Appendix L

Air Quality Assessment Report

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Galway County Council

N6 Galway City Ring Road

NIS - Air Quality Assessment

GCOB_4.03.21_002

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Contents

1 Introduction

This report has been prepared to consider potential air quality impacts as they relate to European sites and is included as an appendix to the Natura Impact Statement for the N6 Galway City Ring Road.

The study considers the construction and operation phases of the proposed road development.

2 Air quality standards and limits

In order to reduce the risk of poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values are set for the protection of human health and ecosystems. Refer to Table 1 below.

The Air Quality Standards Regulations (AQS) 2011 (S.I. No. 180 of 2011) came into force and EU Directive 2008/50/EC was transposed into Irish law. These standards were introduced to avoid, prevent or reduce harmful effects on human health and the environment as a whole.

Table 1: Air Quality Standards (AQS) from Regulations 2011 (S.I No. 180 of 2011)

Pollutant	Limit value for the protection of:	Averaging period	Limit value (µg/m3)	Basis of application of limit value	Limit value attainment date
NO2	Human Health	1-hour	200	≤18 exceedances p.a. (99.79 %ile)	1 January 2010
		Calendar year	40	Annual mean	1 January 2010
NOx	Vegetation	Calendar year	30	Annual mean	1 January 2010
PM10	Human Health	24-hours	50	≤35 exceedances p.a. (98.1%ile)	1 January 2005
		Calendar year	40	Annual mean	1 January 2005
PM2.5	Human Health	Calendar year	20	Annual mean	1 January 2020
CO	Human Health	8-hour Annual Average	10,000	8-hour Average	1 January 2005
Benzene	Human Health	Calendar year	5	Annual mean	1 January 2010
SO2	Vegetation	Calendar year and winter	20	Annual mean	1 January 2010

According to the UK Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Annex F, 2007) road transport represents a negligible source (less than 1%) of UK sulphur dioxide emissions. Concentrations may have been slightly

elevated at heavily trafficked roadside locations in the past, but because the maximum permitted sulphur content of road fuels has periodically been reduced, the contribution is now much lower. On this basis, it is excluded from further assessment.

The TII *'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*', 2011 quotes the United Nations Economic Commission for Europe (UNECE) Critical Loads[1]for Nitrogen. As the Lough Corrib candidate Special Area of Conservation (cSAC) is designated for the protection of a multitude of habitats including, hard water lakes, floating river vegetation, raised bogs, alkaline fens, bog woodland, a number of UNECE Critical Loads could be selected for assessment. The most stringent of these is for inland and surface water habitats (5-10 Kg(N)/ha/yr.) and therefore, this is used in this assessment. Critical levels[2] are also included in this assessment for various relevant pollutants. These are not habitat specific, as in critical loads, but are set to cover broad vegetation types. They are defined as pollutant concentrations, as opposed to deposition values for critical loads.

UNECE also provides critical loads for ammonia, refer to **Table 2**.

Table 2: Ammonia critical loads

Receptor	Time period	Critical level (µg/m3)
Lichens and bryophytes (where they form a key part of the ecosystem integrity	Annual mean	1
Other vegetation	Annual mean	3

3 Relevant guidance

The UK DMRB states that some air pollutants can have an effect on vegetation. Concentrations of pollutants in air and deposition of particles can damage vegetation directly or affect plant health and productivity. It states that the pollutants of most concern for sensitive vegetation near roads, and perhaps the best understood, is NOx. It refers to the EU limit set for NOx for the protection of vegetation. This value was based on the work of UNECE and WHO and has been implemented into the Irish air quality standards. The report states that *'critical loads for the deposition of nitrogen represents the exposure below which there should be*

[1] Critical Loads are defined as: " a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"
(Source: http://www.unece.org/env/lrtap/WorkingGroups/wge/definitions.htm)

2 Critical levels are defined as "concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge".
(Source: http://www.unece.org/env/lrtap/WorkingGroups/wge/definitions.htm)

no significant harmful effects on sensitive elements of the ecosystem (according to current knowledge)'. In relation to heavy metals, the manual states that *small quantities of heavy metals released during combustion and from vehicle wear and tear may accumulate in soils near the road. However, such emissions cannot be reliably quantified or the negative ecological effects determined*.

