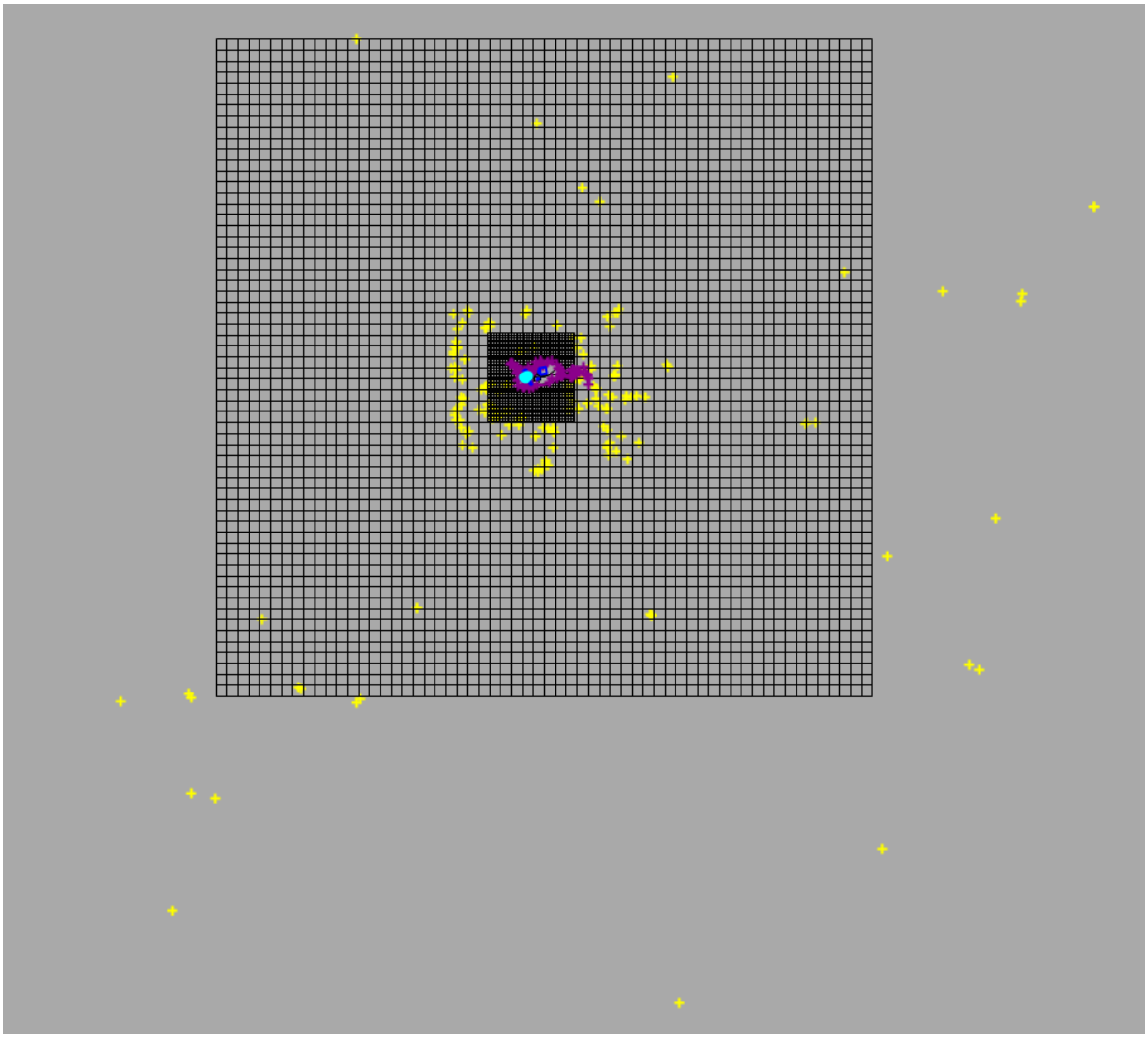
62	D62	Sensitive	549039.8	5888667.86
63	D63	Sensitive	548995.23	5888582.25
64	D64	Sensitive	547663.96	5888675.09
65	D65	Sensitive	547691.72	5888616.01
66	D66	Sensitive	547351.19	5888591.09
67	D67	Sensitive	547566.57	5888367.26
68	D68	Sensitive	547458.14	5888229.68
69	D69	Sensitive	548204.65	5888367.65
70	D70	Sensitive	548168.33	5888377.37
71	D71	Sensitive	548179.82	5888278.63
72	D72	Sensitive	548104.52	5888268.71
73	D73	Sensitive	548087.47	5888276.36
74	D74	Sensitive	548868.17	5887758.17
75	D75	Sensitive	548932.55	5887734.96
76	D76	Sensitive	549199.24	5887833.92
77	D77	Sensitive	550495.61	5887325.05
78	D78	Sensitive	550500.41	5887387.84
79	D79	Sensitive	550324.34	5887658.02
80	D80	Sensitive	550175.96	5887816.96
81	D81	Sensitive	550106.32	5888040.14
82	D82	Sensitive	550280.35	5888035.46
83	D83	Sensitive	549719.64	5888322.66
84	D84	Sensitive	550545.39	5886943.5
85	D85	Sensitive	550599.07	5886878.3
86	D86	Sensitive	550619.22	5886841.34
87	D87	Sensitive	548906.29	5886220.01
88	D88	Sensitive	548844.43	5886058.89
89	D89	Sensitive	548839.4	5886201.26
90	D90	Sensitive	548639.01	5886039.21
91	D91	Sensitive	548457.06	5885821.85
92	D92	Sensitive	548636.36	5886389.69

93	D93	Sensitive	548550.81	5886329.39
94	D94	Sensitive	548404.21	5886782.59
95	D95	Sensitive	548561.83	5886939.6
96	D96	Sensitive	548586.03	5886957.59
97	D97	Sensitive	548556.26	5887008.94
98	D98	Sensitive	548224.25	5886961.36
99	D99	Sensitive	548116.65	5886941.38
100	D100	Sensitive	548087.24	5886915.09
101	D101	Sensitive	548113.24	5886863.86
102	D102	Sensitive	547992.86	5886857.51
103	D103	Sensitive	548373.1	5886229.54
104	D104	Sensitive	548315.25	5886403.1
105	D105	Sensitive	548253.79	5886441.06
106	D106	Sensitive	548247.85	5886176.71
107	D107	Sensitive	548064.53	5886343.47
108	D108	Sensitive	547947.28	5886392.37
109	D109	Sensitive	548165.83	5886496.65
110	D110	Sensitive	548134.46	5886519.2
111	D111	Sensitive	547594.52	5886657.91
112	D112	Sensitive	547536.51	5886681.77
113	D113	Sensitive	547525.32	5886511.09
114	D114	Sensitive	547436.19	5886434.21
115	D115	Sensitive	547394.27	5886356.07
116	D116	Sensitive	547393	5886274
117	D117	Sensitive	547411.53	5886169.04
118	D118	Sensitive	547492.55	5886171.13
119	D119	Sensitive	547529.35	5885997.54
120	D120	Sensitive	547691.21	5885902.94
121	D121	Sensitive	547645.19	5885843.72
122	D122	Sensitive	547560.95	5887071.56
123	D123	Sensitive	547383.27	5887132.26

124	D124	Sensitive	547413.41	5887307.74
125	D125	Sensitive	547393.44	5887360.91
126	D126	Sensitive	547302.14	5887355.52
127	D127	Sensitive	547631.17	5887537.79
128	D128	Sensitive	547372.57	5887669.84
129	D129	Sensitive	547368.9	5887729.98
130	D130	Sensitive	547438.5	5887804.15
131	D131	Sensitive	547456.16	5887824.58
132	D132	Sensitive	547397.26	5887838.43
133	D133	Sensitive	547410.19	5887955.6
134	D134	Sensitive	547799.97	5885520.29
135	D135	Sensitive	547571.76	5885597.33
136	D136	Eco	551884.21	5881704.2
137	D137	Eco	546527.06	5881880.45
138	D138	Eco	543816.93	5880059.04
139	D139	Eco	545150.28	5879719.17
140	D140	Eco	559365.2	5880456.71
141	D141	Eco	560340	5889038
142	D142	Eco	541379.32	5877638.83
143	D143	Eco	541300.32	5879918.27
144	D144	Eco	555616.19	5886093.94
145	D145	Eco	550298.35	5891462.71
146	D146	Eco	561994.19	5891020.25
147	D147	Eco	555437.33	5886114.82
148	D148	Eco	542991.35	5881595.79
149	D149	Eco	551884.21	5881704.2
150	D150	Eco	561994.19	5891020.25
151	D151	Eco	559741.58	5883918.76
152	D152	Eco	540941.97	5874951.22
153	D153	Eco	558525.98	5889087.12
154	D154	Eco	556301.24	5889539.18

155	D155	Eco	539758.39	5879730.61
156	D156	Eco	551090	5887399
157	D157	Eco	552364.44	5893986.85
158	D158	Eco	549265.41	5892929.3
159	D159	Eco	545140.56	5894870.35
160	D160	Eco	550704.49	5891147.68
161	D161	Eco	541376.79	5879816.57
162	D162	Eco	541908.61	5877530.76
163	D163	Eco	555393.6	5886068.88
164	D164	Eco	545229.73	5879802.95
165	D165	Eco	551855.31	5881738.96
166	D166	Eco	546514.36	5881881.51
167	D167	Eco	543873.72	5880034.93
168	D168	Eco	557259.87	5883050.94
169	D169	Eco	560329.65	5888858.8
170	D170	Eco	559146.6	5880560.82
171	D171	Eco	557151.63	5876359.38
172	D172	Eco	552518.66	5872845.96
173	D173		536692	5873573.9

Figure 1 Gridded Receptors



APPENDIX 11.1

NOISE IMPACT ASSESSMENT – PLATES

Location NMP1

Location NMP2

Location NMP3

Location NMP4

Location NMP5

Location NMP6

Location NMP7

Location NMP8

APPENDIX 11.2

NOISE MONITORING DATA

Location	**NMP1**
Project Name:	2024-04-22_SLM_001 LAeq
Device Info:	XL2, SNo. A2A-08898-E0, FW4.71 Type Approved
Mic Type:	NTi Audio M2230, SNo. 5062, User calibrated 2024-04-22 13:15
Mic Sensitivity:	41.0 mV/Pa
Range:	0 - 100 dB

Results

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
Recorded	**2024-04-22 13:21:58**	**2:2:20:58**	**52.0**	**84.3**		
Project Result		**2:2:20:58**	**52.0**	**84.3**	**47.6**	**29.1**

Markers

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
Night (2)		**16:00:00**	**44.9**	**75.8**	**44.6**	**27.2**
Day (3)		**1:2:16:56**	**54.5**	**84.3**	**50.0**	**34.4**
Evening (2)		**8:00:00**	**43.0**	**73.3**	**44.7**	**29.7**

Audit Intervals

Type	Start	Duration	LAeq [dB]	LAFmax [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
15'	**2024-04-22 13:15:00**	**0:08:02**	**49.8**	**71.7**	**52.6**	**38.6**
15'	**2024-04-22 13:30:00**	**0:15:00**	**52.3**	**67.6**	**57.8**	**36.4**
15'	**2024-04-22 13:45:00**	**0:15:00**	**61.1**	**74.1**	**66.1**	**39.4**
15'	**2024-04-22 14:00:00**	**0:15:00**	**56.9**	**70.6**	**61.8**	**37.6**
15'	**2024-04-22 14:15:00**	**0:15:00**	**46.6**	**67.6**	**48.9**	**36.2**
15'	**2024-04-22 14:30:00**	**0:15:00**	**49.2**	**72.1**	**50.1**	**35.9**
15'	**2024-04-22 14:45:00**	**0:15:00**	**44.5**	**61.9**	**46.7**	**36.2**
15'	**2024-04-22 15:00:00**	**0:15:00**	**44.4**	**61.6**	**47.7**	**37.2**
15'	**2024-04-22 15:15:00**	**0:15:00**	**47.2**	**66.7**	**49.5**	**41.5**
15'	**2024-04-22 15:30:00**	**0:15:00**	**59.2**	**78.0**	**53.4**	**42.2**
15'	**2024-04-22 15:45:00**	**0:15:00**	**52.9**	**69.1**	**57.9**	**39.9**
15'	**2024-04-22 16:00:00**	**0:15:00**	**47.1**	**60.9**	**50.0**	**41.0**
15'	**2024-04-22 16:15:00**	**0:15:00**	**51.4**	**72.0**	**52.3**	**41.7**
15'	**2024-04-22 16:30:00**	**0:15:00**	**48.3**	**64.8**	**50.7**	**42.5**
15'	**2024-04-22 16:45:00**	**0:15:00**	**58.0**	**77.1**	**55.1**	**38.7**
15'	**2024-04-22 17:00:00**	**0:15:00**	**42.7**	**57.5**	**46.0**	**36.2**
15'	**2024-04-22 17:15:00**	**0:15:00**	**44.2**	**63.9**	**47.1**	**37.2**
15'	**2024-04-22 17:30:00**	**0:15:00**	**44.1**	**62.6**	**47.0**	**36.9**
15'	**2024-04-22 17:45:00**	**0:15:00**	**56.9**	**75.6**	**57.3**	**37.0**
15'	**2024-04-22 18:00:00**	**0:15:00**	**47.0**	**70.6**	**49.1**	**37.1**
15'	**2024-04-22 18:15:00**	**0:15:00**	**48.9**	**70.6**	**51.9**	**38.7**
15'	**2024-04-22 18:30:00**	**0:15:00**	**47.1**	**67.4**	**50.6**	**37.9**
15'	**2024-04-22 18:45:00**	**0:15:00**	**44.3**	**68.6**	**47.6**	**37.5**
15'	**2024-04-22 19:00:00**	**0:15:00**	**42.8**	**54.9**	**46.3**	**36.6**

15'	2024-04-22 19:15:00	0:15:00	43.0	64.1	45.9	36.4
15'	2024-04-22 19:30:00	0:15:00	42.8	58.9	46.5	34.9
15'	2024-04-22 19:45:00	0:15:00	44.4	65.0	45.2	33.9
15'	2024-04-22 20:00:00	0:15:00	42.0	60.4	45.0	35.7
15'	2024-04-22 20:15:00	0:15:00	50.1	69.0	53.9	35.9
15'	2024-04-22 20:30:00	0:15:00	50.8	61.3	54.6	38.1
15'	2024-04-22 20:45:00	0:15:00	47.9	56.6	53.1	34.2
15'	2024-04-22 21:00:00	0:15:00	39.6	55.1	43.7	32.6
15'	2024-04-22 21:15:00	0:15:00	43.4	66.3	41.1	31.3
15'	2024-04-22 21:30:00	0:15:00	34.3	49.5	37.1	29.7
15'	2024-04-22 21:45:00	0:15:00	32.7	48.7	35.4	28.7
15'	2024-04-22 22:00:00	0:15:00	33.2	53.3	35.0	28.6
15'	2024-04-22 22:15:00	0:15:00	38.4	54.6	43.6	29.5
15'	2024-04-22 22:30:00	0:15:00	37.8	54.2	42.8	28.9
15'	2024-04-22 22:45:00	0:15:00	33.2	48.5	36.0	28.4
15'	2024-04-22 23:00:00	0:15:00	31.8	44.6	34.4	27.4
15'	2024-04-22 23:15:00	0:15:00	34.0	52.3	36.5	28.4
15'	2024-04-22 23:30:00	0:15:00	33.1	47.1	35.9	27.9
15'	2024-04-22 23:45:00	0:15:00	30.5	41.3	32.9	26.6
15'	2024-04-23 00:00:00	0:15:00	32.4	45.3	35.0	27.9
15'	2024-04-23 00:15:00	0:15:00	33.9	51.3	36.9	28.0
15'	2024-04-23 00:30:00	0:15:00	32.6	46.1	35.2	28.1
15'	2024-04-23 00:45:00	0:15:00	33.5	47.8	36.4	28.1
15'	2024-04-23 01:00:00	0:15:00	33.6	45.5	36.6	28.5
15'	2024-04-23 01:15:00	0:15:00	33.1	47.9	36.1	27.5
15'	2024-04-23 01:30:00	0:15:00	32.5	48.1	35.4	27.3
15'	2024-04-23 01:45:00	0:15:00	31.1	44.5	33.5	27.2
15'	2024-04-23 02:00:00	0:15:00	32.6	54.4	34.6	27.3
15'	2024-04-23 02:15:00	0:15:00	31.4	50.5	33.7	26.6
15'	2024-04-23 02:30:00	0:15:00	31.3	49.7	34.0	26.3
15'	2024-04-23 02:45:00	0:15:00	35.4	52.1	38.5	28.5
15'	2024-04-23 03:00:00	0:15:00	29.9	50.4	32.1	25.8
15'	2024-04-23 03:15:00	0:15:00	29.3	41.8	31.2	25.9
15'	2024-04-23 03:30:00	0:15:00	31.9	45.6	34.5	26.6
15'	2024-04-23 03:45:00	0:15:00	30.0	40.7	32.5	26.3
15'	2024-04-23 04:00:00	0:15:00	29.2	44.1	31.6	25.7
15'	2024-04-23 04:15:00	0:15:00	30.4	42.3	32.7	26.8
15'	2024-04-23 04:30:00	0:15:00	29.9	37.8	32.5	25.7
15'	2024-04-23 04:45:00	0:15:00	32.3	52.1	32.4	26.3
15'	2024-04-23 05:00:00	0:15:00	38.0	55.2	37.6	27.6
15'	2024-04-23 05:15:00	0:15:00	38.6	63.5	41.1	30.1
15'	2024-04-23 05:30:00	0:15:00	46.1	60.3	49.8	37.5
15'	2024-04-23 05:45:00	0:15:00	58.3	71.5	63.7	41.6
15'	2024-04-23 06:00:00	0:15:00	51.1	69.1	52.8	38.3
15'	2024-04-23 06:15:00	0:15:00	54.0	75.8	56.9	37.9
15'	2024-04-23 06:30:00	0:15:00	54.8	73.7	53.6	36.0
15'	2024-04-23 06:45:00	0:15:00	42.8	62.6	45.4	35.9
15'	2024-04-23 07:00:00	0:15:00	44.0	59.4	47.4	37.0
15'	2024-04-23 07:15:00	0:15:00	55.1	76.5	53.2	37.2
15'	2024-04-23 07:30:00	0:15:00	45.1	62.8	48.7	35.2

15'	2024-04-23 07:45:00	0:15:00	42.0	55.9	45.7	34.8
15'	2024-04-23 08:00:00	0:15:00	57.3	75.7	53.9	35.2
15'	2024-04-23 08:15:00	0:15:00	54.2	74.1	53.4	36.0
15'	2024-04-23 08:30:00	0:15:00	41.7	57.1	45.0	35.8
15'	2024-04-23 08:45:00	0:15:00	50.4	70.7	47.9	36.1
15'	2024-04-23 09:00:00	0:15:00	42.3	61.3	44.7	34.5
15'	2024-04-23 09:15:00	0:15:00	51.7	72.8	45.1	34.8
15'	2024-04-23 09:30:00	0:15:00	45.9	69.3	44.9	34.2
15'	2024-04-23 09:45:00	0:15:00	44.1	62.9	45.9	33.9
15'	2024-04-23 10:00:00	0:15:00	46.2	64.3	46.0	32.5
15'	2024-04-23 10:15:00	0:15:00	40.2	56.3	44.1	32.5
15'	2024-04-23 10:30:00	0:15:00	52.0	73.2	47.5	35.6
15'	2024-04-23 10:45:00	0:15:00	45.9	64.5	46.7	33.4
15'	2024-04-23 11:00:00	0:15:00	52.9	75.1	47.7	34.8
15'	2024-04-23 11:15:00	0:15:00	45.1	68.9	46.3	34.3
15'	2024-04-23 11:30:00	0:15:00	44.1	62.6	46.9	36.7
15'	2024-04-23 11:45:00	0:15:00	42.9	56.0	46.5	35.9
15'	2024-04-23 12:00:00	0:15:00	43.6	60.8	47.0	36.3
15'	2024-04-23 12:15:00	0:15:00	44.9	60.8	48.4	36.4
15'	2024-04-23 12:30:00	0:15:00	44.2	61.9	47.2	35.8
15'	2024-04-23 12:45:00	0:15:00	47.1	64.1	48.2	33.9
15'	2024-04-23 13:00:00	0:15:00	42.8	61.7	45.6	35.5
15'	2024-04-23 13:15:00	0:15:00	64.1	74.1	68.4	36.9
15'	2024-04-23 13:30:00	0:15:00	65.3	84.3	72.6	33.9
15'	2024-04-23 13:45:00	0:15:00	45.0	65.7	47.4	35.0
15'	2024-04-23 14:00:00	0:15:00	48.1	70.7	50.6	34.3
15'	2024-04-23 14:15:00	0:15:00	44.3	63.8	47.7	34.2
15'	2024-04-23 14:30:00	0:15:00	44.5	64.7	46.0	32.5
15'	2024-04-23 14:45:00	0:15:00	61.0	76.1	66.7	36.7
15'	2024-04-23 15:00:00	0:15:00	64.9	75.3	69.9	39.6
15'	2024-04-23 15:15:00	0:15:00	68.2	75.7	73.1	43.1
15'	2024-04-23 15:30:00	0:15:00	65.4	77.2	69.9	37.3
15'	2024-04-23 15:45:00	0:15:00	45.6	68.2	47.5	35.2
15'	2024-04-23 16:00:00	0:15:00	43.7	64.0	47.1	36.4
15'	2024-04-23 16:15:00	0:15:00	44.4	65.8	47.5	36.5
15'	2024-04-23 16:30:00	0:15:00	44.7	69.0	45.9	36.4
15'	2024-04-23 16:45:00	0:15:00	56.7	75.8	56.5	37.5
15'	2024-04-23 17:00:00	0:15:00	48.6	66.6	52.2	36.3
15'	2024-04-23 17:15:00	0:15:00	40.2	61.4	43.3	33.9
15'	2024-04-23 17:30:00	0:15:00	52.8	67.6	56.2	37.5
15'	2024-04-23 17:45:00	0:15:00	45.2	63.0	48.9	37.9
15'	2024-04-23 18:00:00	0:15:00	41.1	62.5	43.2	34.7
15'	2024-04-23 18:15:00	0:15:00	48.6	66.4	53.6	37.0
15'	2024-04-23 18:30:00	0:15:00	45.6	66.8	47.7	35.2
15'	2024-04-23 18:45:00	0:15:00	47.8	71.2	49.7	36.5
15'	2024-04-23 19:00:00	0:15:00	46.0	73.3	45.4	34.2
15'	2024-04-23 19:15:00	0:15:00	40.9	59.5	44.3	34.0
15'	2024-04-23 19:30:00	0:15:00	42.4	56.5	46.0	35.6
15'	2024-04-23 19:45:00	0:15:00	41.8	65.9	44.1	33.3
15'	2024-04-23 20:00:00	0:15:00	42.8	64.1	44.6	34.4

15'	2024-04-23 20:15:00	0:15:00	41.4	63.3	43.1	34.5
15'	2024-04-23 20:30:00	0:15:00	41.1	54.8	44.4	34.5
15'	2024-04-23 20:45:00	0:15:00	39.6	62.5	40.4	32.1
15'	2024-04-23 21:00:00	0:15:00	38.7	54.5	42.1	32.6
15'	2024-04-23 21:15:00	0:15:00	37.9	54.1	41.0	32.8
15'	2024-04-23 21:30:00	0:15:00	37.2	50.9	40.6	31.6
15'	2024-04-23 21:45:00	0:15:00	45.6	67.1	41.5	30.2
15'	2024-04-23 22:00:00	0:15:00	32.4	47.7	34.6	29.0
15'	2024-04-23 22:15:00	0:15:00	30.8	41.3	32.9	28.2
15'	2024-04-23 22:30:00	0:15:00	29.9	43.7	31.5	27.0
15'	2024-04-23 22:45:00	0:15:00	35.7	64.1	32.4	25.6
15'	2024-04-23 23:00:00	0:15:00	41.4	64.3	44.7	25.3
15'	2024-04-23 23:15:00	0:15:00	40.4	62.4	43.3	26.9
15'	2024-04-23 23:30:00	0:15:00	47.7	70.4	49.2	28.7
15'	2024-04-23 23:45:00	0:15:00	44.1	65.5	46.2	27.0
15'	2024-04-24 00:00:00	0:15:00	42.8	65.3	46.2	28.6
15'	2024-04-24 00:15:00	0:15:00	44.1	67.1	46.9	27.9
15'	2024-04-24 00:30:00	0:15:00	40.9	54.9	46.1	29.3
15'	2024-04-24 00:45:00	0:15:00	40.3	57.7	45.9	28.6
15'	2024-04-24 01:00:00	0:15:00	40.6	54.9	45.8	27.0
15'	2024-04-24 01:15:00	0:15:00	38.3	55.8	44.7	27.0
15'	2024-04-24 01:30:00	0:15:00	34.5	56.3	33.3	28.2
15'	2024-04-24 01:45:00	0:15:00	32.2	42.4	34.0	29.8
15'	2024-04-24 02:00:00	0:15:00	35.7	57.9	37.4	30.0
15'	2024-04-24 02:15:00	0:15:00	33.8	49.9	35.8	29.8
15'	2024-04-24 02:30:00	0:15:00	33.5	46.9	36.3	28.2
15'	2024-04-24 02:45:00	0:15:00	31.4	44.7	34.4	26.6
15'	2024-04-24 03:00:00	0:15:00	32.4	47.0	35.0	27.3
15'	2024-04-24 03:15:00	0:15:00	32.7	46.7	37.0	25.3
15'	2024-04-24 03:30:00	0:15:00	31.0	46.2	33.0	26.7
15'	2024-04-24 03:45:00	0:15:00	29.0	44.7	32.0	24.4
15'	2024-04-24 04:00:00	0:15:00	29.0	39.2	30.7	26.8
15'	2024-04-24 04:15:00	0:15:00	31.6	45.5	33.7	27.8
15'	2024-04-24 04:30:00	0:15:00	33.1	46.8	36.5	28.7
15'	2024-04-24 04:45:00	0:15:00	34.4	54.5	34.1	28.1
15'	2024-04-24 05:00:00	0:15:00	33.8	53.8	34.6	26.3
15'	2024-04-24 05:15:00	0:15:00	39.8	59.9	43.4	28.4
15'	2024-04-24 05:30:00	0:15:00	48.6	68.9	50.4	42.1
15'	2024-04-24 05:45:00	0:15:00	46.0	56.3	49.1	38.6
15'	2024-04-24 06:00:00	0:15:00	45.0	66.9	47.0	37.8
15'	2024-04-24 06:15:00	0:15:00	48.3	72.1	46.4	35.4
15'	2024-04-24 06:30:00	0:15:00	45.1	66.3	47.8	36.3
15'	2024-04-24 06:45:00	0:15:00	44.3	61.8	48.3	37.5
15'	2024-04-24 07:00:00	0:15:00	41.8	58.9	44.7	37.2
15'	2024-04-24 07:15:00	0:15:00	42.7	57.3	45.9	36.8
15'	2024-04-24 07:30:00	0:15:00	46.4	65.5	46.6	37.3
15'	2024-04-24 07:45:00	0:15:00	46.5	69.7	45.8	36.2
15'	2024-04-24 08:00:00	0:15:00	41.6	58.3	44.7	36.2
15'	2024-04-24 08:15:00	0:15:00	41.8	56.8	45.8	35.1
15'	2024-04-24 08:30:00	0:15:00	40.5	54.1	43.7	34.7