The manual describes the assessment procedure to be used to assess the impact of air pollution on ecologically sensitive sites. The procedure was developed in collaboration with the Joint Nature Conservation committee and Natural England and adopted by the TII in its guidelines.

The Natural England report 'The Ecological Effects of Air Pollution from Road Transport' published in 2004 and the 2016 update (The ecological effects of air pollution from road transport: an updated review (NECR199)) were reviewed in the context of this assessment. These reports were commissioned to assess the potential risk to biodiversity due to air pollution from roads.

The reports summarise studies carried out to determine the effect of traffic emissions on NOx and nitrogen deposition on various species. In general, the study concludes that a review of relevant studies *provides further evidence of the impacts on individual species from exposure to NO_x and NO_2 associated with vehicle emissions and that these are greatest within the first 50-100m from the roads but may be discernible at greater distances.*

In relation to Volatile Organic Compounds (VOCs), the report states that most studies testing the responses of plants exposure to VOCs have used high concentrations over short exposure periods (hours or days). Therefore, the effects of exposure to low concentrations of VOC is difficult to determine. Also, few of the studies tested the responses of vegetation to the species of VOCs emitted by vehicles. Studies have generally concentrated on the effects of ethylene which is emitted by motor vehicles and naturally occurring in plants. The report also states that *levels of ethylene likely to be found in the vicinity of roads may be high enough to adversely affect sensitive species*. Sensitive plant parts include flowers, fruit, seed production and morphology. The report concludes *that the response of vegetation to other VOCs emitted by motor vehicles is unclear; although possible effects are degradation of leaf surface waxes, pigment bleaching and ultra-structural changes.*

In relation to metals, the report states:

The studies also evidence that traffic emissions are a significant source of metal contamination for vegetation close to roads, although the leaf concentrations recorded are unlikely to present a significant immediate toxic risk to plants.

Metals are likely to persist in soils and levels may therefore build up over time in the vicinity of roads. A number of laboratory studies have cultured a variety of plant species in soil containing elevated concentrations of heavy metals and have found a range of tolerances depending on the species tested.

There is the potential for elevated concentrations of metals in soils close to roads. However, the report also states that soil metal content is generally only substantially elevated within 20-30m from even the busiest of roads.

In relation to ammonia, the report states:

Ammonia is emitted in small amounts by vehicles with catalytic converters and roadside atmospheric concentrations are well below critical levels for this pollutant (UK CLAG, 1996). Gaseous ammonia is thus unlikely to be a key issue, and effects on vegetation are more likely to arise from enhanced deposition of nitrogen to the soil environment. This elevation in soil nitrogen will be limited to areas within tens of metres of roads due to the high rates of deposition of this gas.

In relation to particulates/dust, the following is stated:

Few attempts have been made to assess the impacts of particulates and dust from motor vehicles on vegetation under controlled conditions… The authors conclude that it is difficult to assess the significance of these results for roadside plants under realistic conditions.

Although the DMRB recommends that the primary focus of the air assessment is on reactive nitrogen compounds, the other pollutants outlined in the documents above are discussed in this impact assessment.

4 Air quality assessment

The route of the proposed road development traverses the Lough Corrib cSAC at two locations; at the site of the proposed River Corrib Bridge between National University of Ireland, Galway (NUIG) and Menlough, and to the west of Lackagh Quarry, in Coolough, where the proposed road development will tunnel beneath the designated area at Lackagh Tunnel. The proposed road development also lies immediately adjacent to the Lough Corrib cSAC boundary to the north of the Coolagh Lakes between Ch. 9+800 and Ch. 10+100 in Menlough and lies immediately adjacent to and partially within the Lough Corrib cSAC boundary at the western approach to Lackagh Tunnel, between Ch. 10+450 and Ch. 11+020. The proposed road development consists of Menlough Viaduct and sections of embankment and cutting at this location.