15'	2024-04-24 08:45:00	0:15:00	43.4	69.4	45.7	35.1
15'	2024-04-24 09:00:00	0:15:00	41.9	67.6	43.7	33.8
15'	2024-04-24 09:15:00	0:15:00	39.9	55.0	43.0	33.0
15'	2024-04-24 09:30:00	0:15:00	46.8	70.1	43.8	34.4
15'	2024-04-24 09:45:00	0:15:00	47.4	69.1	46.1	34.1
15'	2024-04-24 10:00:00	0:15:00	40.9	62.2	43.8	33.0
15'	2024-04-24 10:15:00	0:15:00	41.8	56.7	45.2	34.8
15'	2024-04-24 10:30:00	0:15:00	47.9	67.3	45.5	35.2
15'	2024-04-24 10:45:00	0:15:00	48.5	74.0	46.1	35.5
15'	2024-04-24 11:00:00	0:15:00	40.8	57.8	44.3	33.4
15'	2024-04-24 11:15:00	0:15:00	41.1	61.7	44.3	33.8
15'	2024-04-24 11:30:00	0:15:00	44.8	69.5	45.3	33.0
15'	2024-04-24 11:45:00	0:15:00	44.3	64.8	46.8	34.0
15'	2024-04-24 12:00:00	0:15:00	39.0	51.9	42.3	32.3
15'	2024-04-24 12:15:00	0:15:00	45.2	70.2	42.9	31.4
15'	2024-04-24 12:30:00	0:15:00	39.0	51.2	42.7	32.4
15'	2024-04-24 12:45:00	0:15:00	44.9	69.8	43.3	31.1
15'	2024-04-24 13:00:00	0:15:00	41.4	62.2	42.0	30.7
15'	2024-04-24 13:15:00	0:15:00	40.5	62.7	42.8	30.7
15'	2024-04-24 13:30:00	0:15:00	40.6	59.9	44.1	31.8
15'	2024-04-24 13:45:00	0:15:00	43.7	63.7	43.8	31.3
15'	2024-04-24 14:00:00	0:15:00	42.9	68.4	44.8	30.6
15'	2024-04-24 14:15:00	0:15:00	39.0	62.9	41.3	29.8
15'	2024-04-24 14:30:00	0:15:00	40.6	65.9	43.1	31.3
15'	2024-04-24 14:45:00	0:15:00	47.1	66.4	52.3	31.5
15'	2024-04-24 15:00:00	0:15:00	39.5	68.5	38.3	28.5
15'	2024-04-24 15:15:00	0:15:00	38.3	58.4	41.9	29.5
15'	2024-04-24 15:30:00	0:12:56	44.1	67.4	47.7	30.5

Location NMP2

Time	Duration	LAeq (dB)	LAFMax (dB)	Ln3 (10) (dB)	Ln5 (90) (dB)
22/04/2024 13:15	00:03:34	79.7	101.5	69.7	45.8
22/04/2024 13:20	00:09:16	52.5	67.1	56.1	42.9
22/04/2024 13:30	00:15:00	54.3	74.1	59	39
22/04/2024 13:45	00:15:00	52.9	70.6	56.8	41.2
22/04/2024 14:00	00:15:00	59.7	72.3	62.8	44.4
22/04/2024 14:15	00:15:00	50.5	62.2	54.3	39
22/04/2024 14:30	00:15:00	49.9	62.7	53.8	38.9
22/04/2024 14:45	00:15:00	52.5	67.2	55.9	40.9
22/04/2024 15:00	00:15:00	61.2	86.9	62.8	43.8
22/04/2024 15:15	00:15:00	53.3	67.7	56.9	41.7
22/04/2024 15:30	00:15:00	53.2	66.3	56.9	40.4
22/04/2024 15:45	00:15:00	51.7	65.7	54.9	43.5
22/04/2024 16:00	00:15:00	51.7	67.2	55.6	39.7
22/04/2024 16:15	00:15:00	53.5	75.3	57.1	41.7
22/04/2024 16:30	00:15:00	51.5	68.1	55.4	41.1
22/04/2024 16:45	00:15:00	52.2	65.8	55.8	41.5
22/04/2024 17:00	00:15:00	52.3	68.3	56.2	39.8
22/04/2024 17:15	00:15:00	53.5	66.9	57.7	40.8
22/04/2024 17:30	00:15:00	51.8	64.4	55.8	39
22/04/2024 17:45	00:15:00	52.7	65.3	56.5	42.2
22/04/2024 18:00	00:15:00	53.4	69	56.8	42.6
22/04/2024 18:15	00:15:00	50.9	65	54.8	40.6
22/04/2024 18:30	00:15:00	51.4	64.9	55.2	40.2
22/04/2024 18:45	00:15:00	51.5	64.5	55.7	39.9
22/04/2024 19:00	00:15:00	54	72	57.8	42.3
22/04/2024 19:15	00:15:00	56.6	80.3	59.7	43.1
22/04/2024 19:30	00:15:00	56.5	78	59.6	41.1
22/04/2024 19:45	00:15:00	52.2	65.2	56.1	38.8
22/04/2024 20:00	00:15:00	51	63.8	54.9	37.8
22/04/2024 20:15	00:15:00	51.9	67.2	55.9	36.6
22/04/2024 20:30	00:15:00	47.6	65	52.1	29.3
22/04/2024 20:45	00:15:00	47.1	65.7	51	30.1
22/04/2024 21:00	00:15:00	41.6	58.6	44.6	23.7
22/04/2024 21:15	00:15:00	47.6	65.1	51	25.6
22/04/2024 21:30	00:15:00	46.1	62.5	50.9	24.6
22/04/2024 21:45	00:15:00	44.9	60.3	49.9	24.6
22/04/2024 22:00	00:15:00	41.9	63.6	44.2	20.8
22/04/2024 22:15	00:15:00	38	60.7	37.4	21.1
22/04/2024 22:30	00:15:00	40.7	59.4	43.8	24.3
22/04/2024 22:45	00:15:00	47	69.8	49.4	24.1
22/04/2024 23:00	00:15:00	41.4	59	44.7	22.3
22/04/2024 23:15	00:15:00	34.6	59.5	31.6	21.3
22/04/2024 23:30	00:15:00	34	54.7	31.3	20.4
22/04/2024 23:45	00:15:00	38.7	60.7	30.2	20
23/04/2024 00:00	00:15:00	36.3	60.9	27.4	20
23/04/2024 00:15	00:15:00	37.2	57.6	36.7	21.1
23/04/2024 00:30	00:15:00	41.2	63.1	42.7	21.6
23/04/2024 00:45	00:15:00	43	61.8	47.1	20
23/04/2024 01:00	00:15:00	35.4	56	34.6	20
23/04/2024 01:15	00:15:00	26.1	56.1	28.6	20
23/04/2024 01:30	00:15:00	35.2	57.5	26.6	20

23/04/2024 01:45	00:15:00	24.1	43.2	26.6	20
23/04/2024 02:00	00:15:00	23.1	41	24.5	20
23/04/2024 02:15	00:15:00	23.1	39.1	24.9	20
23/04/2024 02:30	00:15:00	24.1	41.4	26.5	20
23/04/2024 02:45	00:15:00	39.2	60.8	32.6	20
23/04/2024 03:00	00:15:00	32.4	51.8	30.2	20
23/04/2024 03:15	00:15:00	35.9	55.7	33.1	20
23/04/2024 03:30	00:15:00	39.1	62.8	33.7	20
23/04/2024 03:45	00:15:00	42	62.7	41.6	20
23/04/2024 04:00	00:15:00	36.9	56.3	35.7	20
23/04/2024 04:15	00:15:00	47.2	63.9	51.4	27.4
23/04/2024 04:30	00:15:00	53.7	71.2	56.4	41.8
23/04/2024 04:45	00:15:00	59.1	71.1	63.6	46.8
23/04/2024 05:00	00:15:00	56.3	68.6	60.5	46.8
23/04/2024 05:15	00:15:00	55.9	68.1	60	46.2
23/04/2024 05:30	00:15:00	56.1	67.9	60.3	45.6
23/04/2024 05:45	00:15:00	56.5	68.4	60.3	47.8
23/04/2024 06:00	00:15:00	55.3	66.7	59.1	45.8
23/04/2024 06:15	00:15:00	54.4	63.7	57.8	46.5
23/04/2024 06:30	00:15:00	53.9	65.2	57.6	44.1
23/04/2024 06:45	00:15:00	55.2	65.6	59	45.9
23/04/2024 07:00	00:15:00	53.6	66.3	56.7	45.5
23/04/2024 07:15	00:15:00	54.8	70.9	58.3	45.2
23/04/2024 07:30	00:15:00	55.8	65.9	59.3	47.9
23/04/2024 07:45	00:15:00	55.6	68.2	59.3	45.1
23/04/2024 08:00	00:15:00	54.6	66.8	58.4	43.8
23/04/2024 08:15	00:15:00	54.3	66.5	57.9	44.9
23/04/2024 08:30	00:15:00	52.9	64.7	57	40.9
23/04/2024 08:45	00:15:00	53.7	67.3	57.7	42.5
23/04/2024 09:00	00:15:00	50.6	66	54.6	38.2
23/04/2024 09:15	00:15:00	51.2	66.8	54.5	40.6
23/04/2024 09:30	00:15:00	49.9	64.4	52.9	41.4
23/04/2024 09:45	00:15:00	51.5	63.8	55.3	42.1
23/04/2024 10:00	00:15:00	48.3	61.8	52	39.2
23/04/2024 10:15	00:15:00	49.5	68.4	53.1	40.6
23/04/2024 10:30	00:15:00	51	62.8	54.5	42.4
23/04/2024 10:45	00:15:00	52.3	64.8	55.8	43.5
23/04/2024 11:00	00:15:00	51.3	63.2	54.3	43.6
23/04/2024 11:15	00:15:00	51.2	73.5	53.6	38.8
23/04/2024 11:30	00:15:00	49.6	64.4	52.9	40.4
23/04/2024 11:45	00:15:00	50.9	64.2	55	38.7
23/04/2024 12:00	00:15:00	50	63.3	53.5	40.2
23/04/2024 12:15	00:15:00	49.2	65.9	52.6	40
23/04/2024 12:30	00:15:00	49.3	65.1	52.5	38.3
23/04/2024 12:45	00:15:00	48.9	65	52.5	39.9
23/04/2024 13:00	00:15:00	49.9	70.5	53.5	37.8
23/04/2024 13:15	00:15:00	50.4	61.8	54	41.6
23/04/2024 13:30	00:15:00	50.5	65.6	53.5	43.4
23/04/2024 13:45	00:15:00	53.7	86.9	55.2	42.6
23/04/2024 14:00	00:15:00	51.9	73.9	54.8	43
23/04/2024 14:15	00:15:00	51.1	67.6	54.4	41.5
23/04/2024 14:30	00:15:00	54.2	88.3	53.9	38.3
23/04/2024 14:45	00:15:00	52.2	74.8	55.1	42.2

23/04/2024 15:00	00:15:00	51.4	72.2	55.2	41.3
23/04/2024 15:15	00:15:00	52.5	68.2	55.9	42.7
23/04/2024 15:30	00:15:00	58.7	74.6	63.2	42.2
23/04/2024 15:45	00:15:00	51.9	68	55.6	41.6
23/04/2024 16:00	00:15:00	54.8	78.2	57.3	41.9
23/04/2024 16:15	00:15:00	58.1	71.2	62.3	46.2
23/04/2024 16:30	00:15:00	52.8	66.2	56.2	45.4
23/04/2024 16:45	00:15:00	54.8	85.9	57.2	42.5
23/04/2024 17:00	00:15:00	53.5	76.3	56.5	43
23/04/2024 17:15	00:15:00	53.4	74.5	56.6	42.6
23/04/2024 17:30	00:15:00	52.3	75.2	55.4	41.5
23/04/2024 17:45	00:15:00	51.3	64.7	55.2	41.3
23/04/2024 18:00	00:15:00	50.7	75.4	53.2	39.5
23/04/2024 18:15	00:15:00	50.3	63.6	54.5	39.1
23/04/2024 18:30	00:15:00	56.5	81.4	56.8	41.5
23/04/2024 18:45	00:15:00	51.9	73.4	55.3	38.9
23/04/2024 19:00	00:15:00	51	81.5	52.5	38.4
23/04/2024 19:15	00:15:00	50.3	64.3	54	39.3
23/04/2024 19:30	00:15:00	47.8	62.4	51.4	38.2
23/04/2024 19:45	00:15:00	50.9	62.6	54.3	40.8
23/04/2024 20:00	00:15:00	50.7	66	54.5	38.9
23/04/2024 20:15	00:15:00	51.9	67.5	55.7	38
23/04/2024 20:30	00:15:00	47.6	61.5	52	30.1
23/04/2024 20:45	00:15:00	47	62.8	51.4	31.1
23/04/2024 21:00	00:15:00	45.5	62.6	50.3	27.3
23/04/2024 21:15	00:15:00	46.2	65.9	50.9	23.7
23/04/2024 21:30	00:15:00	44	62.2	48.5	21.1
23/04/2024 21:45	00:15:00	42	56.4	46.7	23
23/04/2024 22:00	00:15:00	42	57.3	46.4	21.5
23/04/2024 22:15	00:15:00	40.5	59.2	44	21.7
23/04/2024 22:30	00:15:00	43.7	59.1	48.2	21.9
23/04/2024 22:45	00:15:00	38.5	59.7	32.7	20
23/04/2024 23:00	00:15:00	38.9	54.4	42.9	20
23/04/2024 23:15	00:15:00	40.6	58.2	38.8	20
23/04/2024 23:30	00:15:00	42.3	64.1	40.5	20
23/04/2024 23:45	00:15:00	36	57.5	31.5	20
24/04/2024 00:00	00:15:00	39.6	56	42.3	20
24/04/2024 00:15	00:15:00	38.3	55.5	41.4	20
24/04/2024 00:30	00:15:00	39.2	67.4	32.4	20
24/04/2024 00:45	00:15:00	39	59.6	29.6	20
24/04/2024 01:00	00:15:00	41	58.4	42.6	20
24/04/2024 01:15	00:15:00	19.5	32.1	21.2	20
24/04/2024 01:30	00:15:00	41	60.6	42.3	20
24/04/2024 01:45	00:15:00	43.5	61.3	43.9	20
24/04/2024 02:00	00:15:00	38.6	58.6	39.4	20
24/04/2024 02:15	00:15:00	43	61.9	43.7	20
24/04/2024 02:30	00:15:00	40.4	60.4	36.9	20
24/04/2024 02:45	00:15:00	42	59.3	44.9	20
24/04/2024 03:00	00:15:00	39.4	56.9	36.2	20
24/04/2024 03:15	00:15:00	37	55.8	36.9	20
24/04/2024 03:30	00:15:00	41.3	62.3	44	20
24/04/2024 03:45	00:15:00	37	54.2	39.5	20
24/04/2024 04:00	00:15:00	36.1	53.6	38.4	20

24/04/2024 04:15	00:15:00	50	61.3	54	34.7
24/04/2024 04:30	00:15:00	55.3	68.7	59.2	46
24/04/2024 04:45	00:15:00	56.8	68.5	60.9	47.8
24/04/2024 05:00	00:15:00	56.1	68.2	60.4	46.5
24/04/2024 05:15	00:15:00	55.5	67.4	59.3	48.2
24/04/2024 05:30	00:15:00	54.7	66.8	58.4	46.7
24/04/2024 05:45	00:15:00	54.9	66.1	58.7	46.9
24/04/2024 06:00	00:15:00	54.8	66.9	58.6	46
24/04/2024 06:15	00:15:00	55	68.5	58.3	46.7
24/04/2024 06:30	00:15:00	54.5	69	58	46.1
24/04/2024 06:45	00:15:00	54.8	67.9	58.4	46.6
24/04/2024 07:00	00:15:00	53.6	66.4	57.3	44.2
24/04/2024 07:15	00:15:00	52.2	62.7	55.6	43.7
24/04/2024 07:30	00:15:00	52.4	61.5	55.6	44.8
24/04/2024 07:45	00:15:00	53.5	64.8	57	46
24/04/2024 08:00	00:15:00	53	65.1	56.4	44.4
24/04/2024 08:15	00:15:00	53.4	64.4	56.9	45.1
24/04/2024 08:30	00:15:00	53	67.1	56.9	42.3
24/04/2024 08:45	00:15:00	52.7	64.9	56.4	42.9
24/04/2024 09:00	00:15:00	53.3	65.1	56.9	43.7
24/04/2024 09:15	00:15:00	52.5	67.7	56.2	41.3
24/04/2024 09:30	00:15:00	51.8	66.6	55.5	42.6
24/04/2024 09:45	00:15:00	50.9	62.2	54.2	43.1
24/04/2024 10:00	00:15:00	51.7	62.6	55.1	44.5
24/04/2024 10:15	00:15:00	58.3	74.8	56.4	40.8
24/04/2024 10:30	00:15:00	59.5	76.1	58	43
24/04/2024 10:45	00:15:00	57.4	75.4	56.4	40.4
24/04/2024 11:00	00:15:00	48.7	63.5	52.7	37.3
24/04/2024 11:15	00:15:00	49	62.3	52.7	37.6
24/04/2024 11:30	00:15:00	49	62.2	52.7	38.8
24/04/2024 11:45	00:15:00	50.4	69.8	54.3	37.2
24/04/2024 12:00	00:15:00	47.4	58.8	51.3	37.4
24/04/2024 12:15	00:15:00	47	56.8	51.1	36.9
24/04/2024 12:30	00:15:00	49.4	66.7	53	39.6
24/04/2024 12:45	00:15:00	48.4	62.3	51.9	38.3
24/04/2024 13:00	00:15:00	48.7	64	52.2	35.6
24/04/2024 13:15	00:15:00	63.7	75.9	71.2	39.3
24/04/2024 13:30	00:15:00	47.2	63.2	51.2	35.1
24/04/2024 13:45	00:15:00	45.6	59.1	49.2	34.3
24/04/2024 14:00	00:15:00	47.2	58.8	51.1	36.8
24/04/2024 14:15	00:15:00	47.5	59.4	51.4	34.4
24/04/2024 14:30	00:00:10	51.8	57	54.1	48.1

Location	**NMP3**					
Time	Duration	Name	LAeq (dB)	LAFMax (dB)	Ln3 (10) (dB)	Ln5 (90) (dB)
22/04/2024 12:47	00:12:41	7	53.8	77.3	54.7	35
22/04/2024 13:00	00:15:00	8	41.2	67.7	43.9	32.9
22/04/2024 13:15	00:15:00	9	42.6	60.3	45.4	33.2
22/04/2024 13:30	00:15:00	10	45.2	62.4	48.2	34.6
22/04/2024 13:45	00:15:00	11	52.7	78.2	48.3	37.2
22/04/2024 14:00	00:15:00	12	47.1	63.7	49.2	38.9
22/04/2024 14:15	00:15:00	13	50.6	68.2	54.9	35.5
22/04/2024 14:30	00:15:00	14	47.9	74.7	49.8	38.9
22/04/2024 14:45	00:15:00	15	47.9	62.7	50.7	39.4
22/04/2024 15:00	00:15:00	16	46.8	64.7	49.5	39.3
22/04/2024 15:15	00:15:00	17	44	57.8	46.8	37.6
22/04/2024 15:30	00:15:00	18	47	62.3	50.1	40.5
22/04/2024 15:45	00:15:00	19	45.9	63.2	49.1	36.4
22/04/2024 16:00	00:15:00	20	44.9	67.9	48.2	36.6
22/04/2024 16:15	00:15:00	21	47.5	68.8	49.8	37.3
22/04/2024 16:30	00:15:00	22	44.2	68.7	46.5	36.5
22/04/2024 16:45	00:15:00	23	44.5	61.8	47.5	37.3
22/04/2024 17:00	00:15:00	24	47.4	71.9	50.5	36.7
22/04/2024 17:15	00:15:00	25	47.8	64.3	51.1	37.9
22/04/2024 17:30	00:15:00	26	48.2	67	50.9	38.7
22/04/2024 17:45	00:15:00	27	44.8	62.9	48	38.1
22/04/2024 18:00	00:15:00	28	48.4	69.9	50.2	40.8
22/04/2024 18:15	00:15:00	29	45.7	62.8	48.6	36.5
22/04/2024 18:30	00:15:00	30	47.8	73.2	50.1	39.6
22/04/2024 18:45	00:15:00	31	49	68.7	52	40.2
22/04/2024 19:00	00:15:00	32	49.5	68.8	52.4	41
22/04/2024 19:15	00:15:00	33	47	66.6	49.9	38.3
22/04/2024 19:30	00:15:00	34	46.2	63.6	48.5	37
22/04/2024 19:45	00:15:00	35	44.3	61	46.9	37.5
22/04/2024 20:00	00:15:00	36	42.7	57.6	45.8	36.1
22/04/2024 20:15	00:15:00	37	41.7	58.8	44.4	35.2
22/04/2024 20:30	00:15:00	38	41.8	57	44.8	34.7
22/04/2024 20:45	00:15:00	39	44.3	69.8	46	34.7
22/04/2024 21:00	00:15:00	40	40.2	63.3	42.6	33.3
22/04/2024 21:15	00:15:00	41	39.5	67	41.8	31.4
22/04/2024 21:30	00:15:00	42	40.4	66.8	38.9	27.7
22/04/2024 21:45	00:15:00	43	37.1	56.6	39.4	28.1
22/04/2024 22:00	00:15:00	44	35.7	55.9	39.4	27.8
22/04/2024 22:15	00:15:00	45	35.4	55.9	38.4	26.3
22/04/2024 22:30	00:15:00	46	33.3	48	36.4	25.7
22/04/2024 22:45	00:15:00	47	30	46.7	32.6	24.5
22/04/2024 23:00	00:15:00	48	29.9	52.6	32.7	22.6
22/04/2024 23:15	00:15:00	49	31.5	47.2	34.5	25.3
22/04/2024 23:30	00:15:00	50	35	53.4	39	26.4
22/04/2024 23:45	00:15:00	51	33.6	52.3	37.1	24.8
23/04/2024 00:00	00:15:00	52	33.3	51.2	36.7	24.9

23/04/2024 00:15	00:15:00	53	31.7	47.5	34.9	24.3
23/04/2024 00:30	00:15:00	54	32.9	50.5	36.3	24.8
23/04/2024 00:45	00:15:00	55	31.9	49.7	34.7	24.6
23/04/2024 01:00	00:15:00	56	30.9	57.3	32.8	23.3
23/04/2024 01:15	00:15:00	57	30.9	50.2	32.7	22.9
23/04/2024 01:30	00:15:00	58	28.9	42.3	31.5	22.9
23/04/2024 01:45	00:15:00	59	29.7	47	31.8	22.5
23/04/2024 02:00	00:15:00	60	28.1	42.7	30.9	22.7
23/04/2024 02:15	00:15:00	61	27.8	43.3	30.5	22.1
23/04/2024 02:30	00:15:00	62	27.9	45.3	30.9	21.2
23/04/2024 02:45	00:15:00	63	32.1	54.2	32.8	21.9
23/04/2024 03:00	00:15:00	64	29.3	42.5	32.5	21.6
23/04/2024 03:15	00:15:00	65	27.9	42.9	31.2	20.8
23/04/2024 03:30	00:15:00	66	29.1	47.7	32.4	21.3
23/04/2024 03:45	00:15:00	67	27.4	41.3	31.1	20.3
23/04/2024 04:00	00:15:00	68	26.9	39	29.7	20.7
23/04/2024 04:15	00:15:00	69	28.5	46.3	31.3	21.2
23/04/2024 04:30	00:15:00	70	27.1	43	29.7	20.6
23/04/2024 04:45	00:15:00	71	29.1	48.5	31.6	21.9
23/04/2024 05:00	00:15:00	72	28.3	42.6	31.4	20.2
23/04/2024 05:15	00:15:00	73	31.9	47	35.4	24.6
23/04/2024 05:30	00:15:00	74	44.2	55.6	47.8	35.3
23/04/2024 05:45	00:15:00	75	45	57.2	47.5	40.8
23/04/2024 06:00	00:15:00	76	44.1	59	47	38.5
23/04/2024 06:15	00:15:00	77	42.7	60.7	45	36.8
23/04/2024 06:30	00:15:00	78	43.7	64.5	44.6	34.9
23/04/2024 06:45	00:15:00	79	44.9	63.3	47.6	35.7
23/04/2024 07:00	00:15:00	80	43.4	64.2	46.7	35
23/04/2024 07:15	00:15:00	81	42.9	59	46.5	35.4
23/04/2024 07:30	00:15:00	82	42.2	66.4	45.5	33.9
23/04/2024 07:45	00:15:00	83	43.3	66.9	44.8	33.2
23/04/2024 08:00	00:15:00	84	42.5	60.7	44.9	33.2
23/04/2024 08:15	00:15:00	85	41	58.1	44.3	33.2
23/04/2024 08:30	00:15:00	86	41.2	61.1	44.2	33.3
23/04/2024 08:45	00:15:00	87	45.1	63.3	48.7	35.8
23/04/2024 09:00	00:15:00	88	45.4	68.7	49.8	36.6
23/04/2024 09:15	00:15:00	89	46.8	66.1	46.5	37.7
23/04/2024 09:30	00:15:00	90	45.3	62	48.3	37.9
23/04/2024 09:45	00:15:00	91	43	64	45.8	36.2
23/04/2024 10:00	00:15:00	92	41.2	58	44	33.1
23/04/2024 10:15	00:15:00	93	47.1	66	50.6	35.4
23/04/2024 10:30	00:15:00	94	47.8	73.2	48.5	35.5
23/04/2024 10:45	00:15:00	95	48	71.5	50.9	37.5
23/04/2024 11:00	00:15:00	96	42.4	59.8	45.2	33.9
23/04/2024 11:15	00:15:00	97	45.8	67	48.3	35.9
23/04/2024 11:30	00:15:00	98	47.4	67.4	50.4	34.8
23/04/2024 11:45	00:15:00	99	48.3	64	52.8	34.9
23/04/2024 12:00	00:15:00	100	48.2	69.5	52	35.1

23/04/2024 12:15	00:15:00	101	44.4	64.5	47.6	35.2
23/04/2024 12:30	00:15:00	102	44.2	64.8	46.5	34.2
23/04/2024 12:45	00:15:00	103	43.9	59.9	46.5	34.2
23/04/2024 13:00	00:15:00	104	44.7	66.1	47.7	34.7
23/04/2024 13:15	00:15:00	105	46.4	69.8	48.9	33.7
23/04/2024 13:30	00:15:00	106	41.9	61.3	45.1	32.8
23/04/2024 13:45	00:15:00	107	42.5	61.9	45.6	34
23/04/2024 14:00	00:15:00	108	45.2	58.3	49	34.5
23/04/2024 14:15	00:15:00	109	50.5	70.3	53.4	35.8
23/04/2024 14:30	00:15:00	110	47.9	71.7	49.8	35.3
23/04/2024 14:45	00:15:00	111	47.3	73.8	49.4	36.2
23/04/2024 15:00	00:15:00	112	44.6	72.4	46.4	33.9
23/04/2024 15:15	00:15:00	113	47.7	72.5	49.9	36.9
23/04/2024 15:30	00:15:00	114	50	76.2	51.5	38.6
23/04/2024 15:45	00:15:00	115	48	68.9	49.4	36.2
23/04/2024 16:00	00:15:00	116	45.2	68.5	48.4	37
23/04/2024 16:15	00:15:00	117	47.4	65.9	51.2	37.9
23/04/2024 16:30	00:15:00	118	47.1	62.1	50.7	39.1
23/04/2024 16:45	00:15:00	119	46.3	60.2	50.2	37.2
23/04/2024 17:00	00:15:00	120	51.5	70.3	51.8	37.6
23/04/2024 17:15	00:15:00	121	44.9	65.8	48.5	35.6
23/04/2024 17:30	00:15:00	122	51.6	72.9	53.6	39.6
23/04/2024 17:45	00:15:00	123	47.6	60.2	51.4	38.8
23/04/2024 18:00	00:15:00	124	46.8	73.8	49.3	38.6
23/04/2024 18:15	00:00:09	125	48.1	58.9	49.6	40.7
24/04/2024 14:44	00:00:57	126	76.3	101.5	61	40.6
24/04/2024 14:45	00:15:00	127	48.1	72.1	49.7	35
24/04/2024 15:00	00:15:00	128	59.4	77.9	50.7	32.4
24/04/2024 15:15	00:15:00	129	66.7	78.3	72	48.7
24/04/2024 15:30	00:15:00	130	63.4	79.6	70.3	33
24/04/2024 15:45	00:15:00	131	44	64	47	34.2
24/04/2024 16:00	00:15:00	132	48.9	78.3	46.8	34.1
24/04/2024 16:15	00:15:00	133	48.9	66.7	52.1	36.2
24/04/2024 16:30	00:15:00	134	46.8	63.6	50.4	39.5
24/04/2024 16:45	00:15:00	135	50.6	77.4	51.1	33.7
24/04/2024 17:00	00:15:00	136	44.7	64.2	48.3	33.7
24/04/2024 17:15	00:15:00	137	45.2	57.7	48.8	37.1
24/04/2024 17:30	00:15:00	138	43.5	60.1	46.8	36.5
24/04/2024 17:45	00:15:00	139	43	62.1	44.6	36.3
24/04/2024 18:00	00:15:00	140	41.5	56.7	44.3	36.6
24/04/2024 18:15	00:15:00	141	41.5	59.6	44.3	36.4
24/04/2024 18:30	00:15:00	142	45.9	67	47.6	34.2
24/04/2024 18:45	00:15:00	143	42	60.3	44.6	35.1
24/04/2024 19:00	00:15:00	144	42.4	60	44	34.3
24/04/2024 19:15	00:15:00	145	42.3	55.7	46	33.9
24/04/2024 19:30	00:15:00	146	42.7	63.4	43.5	34.5
24/04/2024 19:45	00:15:00	147	46.4	60.3	50.4	34.8
24/04/2024 20:00	00:15:00	148	46.7	71.3	46.5	35.2