On this basis, the areas of concern that relate to Lough Corrib cSAC from an air quality perspective are as follows:

- River Corrib Bridge crossing between Ch. 9+250 and Ch. 9+600, refer to Figure 8.7
- Menlough between Ch. 9+800 and Ch. 10+100, refer to Figure 8.7
- Lackagh Tunnel between Ch. 10+450 and Ch. 11+450, refer to Figures 8.7 and 8.8

For this section of the proposed road development, projected Annual Average Daily Values (AADT) are as follows:

- 2024 – 31,608
- 2039 – 37,190

The potential for air quality impacts at each of these locations is discussed below for nitrogen oxides, Volatile Organic Compounds (VOC), metals, ammonia and

particulates for the operational phase at each cSAC location. The potential for dust deposition is considered in the construction phase.

4.1 Construction Phase

During the construction phase, there is the potential for air quality impacts on the Lough Corrib cSAC due to the generation of dust.

Other traffic related pollutants, will not pose any long-term air quality risk as traffic volumes during construction will be small in comparison to operational traffic. Furthermore, construction traffic effects will be localised for short periods.

In accordance with TII guidelines and as the works are considered to be of a major scale, there is potential for soiling effects at receptors located within 100 m of the site works and PM_{10} and vegetation effects at receptors located less than 25 m from the site works with standard mitigation in place outlined below.

In order to ensure that any potential direct or indirect dust impacts will not affect vegetation within Lough Corrib cSAC in the vicinity of the construction works, the contractor will implement the following measures during construction of the proposed road development:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only apart from the contractor's car park which will be hardcore
- Any road that has the potential to give rise to fugitive dust will be regularly watered, during dry and/or windy conditions
- Vehicles using site roads will have their speed restricted, and this speed restriction will be enforced rigidly. On any un-surfaced site road, this will be 20 km/h, and on hard surfaced roads as site management dictates
- Wheel washing facilities will be provided for any vehicle exiting site in order to ensure that mud and other wastes are not tracked onto public roads, these will be located at least 50m away from Annex I habitat within a European site
- Material handling systems and site stockpiling of materials will be located at least 50m away from Annex I habitat within a European site. Potentially dusty surfaces will be dampened during dry conditions
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to reduce the potential for dust emissions

These procedures will be strictly monitored and assessed on a daily basis. In the event that elevated levels of dust are noted to occur outside the site boundary, satisfactory procedures will be implemented to rectify the problem before the resumption of construction operations.

Noise barriers in the form of hoarding will be provided around the construction sites. These will also have the effect of reducing off-site dust effects.

The addition of a 2m dust screen around construction works at all locations within or adjacent to the Lough Corrib cSAC will minimise dust impacts at the Lough Corrib cSAC.

4.2 Operational phase

4.2.1 Lough Corrib cSAC

The following sections assess the potential for pollution due to the proposed road development under the headings of Nitrogen compounds, VOC, Metals/Dust and Ammonia at the Lough Corrib cSAC, at the River Corrib Bridge between Ch. 9+250 and Ch. 9+600, between Ch. 9+800 and Ch. 10+100 at Menlough, and Lackagh Tunnel between Ch. 10+450 and Ch. 11+450 during the operational phase, refer to Figures 8.7 and 8.8.

4.2.1.1 Nitrogen compounds

Table 3 presents the results from the air quality modelling using DMRB methodology based on traffic volumes for 2024 (Year of Opening) and 2039 (Design Year) for the Do-Minimum (without the proposed road development) and Do-Something (with the proposed road development) scenarios. The potential impact of NO_x concentration and deposition was assessed at various distances from the road edge. The assessment was carried out in accordance with TII guidelines using the DMRB Screening Model. Background concentrations are based on three years of published monitoring data from the EPA for Zone C, which includes Galway City.

Ambient NO_x concentrations predicted for the opening and design years along a transect of up to 200m from the proposed road development are given in **Table 3** in accordance with TII guidance. The contribution of the proposed road development to dry deposition is also given and was calculated using the TII guidance methodology.

The annual average NO_x concentration at various distances from the road edge complies with the limit value of 30 $\mu g/m^3$ for the Do-Minimum scenario in 2024 and 2039, with NO_x concentrations reaching 32% of this limit in 2024 and 2039. For the Do-Something scenario, the limit values are complied with in 2024 at 88% of the limit value and complied with in 2039 with the predicted concentration at 92% of the limit value, including background concentrations at 10m from the road edge.