24/04/2024 20:15	00:15:00	149	42.8	64.7	44.3	34.6
24/04/2024 20:30	00:15:00	150	44.2	67.4	45.6	35.7
24/04/2024 20:45	00:15:00	151	45.4	71.8	42.9	33.7
24/04/2024 21:00	00:15:00	152	44.9	74.6	45.6	32.5
24/04/2024 21:15	00:15:00	153	40.8	57.3	44.4	32.2
24/04/2024 21:30	00:15:00	154	54.2	71.3	58.6	30.2
24/04/2024 21:45	00:15:00	155	32	49.7	31.8	26.3
24/04/2024 22:00	00:15:00	156	34.5	64.2	32.9	25.8
24/04/2024 22:15	00:15:00	157	48.8	73.6	43.4	25.3
24/04/2024 22:30	00:15:00	158	45	74.8	32.7	26.5
24/04/2024 22:45	00:15:00	159	30.5	42.2	33.2	25.7
24/04/2024 23:00	00:15:00	160	31.2	62.5	30.9	24.2
24/04/2024 23:15	00:15:00	161	32	50.4	31.8	21.5
24/04/2024 23:30	00:15:00	162	30	52.6	31.7	23
24/04/2024 23:45	00:15:00	163	31.6	51.2	35.2	23.9
25/04/2024 00:00	00:15:00	164	30.2	46.9	32.4	23.4
25/04/2024 00:15	00:15:00	165	27.3	46	29.7	21.7
25/04/2024 00:30	00:15:00	166	29.3	56.5	31.2	22.3
25/04/2024 00:45	00:15:00	167	30.7	47.2	33.5	23.8
25/04/2024 01:00	00:15:00	168	27.8	50	29.6	22.9
25/04/2024 01:15	00:15:00	169	28.5	41.9	31.2	23.1
25/04/2024 01:30	00:15:00	170	28.9	41.3	31.9	24
25/04/2024 01:45	00:15:00	171	28.3	40.1	31.2	23.1
25/04/2024 02:00	00:15:00	172	28.2	39.6	30.8	23.5
25/04/2024 02:15	00:15:00	173	27	40.5	29.3	23.1
25/04/2024 02:30	00:15:00	174	27.9	40.9	31.1	21.9
25/04/2024 02:45	00:15:00	175	26.5	36.6	29.3	21.4
25/04/2024 03:00	00:15:00	176	25.8	39.6	28.7	20.6
25/04/2024 03:15	00:15:00	177	34.5	50.1	37.3	25.1
25/04/2024 03:30	00:15:00	178	27	39.4	29.8	21.4
25/04/2024 03:45	00:15:00	179	33.3	53	33.7	20.6
25/04/2024 04:00	00:15:00	180	25.5	39.3	27.2	21.3
25/04/2024 04:15	00:15:00	181	23.1	38	25.7	20
25/04/2024 04:30	00:15:00	182	19.8	39	20.5	20
25/04/2024 04:45	00:15:00	183	19.7	33.2	22	20
25/04/2024 05:00	00:15:00	184	32.3	49.8	36.7	20
25/04/2024 05:15	00:15:00	185	39.3	54.7	43.1	26.7
25/04/2024 05:30	00:15:00	186	44.2	59.4	46.9	38.8
25/04/2024 05:45	00:15:00	187	48.5	66.6	50	39.2
25/04/2024 06:00	00:15:00	188	42.2	56.1	45	36.8
25/04/2024 06:15	00:15:00	189	45.9	62.2	48.7	37.3
25/04/2024 06:30	00:15:00	190	44.3	64.7	46.3	35.4
25/04/2024 06:45	00:15:00	191	43.1	62.6	45.8	37
25/04/2024 07:00	00:15:00	192	57.5	89.3	46.2	35.2
25/04/2024 07:15	00:15:00	193	43	62.3	45.8	34.6
25/04/2024 07:30	00:15:00	194	41	59.2	42.1	33.3
25/04/2024 07:45	00:15:00	195	46.1	69.8	46.9	34.1
25/04/2024 08:00	00:15:00	196	40.1	59.6	42.6	32.4

25/04/2024 08:15	00:15:00	197	42.3	62.4	46.1	33.4
25/04/2024 08:30	00:15:00	198	50.3	72.9	49.5	38.3
25/04/2024 08:45	00:15:00	199	43.2	63.5	44.6	37.9
25/04/2024 09:00	00:15:00	200	48.3	69.7	49.6	39.7
25/04/2024 09:15	00:15:00	201	46.3	64.6	48.1	35.5
25/04/2024 09:30	00:15:00	202	42.5	56.4	46	34.2
25/04/2024 09:45	00:15:00	203	42.1	58.3	45.6	32.9
25/04/2024 10:00	00:15:00	204	42.6	59.8	46.2	34.4
25/04/2024 10:15	00:15:00	205	45	60.3	48	38.8
25/04/2024 10:30	00:15:00	206	41.2	58.3	44.7	34
25/04/2024 10:45	00:15:00	207	43.4	57.4	46.6	34.8
25/04/2024 11:00	00:15:00	208	43.2	64.1	43.3	31.5
25/04/2024 11:15	00:15:00	209	42	63.6	42.4	30.7
25/04/2024 11:30	00:15:00	210	41.4	60.9	44.9	31.4
25/04/2024 11:45	00:15:00	211	42.9	68.3	44.4	31.8
25/04/2024 12:00	00:15:00	212	48.8	66.5	50.2	31.9
25/04/2024 12:15	00:15:00	213	44.3	61.5	47.6	32.7
25/04/2024 12:30	00:15:00	214	41	59.5	44.3	31.4
25/04/2024 12:45	00:15:00	215	41.8	58.6	45	31.5
25/04/2024 13:00	00:15:00	216	40.4	55.8	44.3	29.3
25/04/2024 13:15	00:15:00	217	44.3	70.9	45.2	31.5
25/04/2024 13:30	00:15:00	218	39.9	53.9	43.9	30.8
25/04/2024 13:45	00:15:00	219	43	61.2	44.3	30.6
25/04/2024 14:00	00:15:00	220	46.4	75.3	45.7	32.6
25/04/2024 14:15	00:15:00	221	40	60	43	31.7
25/04/2024 14:30	00:15:00	222	43.7	78.8	43.4	29.1
25/04/2024 14:45	00:15:00	223	43.9	69.6	45.2	33.6
25/04/2024 15:00	00:15:00	224	43	60.2	45.4	32.5
25/04/2024 15:15	00:15:00	225	40.6	59.1	42.1	31.6
25/04/2024 15:30	00:15:00	226	41.7	56.6	45.5	31.2
25/04/2024 15:45	00:15:00	227	52.7	77.5	50.2	33.8
25/04/2024 16:00	00:15:00	228	43.5	58.7	46.6	34.8
25/04/2024 16:15	00:15:00	229	45.1	65.4	48.7	34.3
25/04/2024 16:30	00:15:00	230	44.2	66.1	47	34.4
25/04/2024 16:45	00:15:00	231	42.8	58	46.5	33.6
25/04/2024 17:00	00:15:00	232	45.6	63.6	48.3	34.8
25/04/2024 17:15	00:15:00	233	47	64.7	50	36.3
25/04/2024 17:30	00:15:00	234	46	62.6	48.3	38.9
25/04/2024 17:45	00:15:00	235	45.9	60.5	47.7	42.7
25/04/2024 18:00	00:15:00	236	44.3	57.8	46.6	39.7
25/04/2024 18:15	00:15:00	237	47.3	76.9	46.6	38
25/04/2024 18:30	00:15:00	238	45.3	61.5	48.1	40.3
25/04/2024 18:45	00:15:00	239	44	56	45.8	41.3
25/04/2024 19:00	00:15:00	240	46.4	67.2	47	41.7
25/04/2024 19:15	00:15:00	241	48.1	63	51.4	42.1
25/04/2024 19:30	00:15:00	242	51.5	62.8	54.4	45.8
25/04/2024 19:45	00:15:00	243	45.8	67	47.1	40.6
25/04/2024 20:00	00:15:00	244	45.5	66.1	47	41.8

25/04/2024 20:15	00:15:00	245	46.4	64.4	49	41.4
25/04/2024 20:30	00:15:00	246	49.1	65	54.1	40.5
25/04/2024 20:45	00:15:00	247	48.6	68.6	53.6	37.9
25/04/2024 21:00	00:15:00	248	42.9	57.5	46	36.4
25/04/2024 21:15	00:15:00	249	40.7	60.1	43.2	35.5
25/04/2024 21:30	00:15:00	250	37.4	59.9	38.8	32.4
25/04/2024 21:45	00:15:00	251	38	61.3	39	31.9
25/04/2024 22:00	00:15:00	252	36.5	56	38.1	32.6
25/04/2024 22:15	00:15:00	253	32.3	51.9	34	28.7
25/04/2024 22:30	00:15:00	254	37.2	64.1	35	29.2
25/04/2024 22:45	00:15:00	255	29.4	42.7	32	25.2
25/04/2024 23:00	00:15:00	256	33.5	52.2	35	24.7
25/04/2024 23:15	00:15:00	257	30.8	46.7	34.2	24.8
25/04/2024 23:30	00:15:00	258	32	49.8	34	26.6
25/04/2024 23:45	00:15:00	259	33.1	59.7	34.2	29.6
26/04/2024 00:00	00:15:00	260	29.3	43.6	31.3	25.6
26/04/2024 00:15	00:15:00	261	28.5	49.3	29.9	24.4
26/04/2024 00:30	00:15:00	262	29.6	49.3	31.7	24.8
26/04/2024 00:45	00:15:00	263	27.5	44	29.7	23.2
26/04/2024 01:00	00:15:00	264	27.4	48.9	29.5	22.9
26/04/2024 01:15	00:15:00	265	32.4	53.3	31.8	23.2
26/04/2024 01:30	00:15:00	266	26.5	40.6	28.7	22.8
26/04/2024 01:45	00:15:00	267	27.6	43.4	29.8	23.5
26/04/2024 02:00	00:15:00	268	28.2	43.3	30.6	23.4
26/04/2024 02:15	00:15:00	269	26.7	41.9	29.3	22.2
26/04/2024 02:30	00:15:00	270	27.8	39.9	30.5	23.2
26/04/2024 02:45	00:15:00	271	26.9	42.8	29.3	21.8
26/04/2024 03:00	00:15:00	272	27.5	37.5	30.3	22.4
26/04/2024 03:15	00:15:00	273	31.9	44.7	35.7	24.7
26/04/2024 03:30	00:15:00	274	27.7	45.1	29.8	23.1
26/04/2024 03:45	00:15:00	275	30.8	46.6	33.8	21.4
26/04/2024 04:00	00:15:00	276	27.2	47.5	29.9	21.9
26/04/2024 04:15	00:15:00	277	28.5	41.1	31.5	22.2
26/04/2024 04:30	00:15:00	278	27.4	39.2	29.9	22.7
26/04/2024 04:45	00:15:00	279	30.6	49.4	32.8	24.5
26/04/2024 05:00	00:15:00	280	38	51.5	42	28
26/04/2024 05:15	00:15:00	281	45.1	55.3	48.1	39.9
26/04/2024 05:30	00:15:00	282	46.9	58.4	50.4	40.9
26/04/2024 05:45	00:15:00	283	46.7	57.4	50	40.3
26/04/2024 06:00	00:15:00	284	44.5	58.8	47.4	38.8
26/04/2024 06:15	00:15:00	285	48.1	68.1	49.7	37.1
26/04/2024 06:30	00:15:00	286	45.6	67.4	46.3	37.1
26/04/2024 06:45	00:15:00	287	42.5	60.1	44.8	37
26/04/2024 07:00	00:15:00	288	41.7	54	44	37.7
26/04/2024 07:15	00:15:00	289	43.4	61.9	45.4	37.2
26/04/2024 07:30	00:15:00	290	47.9	65.3	50.3	36.6
26/04/2024 07:45	00:15:00	291	62.6	93.2	44	35.8
26/04/2024 08:00	00:15:00	292	41.6	56.2	45.1	35.6