The potential impact of the proposed road development results in a maximum increase in NO_x concentrations of a maximum of 18.02$\mu g/m^3$ at 10m from the road edge. All predicted concentrations are in compliance with the Air Quality Standard of 30$\mu g/m^3$ for the protection of vegetation.

The proposed road development contribution to the NO_2 dry deposition rate along the 200m transect from the road edge is also detailed in **Table 3**. The maximum increase in the NO_2 dry deposition rate is 1.15 Kg (N)/ha/yr. in 2024 and 1.18 Kg(N)/ha/yr. in 2039 for the do-something scenario. This is approximately 20% of

the critical load for the lower boundary limit of inland and surface water habitats of 5-10 Kg(N)/ha/yr. (TII 2011).

Modelled background concentrations for 1990, 2000 and 2020 nitrogen deposition are provided in the EPA research document *'Development of Critical Loads for Ireland: Simulating Impacts on Systems (SIOS)*, Aherne, Henry and Wolniewicz. In the area of the proposed road development, background levels are in the range of 1 to 2.5 kg(N)/ha/yr.

The addition of these background levels results in continued compliance with the critical load.

Table 3: Predicted Nitrogen Concentration including Background and Deposition at the Lough Corrib cSAC for 2024 and 2039

Distance to Proposed Road Development (m)	NO_x Concentration (µg/m^3) 2024				NO_x Concentration (µg/m^3) 2039			NO_2 Dry Deposition Rate Impact (kg(N)/ha/yr.)	
	Background	Do-Minimum	Do-Something	Increase	Do-Minimum	Do-Something	Increase	2024	2039
10	9.5	9.5	26.37	16.87	9.5	27.52	18.02	1.15	1.18
20	9.5	9.5	22.27	12.77	9.5	23.14	13.64	1.03	1.06
30	9.5	9.5	19.3	9.80	9.5	19.97	10.47	0.95	0.97
40	9.5	9.5	17.13	7.63	9.5	17.65	8.15	0.88	0.89
50	9.5	9.5	15.49	5.99	9.5	15.9	6.40	0.82	0.84
60	9.5	9.5	14.22	4.72	9.5	14.55	5.05	0.78	0.79
70	9.5	9.5	13.22	3.72	9.5	13.48	3.98	0.74	0.75
80	9.5	9.5	12.43	2.93	9.5	12.63	3.13	0.71	0.72
90	9.5	9.5	11.79	2.29	9.5	11.95	2.45	0.69	0.69
100	9.5	9.5	11.29	1.79	9.5	11.41	1.91	0.67	0.67
110	9.5	9.5	10.9	1.40	9.5	10.99	1.49	0.65	0.65
120	9.5	9.5	10.59	1.09	9.5	10.66	1.16	0.64	0.64
130	9.5	9.5	10.36	0.86	9.5	10.42	0.92	0.63	0.63
140	9.5	9.5	10.2	0.70	9.5	10.24	0.74	0.62	0.62
150	9.5	9.5	10.09	0.59	9.5	10.13	0.63	0.61	0.62
160	9.5	9.5	10.03	0.53	9.5	10.07	0.57	0.61	0.61
170	9.5	9.5	10	0.50	9.5	10.04	0.54	0.61	0.61

Distance to Proposed Road Development (m)	NO_x Concentration ($\mu g/m^3$) 2024				NO_x Concentration ($\mu g/m^3$) 2039			NO_2 Dry Deposition Rate Impact (kg(N)/ha/yr.)	
	Background	**Do-Minimum**	**Do-Something**	**Increase**	**Do-Minimum**	**Do-Something**	**Increase**	**2024**	**2039**
180	9.5	9.5	9.92	0.42	9.5	9.95	0.45	0.60	0.61
190	9.5	9.5	9.84	0.34	9.5	9.86	0.36	0.60	0.60
200	9.5	9.5	9.76	0.26	9.5	9.78	0.28	0.60	0.60
Standards	$30\mu g/m^3$	$30\mu g/m^3$	$30\mu g/m^3$		$30\mu g/m^3$	$30\mu g/m^3$		5-10 Kg(N)/ha/yr	

4.2.1.2 VOC

No critical load limits exist for VOCs for the protection of vegetation.

An assessment of emissions of benzene was carried out for the proposed road development, in accordance with TII methodology using the DMRB modelling spreadsheet. Predicted concentrations were compared to the air quality standard of 5µg/m^3 for the protection of human health. The maximum predicted concentration for the Do-Something scenario was 8.2% of the standard including background concentrations of 5 µg/m^3. As stated previously, these limits have been developed to protect the environment as a whole.

Benzene concentrations predicted for the opening and design years along a transect of up to 200m from the proposed road development are given in **Table 4**.

Table 4: Predicted Benzene concentrations at the Lough Corrib cSAC including Background Concentrations for 2024 and 2039

Distance to Proposed Road Development (m)	**Benzene Concentration (µg/m^3) 2024**			**Benzene Concentration (µg/m^3) 2039**		
	Do-Minimum	Do-Something	Increase	Do-Minimum	Do-Something	Increase
10	0.3	0.39	0.09	0.3	0.41	0.11
20	0.3	0.37	0.07	0.3	0.38	0.08
30	0.3	0.36	0.06	0.3	0.36	0.06
40	0.3	0.34	0.04	0.3	0.35	0.05
50	0.3	0.33	0.03	0.3	0.34	0.04
60	0.3	0.33	0.03	0.3	0.33	0.03
70	0.3	0.32	0.02	0.3	0.32	0.02
80	0.3	0.32	0.02	0.3	0.32	0.02
90	0.3	0.31	0.01	0.3	0.32	0.02
100	0.3	0.31	0.01	0.3	0.31	0.01
110	0.3	0.31	0.01	0.3	0.31	0.01
120	0.3	0.31	0.01	0.3	0.31	0.01
130	0.3	0.3	0.01	0.3	0.31	0.01
140	0.3	0.3	0.01	0.3	0.3	0.01
150	0.3	0.3	0.01	0.3	0.3	0.01
160	0.3	0.3	0.01	0.3	0.3	0.01
170	0.3	0.3	0.01	0.3	0.3	0.01
180	0.3	0.3	0.01	0.3	0.3	0.01
190	0.3	0.3	0.01	0.3	0.3	0.01
200	0.3	0.3	0.01	0.3	0.3	0.01
Standards	**5µg/m^3**	**5µg/m^3**	**5µg/m^3**	**5µg/m^3**	**5µg/m^3**	**5µg/m^3**

As outlined in Section 3, the Natural England report states that *levels of ethylene likely to be found in the vicinity of roads may be high enough to adversely affect sensitive species*. On this basis, comparisons of emission factors of VOCs (mg/vehicle/km) have been examined in order to estimate an appropriate ratio of ethylene to benzene. The five studies examined[3]; various types of vehicles, over a ten year period, across three countries. The highest ratio of ethylene to benzene determined was 3:1, for vehicles which were primarily diesel emissions. Increases in ethylene from the proposed road development have been predicted using this ratio and results presented in **Table 5**. No background data or relevant limit values are available for ethylene.

Table 5: Predicted Ethylene concentrations at the Lough Corrib cSAC for 2024 and 2039

Distance to Proposed Road Development (m)	Ethylene Concentration (µg/m^3) 2024	Ethylene Concentration (µg/m^3) 2039
	Increase	Increase
10	0.28	0.33
20	0.22	0.25
30	0.17	0.19
40	0.13	0.15
50	0.10	0.12
60	0.08	0.09
70	0.06	0.07
80	0.05	0.06
90	0.04	0.05
100	0.03	0.04
110	0.02	0.03
120	0.02	0.02
130	0.03	0.02
140	0.03	0.03
150	0.03	0.03
160	0.03	0.03
170	0.03	0.03
180	0.03	0.03
190	0.03	0.03
200	0.03	0.03

[3] Atmospheric Chemistry and Physics, 2009. *Vehicular emission of volatile organic compounds (VOCs) from a tunnel in Hong Kong*). Available at http://www.klacp.ac.cn/kycg/scilw/201506/W020150612344767439939.pdf

4.2.1.3 Metals/Dust

No critical load limits exist for metals or dust for the protection of vegetation.