26/04/2024 08:15	00:15:00	293	41.7	60	44.3	34.4
26/04/2024 08:30	00:15:00	294	44.3	66.6	47.2	33.9
26/04/2024 08:45	00:15:00	295	44.1	62.2	47.2	37.6
26/04/2024 09:00	00:15:00	296	42	61.4	43.4	37
26/04/2024 09:15	00:15:00	297	40.9	64.1	42.9	36.3
26/04/2024 09:30	00:15:00	298	58.2	84.2	47	36.6
26/04/2024 09:45	00:15:00	299	43.5	76.5	44.3	32.4
26/04/2024 10:00	00:15:00	300	42.5	77.1	41.9	31.8
26/04/2024 10:15	00:15:00	301	46	65.6	48.4	36.9
26/04/2024 10:30	00:15:00	302	43.9	65.1	41.2	31.4
26/04/2024 10:45	00:15:00	303	42	58.6	44.6	32.1
26/04/2024 11:00	00:15:00	304	41.7	58.7	45.5	32
26/04/2024 11:15	00:15:00	305	39.4	58.9	42.7	31
26/04/2024 11:30	00:15:00	306	41.8	62.8	44.6	32.7
26/04/2024 11:45	00:15:00	307	44.2	63.4	48.2	32.6
26/04/2024 12:00	00:15:00	308	42.5	59.1	46.6	31.5
26/04/2024 12:15	00:15:00	309	41.3	58.3	45.1	31.8
26/04/2024 12:30	00:15:00	310	40.7	62	42.5	32.3
26/04/2024 12:45	00:15:00	311	39.9	58.6	42.9	30.4
26/04/2024 13:00	00:15:00	312	39	59.4	42	30.6
26/04/2024 13:15	00:15:00	313	45.3	73.6	43	31.9
26/04/2024 13:30	00:15:00	314	40.3	58	43.8	31.6
26/04/2024 13:45	00:15:00	315	39.5	55.6	42.6	30.3
26/04/2024 14:00	00:15:00	316	41	57.7	44.8	29.7
26/04/2024 14:15	00:15:00	317	41.7	60.5	44.8	31.8
26/04/2024 14:30	00:15:00	318	42.8	55.1	46.3	34
26/04/2024 14:45	00:15:00	319	44.7	65	47.5	31.4
26/04/2024 15:00	00:15:00	320	46.3	74.5	47.3	29.8
26/04/2024 15:15	00:15:00	321	39.9	60.8	42.2	32
26/04/2024 15:30	00:15:00	322	43.8	72.2	41.4	33.5
26/04/2024 15:45	00:15:00	323	42.1	65.8	44.1	32.9
26/04/2024 16:00	00:15:00	324	41.6	63.2	43.8	34.8
26/04/2024 16:15	00:15:00	325	40.1	61	43	32.5
26/04/2024 16:30	00:15:00	326	39.1	50.6	42.2	34
26/04/2024 16:45	00:15:00	327	44.7	62.2	48.7	33.9
26/04/2024 17:00	00:09:04	328	53.6	79.5	53.1	32.1
26/04/2024 17:15	00:15:00	329	13.8	22.1	20	20

Location	**NMP4**					
Time	Duration	Name	LAeq (dB)	LAFMax (dB)	Ln3 (10) (dB)	Ln5 (90) (dB)
22/04/2024 12:52	00:07:23	2	51.4	67.3	55.4	33.3
22/04/2024 13:00	00:15:00	3	38.8	66.3	41.6	31.1
22/04/2024 13:15	00:15:00	4	38.3	53.4	41.9	30.7
22/04/2024 13:30	00:15:00	5	36.6	53.9	40	29.7
22/04/2024 13:45	00:15:00	6	38.3	57	41.4	30
22/04/2024 14:00	00:15:00	7	38.3	59.6	40.8	31.2
22/04/2024 14:15	00:15:00	8	37.9	59.7	40.6	32.3
22/04/2024 14:30	00:15:00	9	40.9	57.8	43.4	35.4
22/04/2024 14:45	00:15:00	10	40.2	59.8	40.3	31.4
22/04/2024 15:00	00:15:00	11	54.7	68.3	59.5	34.6
22/04/2024 15:15	00:15:00	12	53.5	70	58.3	37.7
22/04/2024 15:30	00:15:00	13	54.3	70.9	55	37.1
22/04/2024 15:45	00:15:00	14	52.8	67.9	54.8	37.2
22/04/2024 16:00	00:15:00	15	51.9	66.5	55	35.4
22/04/2024 16:15	00:15:00	16	49.3	62.2	53.6	36.7
22/04/2024 16:30	00:15:00	17	63.3	82.8	59.8	35.9
22/04/2024 16:45	00:15:00	18	46.8	64.6	47.3	33
22/04/2024 17:00	00:15:00	19	49.7	65.8	52.1	36.6
22/04/2024 17:15	00:15:00	20	47.6	62.5	51.1	33.7
22/04/2024 17:30	00:15:00	21	38.7	56.5	41.5	31.5
22/04/2024 17:45	00:15:00	22	37.7	54.2	40.8	32
22/04/2024 18:00	00:15:00	23	40.1	61	42.6	32.2
22/04/2024 18:15	00:15:00	24	41.2	64.1	44.1	31.6
22/04/2024 18:30	00:15:00	25	45.1	64.5	48.8	32
22/04/2024 18:45	00:15:00	26	49.4	64	51.3	32
22/04/2024 19:00	00:15:00	27	45.3	63.1	43.7	31.7
22/04/2024 19:15	00:15:00	28	45.2	63.7	48.1	31.4
22/04/2024 19:30	00:12:07	29	43.1	66.4	42.4	30.5
24/04/2024 12:50	00:09:05	30	63.8	96.9	43.1	29
24/04/2024 13:00	00:15:00	31	36.8	58	39.5	27.9
24/04/2024 13:15	00:15:00	32	45.5	64.7	44.8	29.5
24/04/2024 13:30	00:15:00	33	40.4	66.9	43.7	28.8
24/04/2024 13:45	00:15:00	34	40.8	59.1	40.4	29.4
24/04/2024 14:00	00:15:00	35	34.8	49	38.2	26.6
24/04/2024 14:15	00:15:00	36	38.7	58.7	42.4	27.4
24/04/2024 14:30	00:15:00	37	41.2	64.5	44.1	27.6
24/04/2024 14:45	00:15:00	38	40.8	59	44.4	26.9
24/04/2024 15:00	00:15:00	39	35.5	51.2	38.9	27.8
24/04/2024 15:15	00:15:00	40	49.5	77.5	44.9	29.1
24/04/2024 15:30	00:15:00	41	47.7	63.8	44.5	28.9
24/04/2024 15:45	00:15:00	42	52.6	65.5	58.5	28.4
24/04/2024 16:00	00:15:00	43	38.2	54.6	41	32.2
24/04/2024 16:15	00:15:00	44	40	63.3	42.3	31
24/04/2024 16:30	00:15:00	45	40.7	58.7	44.2	32.5
24/04/2024 16:45	00:15:00	46	37	53.1	39.6	30.3
24/04/2024 17:00	00:15:00	47	35.3	53.6	38.6	27.2

24/04/2024 17:15	00:15:00	48	35.3	55.7	37.8	26.8
24/04/2024 17:30	00:15:00	49	37.9	54.7	41.2	27.8
24/04/2024 17:45	00:15:00	50	38.2	58.3	41.3	29.8
24/04/2024 18:00	00:15:00	51	39.4	59.4	42.3	28.5
24/04/2024 18:15	00:15:00	52	39.4	59.9	41.6	31.1
24/04/2024 18:30	00:15:00	53	40.5	58.5	43.1	34.1
24/04/2024 18:45	00:15:00	54	42.7	58.2	46.4	33.3
24/04/2024 19:00	00:15:00	55	42	61.8	45.9	29.8
24/04/2024 19:15	00:15:00	56	48.1	64.7	51.7	31.5
24/04/2024 19:30	00:15:00	57	42.5	59.5	46.2	31.6
24/04/2024 19:45	00:15:00	58	38.8	55.3	42.3	28.5
24/04/2024 20:00	00:15:00	59	37.3	53.4	40.8	28.1
24/04/2024 20:15	00:15:00	60	35.9	53.2	38.6	27.7
24/04/2024 20:30	00:15:00	61	27.9	48.6	30	24.9
24/04/2024 20:45	00:15:00	62	27.5	40.7	28.8	25.5
24/04/2024 21:00	00:15:00	63	27.6	41.2	29.4	25.2
24/04/2024 21:15	00:15:00	64	26.9	44.3	28.2	24.3
24/04/2024 21:30	00:15:00	65	26.5	40.1	27.8	24.6
24/04/2024 21:45	00:15:00	66	27	40	28.1	25.3
24/04/2024 22:00	00:15:00	67	27.1	40.1	28.5	24.8
24/04/2024 22:15	00:15:00	68	25.4	41.4	26.5	23.7
24/04/2024 22:30	00:15:00	69	27.1	39.9	29	23.8
24/04/2024 22:45	00:15:00	70	28.5	47.3	30.9	23.9
24/04/2024 23:00	00:15:00	71	25.6	38.3	27.4	23.4
24/04/2024 23:15	00:15:00	72	24.9	34.8	26.4	23.2
24/04/2024 23:30	00:15:00	73	26.9	41.2	29.3	23.6
24/04/2024 23:45	00:15:00	74	26.7	39.1	29.1	23.8
25/04/2024 00:00	00:15:00	75	24.9	40.3	26.2	23.2
25/04/2024 00:15	00:15:00	76	24.1	33.8	25.4	22.7
25/04/2024 00:30	00:15:00	77	23.9	36.9	25.3	22.2
25/04/2024 00:45	00:15:00	78	25.1	38.5	26.2	23
25/04/2024 01:00	00:15:00	79	24.8	32.3	26.1	23.1
25/04/2024 01:15	00:15:00	80	25.1	38.8	26.1	23.2
25/04/2024 01:30	00:15:00	81	24.3	30.4	25.5	23.2
25/04/2024 01:45	00:15:00	82	23.9	29.2	25.2	22.1
25/04/2024 02:00	00:15:00	83	24	28.3	25.1	22.5
25/04/2024 02:15	00:15:00	84	33.5	52.4	37.5	23.9
25/04/2024 02:30	00:15:00	85	27	39.4	27.7	25.2
25/04/2024 02:45	00:15:00	86	33.8	50.5	33.3	26.2
25/04/2024 03:00	00:15:00	87	29.6	40.4	30.9	27.6
25/04/2024 03:15	00:15:00	88	28.2	39.2	29.6	25.8
25/04/2024 03:30	00:15:00	89	27	37.3	27.6	26.1
25/04/2024 03:45	00:15:00	90	27.5	35.9	28	26.9
25/04/2024 04:00	00:15:00	91	32.8	47.9	36.1	27.6
25/04/2024 04:15	00:15:00	92	44.8	61.6	48.1	32.8
25/04/2024 04:30	00:15:00	93	51.5	67.5	55.5	39
25/04/2024 04:45	00:15:00	94	48	61.7	52.3	37.7
25/04/2024 05:00	00:15:00	95	47	68.2	47.7	35.1

25/04/2024 05:15	00:15:00	96	43.7	58.9	47.2	35.7
25/04/2024 05:30	00:15:00	97	43.3	57.2	47	34.5
25/04/2024 05:45	00:15:00	98	43	57.5	46.3	34.5
25/04/2024 06:00	00:15:00	99	43.6	55.6	47.4	35.7
25/04/2024 06:15	00:15:00	100	45	56.7	49	34.9
25/04/2024 06:30	00:15:00	101	47.2	59.5	51.4	35.4
25/04/2024 06:45	00:15:00	102	47.9	62.3	52.7	33.6
25/04/2024 07:00	00:15:00	103	47.5	61.8	51.9	34.6
25/04/2024 07:15	00:15:00	104	48.2	62.1	52.8	31.7
25/04/2024 07:30	00:15:00	105	42.3	62.5	45.5	32.4
25/04/2024 07:45	00:15:00	106	40.7	59.2	44.1	31.2
25/04/2024 08:00	00:15:00	107	41.3	68	44.7	30.7
25/04/2024 08:15	00:15:00	108	42.8	57.7	46.5	31.8
25/04/2024 08:30	00:15:00	109	39.7	54.8	43.3	30.8
25/04/2024 08:45	00:15:00	110	48.3	67.6	48.9	30.7
25/04/2024 09:00	00:15:00	111	58.8	69.8	63.4	33.9
25/04/2024 09:15	00:15:00	112	49	72.1	49.5	33.8
25/04/2024 09:30	00:15:00	113	52	65.8	58.1	34.4
25/04/2024 09:45	00:15:00	114	41.4	71.4	43.4	34.2
25/04/2024 10:00	00:15:00	115	42.6	64.3	45.7	31.3
25/04/2024 10:15	00:15:00	116	42.8	65.5	45.2	30.4
25/04/2024 10:30	00:15:00	117	40.2	56.9	43.6	30.3
25/04/2024 10:45	00:15:00	118	39.8	62.1	43	30
25/04/2024 11:00	00:15:00	119	39.4	57	42.1	29.6
25/04/2024 11:15	00:15:00	120	45.5	62.3	50.1	31.8
25/04/2024 11:30	00:15:00	121	42.6	61.2	46	30.6
25/04/2024 11:45	00:15:00	122	36.9	57.7	39.9	28.2
25/04/2024 12:00	00:15:00	123	47.1	66.3	44	30.3
25/04/2024 12:15	00:15:00	124	37.8	56.5	41.4	29.1
25/04/2024 12:30	00:15:00	125	37.9	51.8	41.4	29.9
25/04/2024 12:45	00:15:00	126	36.8	52.8	40	29.2
25/04/2024 13:00	00:15:00	127	43.9	76.2	41.5	29.4
25/04/2024 13:15	00:15:00	128	44.6	61.4	44	31.6
25/04/2024 13:30	00:15:00	129	47.5	62.2	49.9	31.4
25/04/2024 13:45	00:15:00	130	40.1	60.7	43.8	30.3
25/04/2024 14:00	00:15:00	131	38.6	54.7	41.7	30.8
25/04/2024 14:15	00:15:00	132	38.3	52.1	41.6	30.9
25/04/2024 14:30	00:15:00	133	39	62.5	42	29.5
25/04/2024 14:45	00:15:00	134	57.9	70.1	63.6	32.7
25/04/2024 15:00	00:15:00	135	44.2	62.7	47.8	36.3
25/04/2024 15:15	00:15:00	136	42.9	63.6	46.2	36.3
25/04/2024 15:30	00:15:00	137	43	66.6	46	34.4
25/04/2024 15:45	00:15:00	138	54.6	67.2	59.1	34.2
25/04/2024 16:00	00:15:00	139	37.2	55.9	41	28.8
25/04/2024 16:15	00:15:00	140	40.3	53.9	43	35.1
25/04/2024 16:30	00:15:00	141	39.6	58.4	41.4	36.5
25/04/2024 16:45	00:15:00	142	39.4	54.4	41.4	36.1
25/04/2024 17:00	00:15:00	143	39	56.7	40.5	35.8