As outlined in the Environmental Protection Agency Air Quality in Ireland report 2015, *high levels of heavy metals are usually observed in areas with a lot of heavy industry such as smelting and mining. Ireland as a country which has few heavy industries such as these, and as a consequence, the concentration of heavy metals is likely to remain low in the future*. No reference is made to high levels of metals due to traffic emissions.

Heavy metals are continually monitored by the EPA for Zone C, at the heavily trafficked Bodkin Roundabout, Galway. Since 2015 measured heavy metals (Lead, Arsenic, Cadmium and Nickel) are all well below target values i.e. Lead 0.7%, Arsenic 15%, Cadmium 6%, Nickel 3% of the target values (Directive 2004/107/EC). These limits were developed to protect the environment as a whole.

Heavy metals from car emissions are associated with emissions of Particulate Matter, PM_{10} (particulate matter less than 10µm) and $PM_{2.5}$ (particulate matter less than 2.5µm). An assessment of emissions of PM_{10} and $PM_{2.5}$ was prepared in accordance with TII guidelines using the DMRB modelling spreadsheet. Predicted concentrations are compared to the air quality standard of 40µg/m^3 and 25µg/m^3 respectively for the protection of human health. The maximum predicted concentrations for the Do-Something scenario including background concentrations was 51.6% and 52% of the standards respectively. As stated previously, these limits have been developed to protect the environment as a whole.

PM_{10} concentrations predicted for the opening and design years along a transect of up to 200m from the proposed road development are given in **Table 6**. Values include background concentrations of 18.3 µg/m^3.

Table 6: Predicted PM_{10} concentrations at the Lough Corrib cSAC including Background Concentrations for 2024 and 2039

Distance to Proposed Road Development (m)	PM_{10} Concentration (µg/m^3) 2024			PM_{10} Concentration (µg/m^3) 2039		
	Do-Minimum	Do-Something	Increase	Do-Minimum	Do-Something	Increase
10	18.3	20.62	4.32	18.3	20.8	4.5
20	18.3	20.06	3.76	18.3	20.19	3.89
30	18.3	19.65	3.35	18.3	19.75	3.45
40	18.3	19.35	3.05	18.3	19.43	3.13
50	18.3	19.13	2.83	18.3	19.19	2.89
60	18.3	18.95	2.65	18.3	19	2.7
70	18.3	18.81	2.51	18.3	18.85	2.55
80	18.3	18.7	2.4	18.3	18.73	2.43
90	18.3	18.62	2.32	18.3	18.64	2.34
100	18.3	18.55	2.25	18.3	18.57	2.27

Distance to Proposed Road Development (m)	PM_{10} Concentration (µg/m^3) 2024			PM_{10} Concentration (µg/m^3) 2039		
	Do-Minimum	Do-Something	Increase	Do-Minimum	Do-Something	Increase
110	18.3	18.49	2.19	18.3	18.51	2.21
120	18.3	18.45	2.15	18.3	18.46	2.16
130	18.3	18.42	2.12	18.3	18.43	2.13
140	18.3	18.4	2.1	18.3	18.4	2.1
150	18.3	18.38	2.08	18.3	18.39	2.09
160	18.3	18.37	2.07	18.3	18.38	2.08
170	18.3	18.37	2.07	18.3	18.37	2.07
180	18.3	18.36	2.06	18.3	18.36	2.06
190	18.3	18.35	2.05	18.3	20.25	3.95
200	18.3	18.34	2.04	18.3	18.34	2.04
Standards	**40µg/m^3**	**40µg/m^3**	**40µg/m^3**	**40µg/m^3**	**40µg/m^3**	**40µg/m^3**

4.2.1.4 Ammonia

As outlined in Section 3, ammonia is emitted in small amounts by vehicles with catalytic converters and *roadside atmospheric concentrations are well below critical levels* for this pollutant, refer to Table 2 for critical levels. The Natural England report states that it is *unlikely to be a key issue, and effects on vegetation are more likely to arise from enhanced deposition of nitrogen to the soil environment*. The potential impact of nitrogen deposition on ecological sites has been assessed in Section 4.1.1.1.

4.2.2 River Corrib Bridge Crossing

The proposed road development crosses the River Corrib which is within the Lough Corrib cSAC on a bridge and embankment (between Ch. 9+250 and Ch. 9+600) structure, refer to Figure 8.7.

Barriers are proposed on both sides of the bridge structure. These will contain the majority of pollutants generated by traffic accessing the proposed road development. The elevated position of the proposed road development at this location will also result in good dispersion of pollution generated from traffic. This will have the effect of significantly lowering ground level concentrations. In addition, predicted concentrations of NO_x and nitrogen deposition are below relevant limits at this location even within 10m from the road edge, refer to **Table 3**.

Predicted concentrations of VOCs and dust are in compliance with air quality standards for the protection of the environment as a whole, refer to Section 4.2.1.

4.2.3 Menlough – Ch. 9+800 to Ch. 10+100

To the east of the River Corrib the proposed road development continues east on embankment toward the Menlough Viaduct and traverses along the boundary of the Lough Corrib cSAC, overlapping it in places, refer to Figure 8.7. The ecologically sensitive area where the qualifying interests of the Lough Corrib cSAC are located is to the southeast of this section of the proposed road development and comprises of an area of semi-natural Oak-Ash-Hazel woodlands, scrub, wet grassland, exposed limestone rock and calcareous grassland; some of which correspond to Qualifying Interest Annex I habitats of the European site.

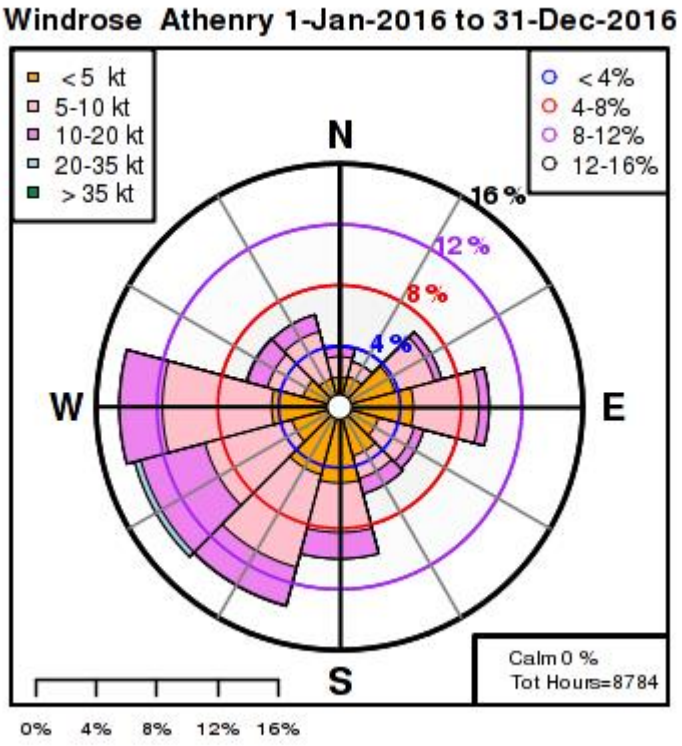
The elevated position of the proposed road development at this location will result in good dispersion of pollution generated from traffic. In addition, concentrations of NO_x and nitrogen deposition are predicted to be below relevant limits at this location, even within 10m from the road edge (which lies c.15m from the proposed road edge in this area, at its closest point).

Predicted concentrations of VOCs and metals/dust are in compliance with air quality standards for the protection of the environment as a whole, refer to Section 4.2.1.

A windrose for Athenry meteorological station is provided in Figure 1 (www.met.ie). This demonstrates that the prevailing wind in the area is from the south-west and west. The wind directions required to direct pollution towards this sensitive area are from the northwest and west. According to the windrose, wind from the northwest in 2016 was recorded for approximately 7% of the time in 2016. Therefore, the likelihood of pollution generated by road traffic interacting with the sensitive area is low due to northwest winds. Westerly winds were recorded for approximately 15% of the time in 2016. However, for approximately 10% of this time the wind speeds recorded are greater than 5 knots. This results in high dispersion of potential pollutants during this time, greatly reducing pollutant concentrations.