25/04/2024 17:15	00:15:00	144	38	55.1	39.7	34.2
25/04/2024 17:30	00:15:00	145	40.8	56.2	43.3	36.1
25/04/2024 17:45	00:15:00	146	40.2	54.6	42.9	35.4
25/04/2024 18:00	00:15:00	147	40.9	61	44.1	34.9
25/04/2024 18:15	00:15:00	148	44.5	62.5	47	35.7
25/04/2024 18:30	00:15:00	149	45.2	57	49.2	36.3
25/04/2024 18:45	00:15:00	150	41.9	55.5	45	35.6
25/04/2024 19:00	00:15:00	151	41.9	56.9	44.9	36.4
25/04/2024 19:15	00:15:00	152	41.2	57.9	43.8	36.1
25/04/2024 19:30	00:15:00	153	43.8	59.7	47.3	36.6
25/04/2024 19:45	00:15:00	154	40.2	54.2	43.8	32.6
25/04/2024 20:00	00:15:00	155	38.1	50.6	41.1	32.8
25/04/2024 20:15	00:15:00	156	36.6	54.9	37.9	31.8
25/04/2024 20:30	00:15:00	157	33.8	45	35.6	31.5
25/04/2024 20:45	00:15:00	158	38.3	71.5	36.7	32.3
25/04/2024 21:00	00:15:00	159	33.3	48.7	34.5	30.9
25/04/2024 21:15	00:15:00	160	32.1	46.8	34.6	28
25/04/2024 21:30	00:15:00	161	32.6	44.5	34.9	29.5
25/04/2024 21:45	00:15:00	162	30.4	43.5	32.7	27.3
25/04/2024 22:00	00:15:00	163	30.2	42.5	31.4	28
25/04/2024 22:15	00:15:00	164	34.2	51.4	36.2	30.3
25/04/2024 22:30	00:15:00	165	34.8	45.4	36.6	32.3
25/04/2024 22:45	00:15:00	166	34	46.3	35.9	30.9
25/04/2024 23:00	00:15:00	167	32.5	44.7	34.3	30.3
25/04/2024 23:15	00:15:00	168	29.8	41	31.2	28.3
25/04/2024 23:30	00:15:00	169	32.1	46.9	34.1	28.8
25/04/2024 23:45	00:15:00	170	29.7	38.1	31.2	28.1
26/04/2024 00:00	00:15:00	171	29.8	41	31.3	27.9
26/04/2024 00:15	00:15:00	172	32.2	45.9	34.4	28
26/04/2024 00:30	00:15:00	173	30.6	44.6	31.9	28.4
26/04/2024 00:45	00:15:00	174	30.1	39.7	31.5	28.4
26/04/2024 01:00	00:15:00	175	30.4	41.8	31.9	28.4
26/04/2024 01:15	00:15:00	176	34.9	56.9	32	28.1
26/04/2024 01:30	00:15:00	177	30.5	42.3	32.2	28.4
26/04/2024 01:45	00:15:00	178	29.4	40.1	30.9	27.9
26/04/2024 02:00	00:15:00	179	29.6	39.3	31	27.8
26/04/2024 02:15	00:15:00	180	33.2	49.9	36.4	27.7
26/04/2024 02:30	00:15:00	181	30.1	44.2	32.3	27.1
26/04/2024 02:45	00:15:00	182	33.1	47.9	37.3	26.7
26/04/2024 03:00	00:15:00	183	31.2	47.8	33.5	26.8
26/04/2024 03:15	00:15:00	184	30.1	45.9	32.2	27
26/04/2024 03:30	00:15:00	185	28.9	42.7	30.5	26.6
26/04/2024 03:45	00:15:00	186	29.6	43.1	32	26.2
26/04/2024 04:00	00:15:00	187	40.2	59.5	44.2	26.7
26/04/2024 04:15	00:15:00	188	48	64.7	51.6	38.7
26/04/2024 04:30	00:15:00	189	46.8	67.1	49.5	38.9
26/04/2024 04:45	00:15:00	190	43	61.3	45.7	37.6
26/04/2024 05:00	00:15:00	191	44.4	59.9	46.4	37.2

26/04/2024 05:15	00:15:00	192	42.4	56.9	45.3	36.2
26/04/2024 05:30	00:15:00	193	42.9	57.7	45.3	36.8
26/04/2024 05:45	00:15:00	194	44.5	64.6	46.2	37.9
26/04/2024 06:00	00:15:00	195	43.5	61.2	45.3	38.5
26/04/2024 06:15	00:15:00	196	42.8	59.8	45.2	37.2
26/04/2024 06:30	00:15:00	197	44.4	61.6	47	36.9
26/04/2024 06:45	00:15:00	198	40.4	53.1	43.2	35.4
26/04/2024 07:00	00:15:00	199	54.3	80	46.9	34.5
26/04/2024 07:15	00:15:00	200	50.7	70.8	49.7	38.5
26/04/2024 07:30	00:15:00	201	47.2	63.9	49.7	38.8
26/04/2024 07:45	00:15:00	202	48.2	61.4	50.8	44.5
26/04/2024 08:00	00:15:00	203	42.5	57.7	46.1	33.4
26/04/2024 08:15	00:15:00	204	45	63.5	48	33.4
26/04/2024 08:30	00:15:00	205	44.2	62.4	46.7	35.6
26/04/2024 08:45	00:15:00	206	53.6	77.7	51.6	34
26/04/2024 09:00	00:15:00	207	40.7	63.2	42.7	33.3
26/04/2024 09:15	00:15:00	208	40.9	67.6	42.8	33.7
26/04/2024 09:30	00:15:00	209	38.8	60.2	41.1	32.7
26/04/2024 09:45	00:15:00	210	39.7	59.7	42.4	32.4
26/04/2024 10:00	00:15:00	211	41.7	59.8	44.6	33.7
26/04/2024 10:15	00:15:00	212	46	62.5	46.6	37.1
26/04/2024 10:30	00:15:00	213	42.9	56.1	46.3	33.3
26/04/2024 10:45	00:15:00	214	41.5	56	46.4	31.9
26/04/2024 11:00	00:15:00	215	40.8	52.3	45.7	32.3
26/04/2024 11:15	00:15:00	216	41.7	51.9	44.9	32.6
26/04/2024 11:30	00:15:00	217	40	54.2	45.3	32.1
26/04/2024 11:45	00:15:00	218	44.5	63.3	42.7	31.7
26/04/2024 12:00	00:15:00	219	38.2	60.6	40.8	31.6
26/04/2024 12:15	00:15:00	220	40.3	58.6	43.1	33.5
26/04/2024 12:30	00:15:00	221	38.6	51.8	40.8	35
26/04/2024 12:45	00:15:00	222	40	57.8	42.5	34.7
26/04/2024 13:00	00:15:00	223	41.3	58.2	43.9	33.2
26/04/2024 13:15	00:15:00	224	50.4	66.7	51.1	32.5
26/04/2024 13:30	00:15:00	225	46.1	68.3	49	32
26/04/2024 13:45	00:15:00	226	40.1	64.8	42.7	31.9
26/04/2024 14:00	00:15:00	227	36.9	49.2	40.1	31.3
26/04/2024 14:15	00:15:00	228	38.1	53.6	41.1	32.9
26/04/2024 14:30	00:15:00	229	39.8	56.5	42.4	34.8
26/04/2024 14:45	00:15:00	230	41.2	56.5	44.1	35
26/04/2024 15:00	00:15:00	231	40.7	58.7	43.1	36.3
26/04/2024 15:15	00:15:00	232	47.9	64.9	48.5	34.4
26/04/2024 15:30	00:06:29	233	41.4	65.7	41.9	32.8
26/04/2024 16:00	00:15:00	234	69.7	103	68.6	20
26/04/2024 16:15	00:13:51	235	77.6	105	73.9	30.5

NMP5

Start: 2024-04-24 11:23:50

End: 2024-04-24 12:08:53

Country roadside location.

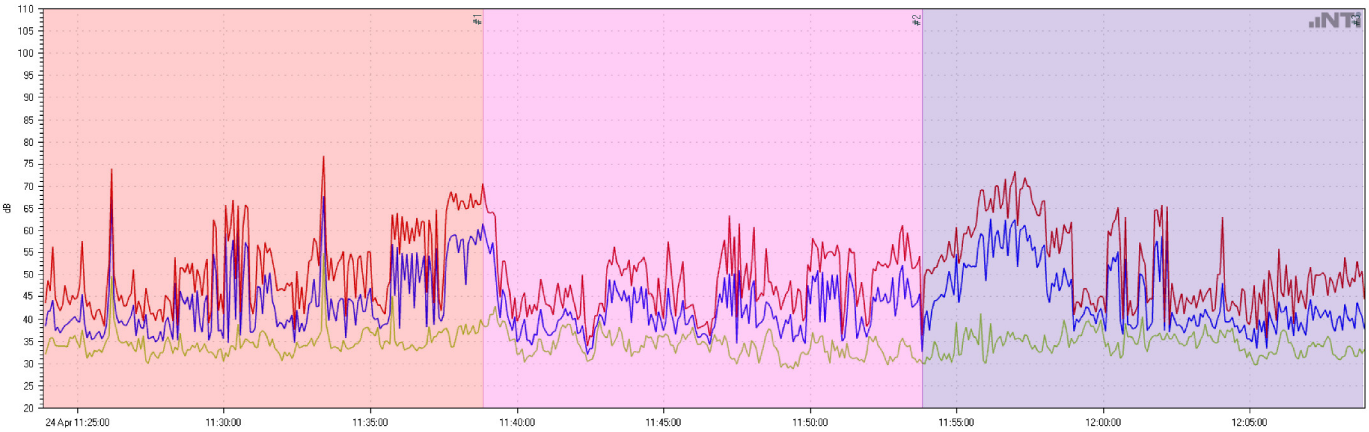
Configuration

Device Info: XL2, SNo. A2A-16311-E0, FW4.21 Type Approved

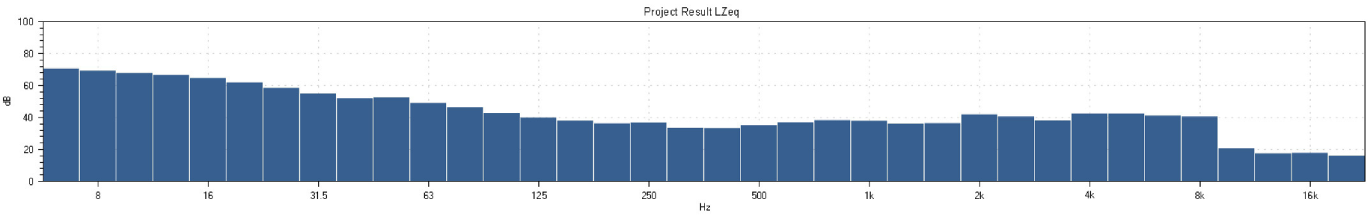
Mic Type: NTi Audio M2230, SNo. 8567, User calibrated 2024-04-24 11:22

Mic Sensitivity: 38.9 mV/Pa

Range: 20 - 120 dB



LAFmax_dt LAFmin_dt LAeq_dt



Results

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
Recorded	**2024-04-24 11:23:50**	**00:45:03**	**76.8**	**28.7**	**50.9**		
Project Result		**00:45:03**	**76.8**	**28.7**	**50.9**	**51.7**	**34.2**

Markers

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
#1 (1)		**00:15:00**	**76.8**	**30.0**	**52.6**	**55.3**	**34.8**
#2 (1)		**00:15:00**	**66.3**	**28.7**	**45.5**	**49.0**	**33.5**
#3 (1)		**00:15:00**	**73.3**	**29.6**	**51.9**	**55.0**	**34.4**
Unmarked		**00:00:03**	**44.3**	**33.1**	**37.6**	**39.8**	**35.6**

NMP6

Start: 2024-04-24 12:21:26

End: 2024-04-24 13:06:29

Quiet countryside location.