The separation between the edge of the proposed road carriageway and the QI Annex I habitat within Lough Corrib cSAC is approximately 15m. As outlined in **Table 3**, the nitrogen deposition due to the proposed road development at such distances including background depostion is predicted to be less than relevant limits.

Figure 1: Windrose for Athenry 2016



4.2.4 Lackagh Tunnel

East of the Menlough Viaduct, the proposed road development enters a section of cut preceding Lackagh Tunnel immediately west of Lackagh Quarry and exits the tunnel in the disused quarry. The Lackagh Tunnel passes underneath Lough Corrib cSAC, refer to Figures 8.7 and 8.8. The overlying habitats within the Lough Corrib cSAC at this location comprise a mosaic of wooded Limestone pavement, scrub covered Limestone pavement, exposed Limestone pavement, and Calcareous grassland. All of these habitat types are Qualifying Interest (QI) habitats of the Lough Corrib cSAC.

As the proposed road development is in Lackagh Tunnel under the Lough Corrib cSAC at this location surrounded by quarry walls up to 40m in height, emissions generated here will not be physically able to interact with the designated areas. At the portals and at the western approach to the tunnel which runs adjacent (approximately 10m) to the Lough Corrib cSAC, there is the potential for air quality impacts. However, as outlined in **Table 3**, the nitrogen deposition due to the proposed road development at such distances is predicted to be less than relevant limits.

In addition, the dispersal of pollution at the eastern and western approach to the tunnel will be contained due to the effective barrier caused by the cutting along the Lough Corrib cSAC at this location.

Between Ch. 10+450 and Ch. 10+600 and between Ch. 10+750 and Ch. 10+900 there are short sections of embankment adjacent to the Lough Corrib cSAC. QI

habitats are located c.75m from the first location (north of the road carriageway) and at the second location, c.45m from the northern edge of the road carriageway and c.15m from the southern edge of the road carriageway. At these distances of between 10 and 75m from the edge of the road, NOx concentrations are predicted to be in compliance with the air quality standards for the protection of vegetation and the nitrogen depositions are in compliance with critical load for nitrogen deposition, refer to **Table 3**.

Predicted concentrations of VOCs and metals/dust are in compliance with air quality standards for the protection of the environment as a whole, refer to Section 4.2.1.

5 Conclusion

An assessment has been carried out to determine the potential air quality impacts at European sites, in support of the NIS prepared for the proposed road development.

It is concluded that at the three locations where interactions with the Lough Corrib cSAC occur, predicted NO_x concentrations are within air quality standards and depositions within critical loads for nitrogen deposition. All other predicted pollutant concentrations are also well within the air quality standards for the protection of the environment as a whole.

The barriers along the bridge crossing of the River Corrib will contain the majority of pollutants generated by traffic accessing the proposed road development. The elevated position of the proposed road development at this location will also result in good dispersion of pollution generated from traffic.

To the southeast of the proposed road development in Menlough between Ch. 9+800 and Ch. 10+100 is an area comprising semi-natural Oak-Ash-Hazel woodlands, scrub, wet grassland, exposed limestone rock and calcareous grassland. Predicted pollutant concentrations and nitrogen deposition at such distances are predicted to comply with limit values and critical loads.

There is a short section of embankment within the Lough Corrib cSAC before the entrance to the Lackagh Tunnel. No QI habitats are in close proximity at this location. Where the proposed road development tunnels beneath the Lough Corrib cSAC, emissions generated will not be physically able to interact with the designated areas. The dispersal of pollution at the western approach to Lackagh Tunnel, and at Lackagh Quarry, will be contained due to the effective barrier caused by the cutting along the Lough Corrib cSAC at this location.

In summary, where pollutant concentrations have been predicted, all values are well within the air quality standards for the protection of the environment as a whole and critical loads. Furthermore, and considering all potential air pollutants, embankments proposed as part of the road development will increase the dispersal of pollutants, thereby significantly lowering ground level concentrations. In addition, the provision of barriers and cuttings will have the effect of containing pollution within the area immediate to the proposed road carriageway.