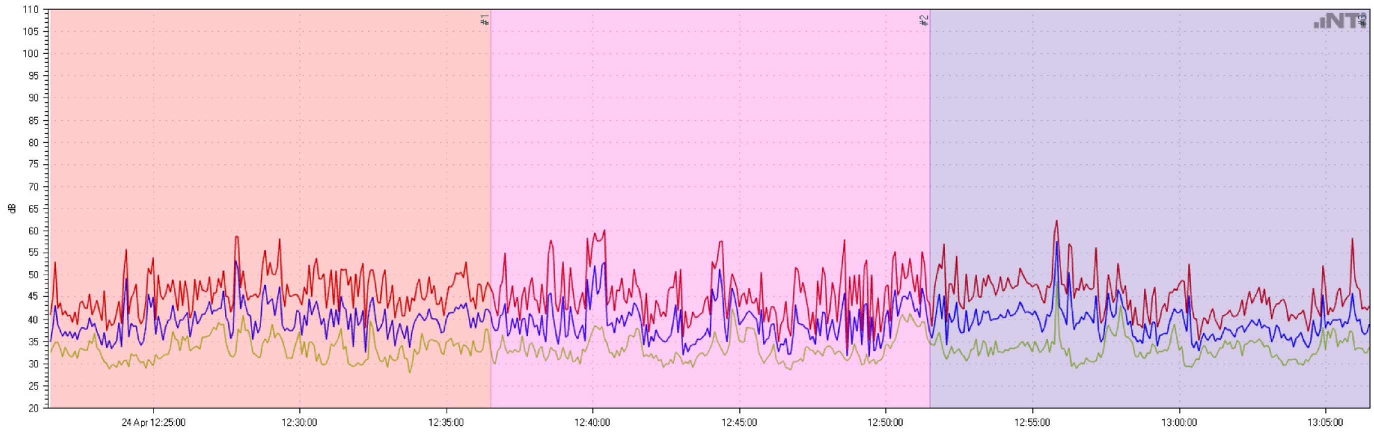
Configuration

Device Info: XL2, SNo. A2A-16311-E0, FW4.21 Type Approved

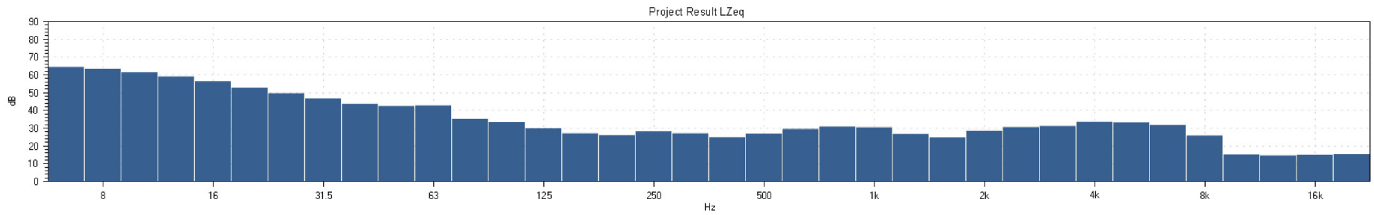
Mic Type: NTi Audio M2230, SNo. 8567, User calibrated 2024-04-24 11:22

Mic Sensitivity: 38.9 mV/Pa

Range: 20 - 120 dB



LAFmax_dt LAFmin_dt LAeq_dt



Results

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
Recorded	**2024-04-24 12:21:26**	**00:45:03**	**62.5**	**27.7**	**41.5**		
Project Result		**00:45:03**	**62.5**	**27.7**	**41.5**	**43.7**	**33.3**

Markers

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
#1 (1)		**00:15:00**	**58.7**	**27.7**	**41.3**	**43.9**	**33.4**
#2 (1)		**00:15:00**	**60.2**	**28.4**	**41.8**	**44.6**	**32.6**
#3 (1)		**00:15:00**	**62.5**	**28.9**	**41.4**	**42.8**	**34.1**
Unmarked		**00:00:03**	**42.8**	**34.8**	**39.1**	**41.0**	**36.9**

NMP7

Start: 2024-04-24 13:34:30

End: 2024-04-24 14:19:37

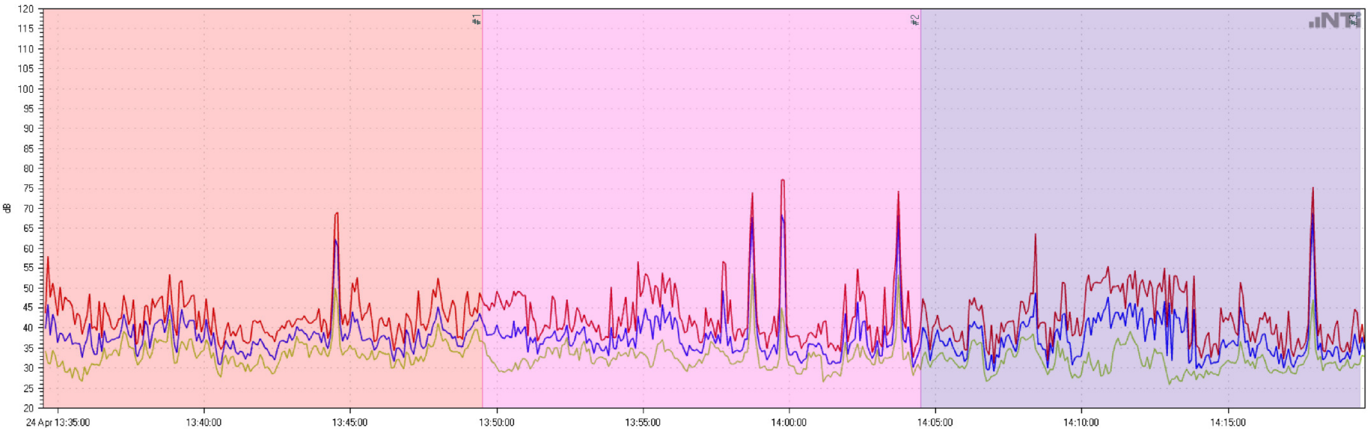
Configuration

Device Info: XL2, SNo. A2A-16311-E0, FW4.21 Type Approved

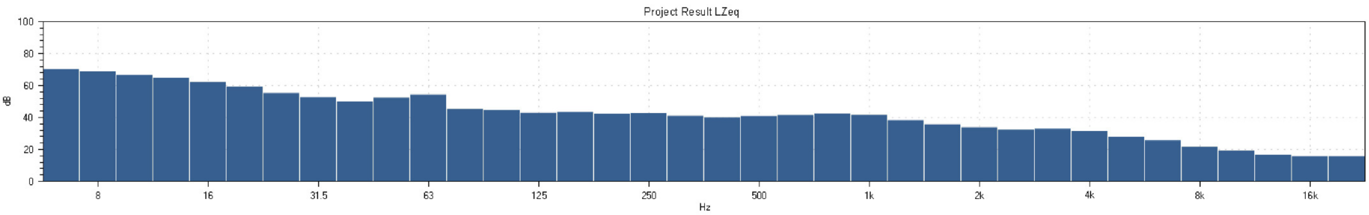
Mic Type: NTi Audio M2230, SNo. 8567, User calibrated 2024-04-24 11:22

Mic Sensitivity: 38.9 mV/Pa

Range: 20 - 120 dB



LAFmax_dt LAFmin_dt LAeq_dt



Results

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq	
						10.0% [dB]	90.0% [dB]
Recorded	**2024-04-24 13:34:30**	**00:45:07**	**77.1**	**25.8**	**48.6**		
Project Result		**00:45:07**	**77.1**	**25.8**	**48.6**	**42.4**	**31.5**

Markers

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq	
						10.0% [dB]	90.0% [dB]
#1 (1)		**00:15:00**	**69.0**	**26.5**	**43.6**	**42.1**	**32.7**
#2 (1)		**00:15:00**	**77.1**	**26.4**	**51.5**	**42.2**	**31.9**
#3 (1)		**00:15:00**	**75.4**	**25.8**	**47.2**	**43.8**	**30.6**
Unmarked		**00:00:07**	**41.0**	**32.7**	**36.9**	**39.1**	**34.2**

NMP8 #1 & 2

Start: 2024-04-24 15:03:46

End: 2024-04-24 15:33:51

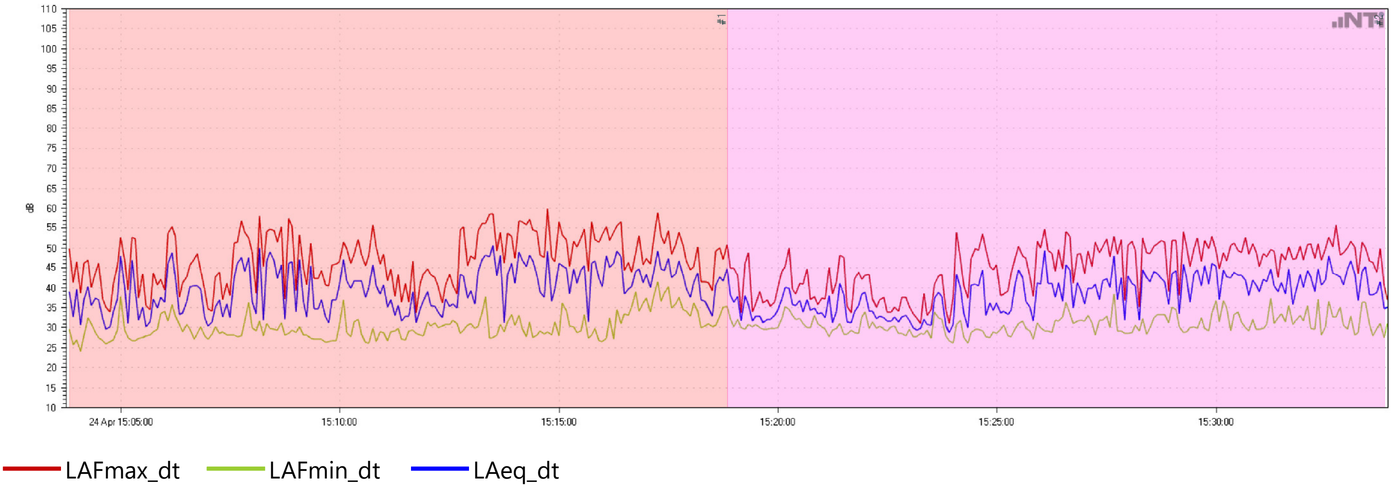
Configuration

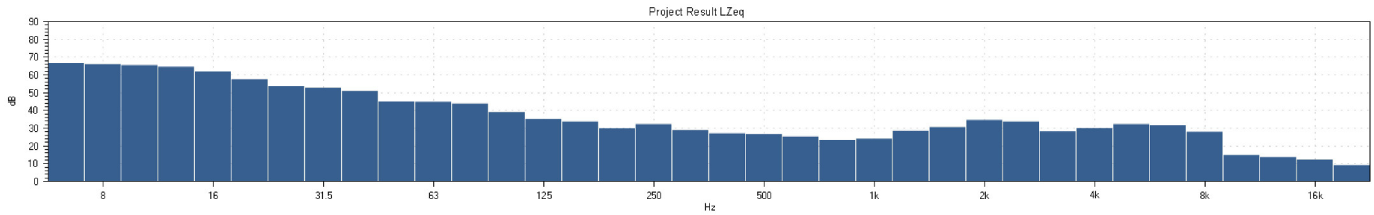
Device Info: XL2, SNo. A2A-16311-E0, FW4.21 Type Approved

Mic Type: NTi Audio M2230, SNo. 8567, User calibrated 2024-04-24 14:20

Mic Sensitivity: 39.0 mV/Pa

Range: 0 - 100 dB





Results

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
Recorded	**2024-04-24 15:03:46**	**00:30:05**	**59.8**	**24.0**	**41.9**		
Project Result		**00:30:05**	**59.8**	**24.0**	**41.9**	**46.4**	**30.4**

Markers

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
#1 (1)		**00:15:00**	**59.8**	**24.0**	**42.9**	**47.9**	**30.3**
#2 (1)		**00:15:00**	**55.6**	**26.0**	**40.6**	**45.0**	**30.5**
Unmarked		**00:00:05**	**38.5**	**27.4**	**33.7**	**35.2**	**28.2**

NMP8 #3

Start: 2024-04-24 14:48:12

End: 2024-04-24 15:03:17

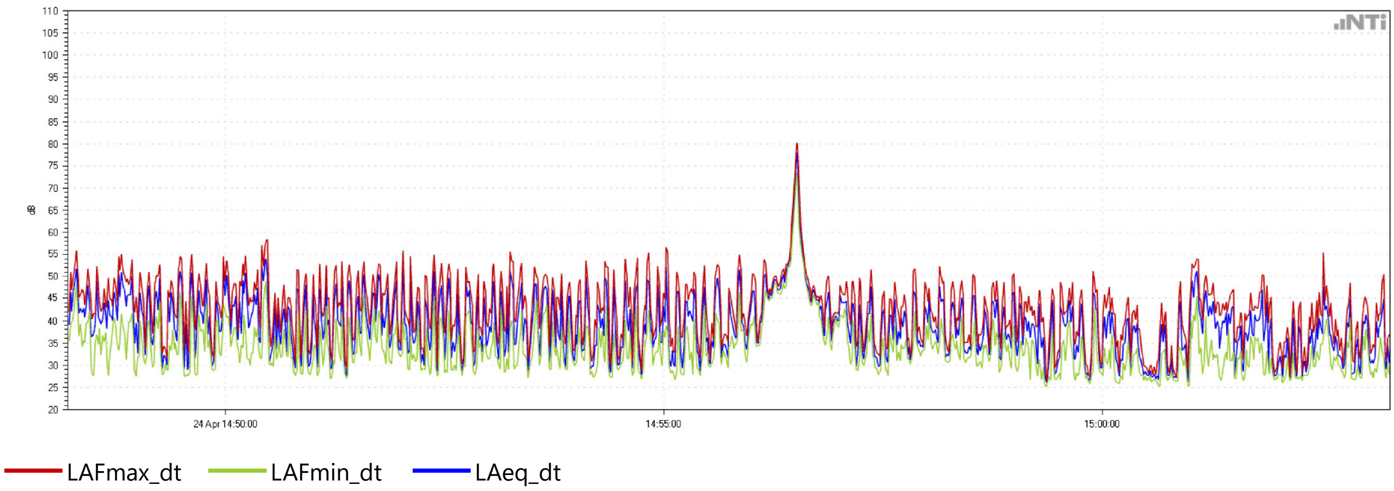
Configuration

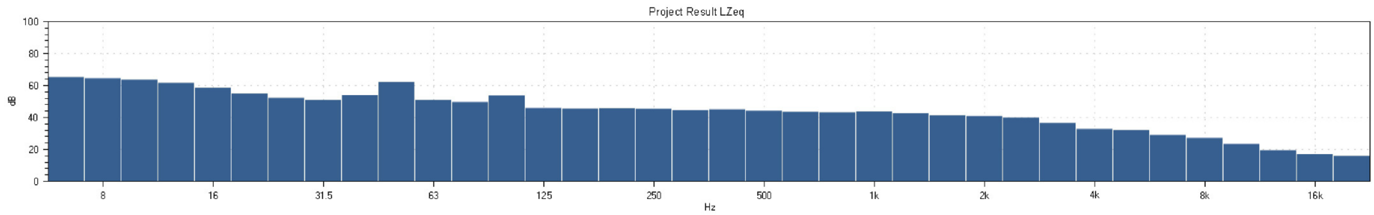
Device Info: XL2, SNo. A2A-16311-E0, FW4.21 Type Approved

Mic Type: NTi Audio M2230, SNo. 8567, User calibrated 2024-04-24 14:20

Mic Sensitivity: 39.0 mV/Pa

Range: 20 - 120 dB





Results

Type	Start	Duration	LAFmax [dB]	LAFmin [dB]	LAeq [dB]	LAeq 10.0% [dB]	LAeq 90.0% [dB]
Recorded	**2024-04-24 14:48:12**	**00:15:05**	**80.1**	**25.1**	**52.1**		
Project Result		**00:15:05**	**80.1**	**25.1**	**52.1**	**47.3**	**30.0**