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Chapter 16 Air Quality

Ecology Related Addenda to EIAR

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1 Air Quality Ecology Updates

In December 2022 Transport Infrastructure Ireland (TII) published new guidance documents and standards for the EIAR with respect to Air Quality:

- PE-ENV-01106: Air Quality Assessment of Specified Infrastructure Projects (TII 2022a);
- PE-ENV-01107: Air Quality Assessment Standard for Proposed National Roads (TII 2022b).

These guidance documents were issued in December 2022 and supersede the 2011 Transport Infrastructure Ireland '*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes'*, or 2011 TII Air Quality Guidelines. The methodology for assessing national roads and other specified infrastructure projects, such as light rail, in PE-ENV-01106 is based on methodology employed in the UK, namely Highways England 2019 guidance *'Design Manual for Roads and Bridges (DMRB) LA 105'* (an older version is referred to in the 2011 TII Air Quality Guidelines) and the UK Department for Environment Food & Rural Affairs (DEFRA) 2022 *'Local Air Quality Management, Technical Guidance LAQM.TG(22)*'. LA 105 and the 2011 TII Air Quality Guidelines were used as the basis of the air quality assessment within the EIAR.

An additional information on the non-ecological elements of the Guidance updates have been included in Dr. Avril Challoner's Witness Statement submitted on Day 1 of the Oral Hearing.

This addendum updates the EIAR ecology assessment for oxides of nitrogen (NO_x), ammonia (NH_3) concentrations, nitrogen deposition levels and total acid deposition levels in the worst-case construction scenarios (southern and northern peaks) and operational phase opening year scenarios was conducted in line with the updated TII Guidance (TII 2022a). The traffic data, modelling scenarios and ecological receptors remained as detailed within the EIAR for this update, unless updates are specified within this Addenda.

1.1 Ammonia Inclusion (NH_3)

Road traffic emission rates for ammonia (NH_3) were not included within the EIAR as they were not required by guidance at the time. However, since the publication of the TII guidance (PE-ENV-01107 and PE-ENV-01106) a requirement for inclusion is now in place. The inclusion of NH_3 also allows for the inclusion of the contribution of NH_3 to total nitrogen deposition levels. The 2011 TII guidance (TII 2011) methodology applied within the EIAR previously did not allow for the inclusion of NH_3 which, along with NO_2, is a component of the nutrient nitrogen deposition level.

Road traffic emission rates for NH_3 were generated the Calculator for Road Emissions of Ammonia (CREAM) Tool developed by Air Quality Consultants (Air Quality Consultants, 2020), as recommended by TII (TII, 2022a). The tool inputs are the traffic data for each scenario. The CREAM Tool (Air Quality Consultants, 2020) outputs (road traffic emission rates for NH_3) are used as NH_3 emission rates inputs for the ADMS model. For details on the ADMS modelling methodology see Section 16.3.6.3 of the EIAR.

PE-ENV-01107 (TII 2022b) also specifically states in Section 3.5.2 that it is not necessary to include sites that have been designated as a geological feature or a water course.

The methodology for calculation of impacts from modelled emissions are detailed in Section 3.

1.2 Background Updates

In addition to the updated TII Guidance PE-ENV-01106 and PE-ENV-01107, Air Pollution Information System (APIS), a long-standing tool as a comprehensive source of information on air pollution and the effects on habitats and species has become available in Ireland. APIS has been developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology[1]. APIS is recommended for use for background levels in Chartered Institute of Ecology and Environmental Management 2021 Guidance "Advisory Note: Ecological Assessment of Air Quality Impacts". Ireland was added to APIS (previously it was only a UK information source) in July 2023 for designated sites, with further updates in November 2023. This includes modelled background deposition and concentration data for a 1 km x 1 km grid square[2]. Road sources are included in the APIS background and cannot be removed so there is some double counting of emissions, in particular in areas of a high density of roads across the 1 km x 1 km grid square.

This data was not available at the time of the EIAR and allows a more site-specific background concentration for NO_x, NH_3 and nitrogen deposition. The backgrounds used in the updated modelling are shown in Table 1-1. It should be noted that NH_3 is above the lower critical value of 1 µg/m^3 at all locations.

Previously a highly conservative background NO_x concentration of 28.1 µg/m^3 was used across all locations, the availability of APIS provides a more site-specific alternative. Given the limit value of 30 µg/m^3 this high background resulted in a significant number of exceedances in the EIAR due to the highly conservative assessment.

Table 1-1: APIS Background Concentrations at Closest Point to Road

Location	NO_x (µg/m^3)	NH_3 (µg/m^3)	Nitrogen Deposition (kg/ha/yr)
North Dublin Bay pHNA & South Dublin Bay and River Tolka Estuary SPA	27.3	1.3	7.4
Malahide Estuary SPA SAC pNHA	12.2	1.6	5.4
Santry Demesne pNHA (Northwood Avenue Southern Side)	16.4	1.5	6.7
Santry Demesne pNHA (Northwood Avenue Northern Side)	17.1	1.5	7
Santry Demesne pNHA (Swords Road Western Side)	17	1.5	6.8
Santry Demesne pNHA (Santry Avenue)	16.4	1.5	6.7
Grand Canal pNHA (M50 Viaduct)	16.9	1.8	6.4
Liffey Valley pNHA (M50)	13.6	1.8	6.4
Royal Canal pNHA (M50)	11.9	1.8	6.2
Rogerstown Estuary SAC SPA pNHA	5.5	1.7	7.5
Bog Of the Ring pNHA	5.5	1.9	6.4
Royal Canal pNHA (Drumcondra)	19.3	1.5	6.8
Royal Canal pNHA (Dolphins Barn)	12.7	1.5	6.4
Royal Canal pNHA (Emmett Bridge)	11.9	1.5	6.5
Grand Canal pNHA (La Touche Bridge)	12.4	1.4	6.5
Royal Canal pNHA (Sallys Bridge)	12.7	1.5	6.4
Royal Canal pNHA (Glasnevin)	19.5	1.5	6.8
Feltrim Hill pNHA	5.5	1.9	6.4
Knock Lake pNHA	5.5	1.9	6.4

[1] https://www.apis.ac.uk/introduction.html
[2] https://www.apis.ac.uk/app

2 Additional Model Refinements

In addition, to the updates to the TII Guidance (PE-ENV-01107 and PE-ENV-01106) and availability of background APIS data some additional updates have been made to a number of locations within the ADMS model for ecology. These are model refinements from the EIAR stage to make the model more accurate.

In the modelling completed at the time of the EIAR, did not apply any elevations to roads which were bridges. This results in a more conservative assessment but it was decided to update the model for bridges of above sensitive ecological receptors after discussion with the Project Ecologist. Updating the model for these bridge heights allows for more inclusion of the dispersion of the pollutants more accurately. The data for bridge heights was provided by TII.

The following bridges have been elevated to the height above the sensitive ecological habitats:

- Malahide Estuary (10 m);
- M50 Grand Canal (5 m); and
- Liffey Valley Bridge (40 m).

In addition, the Royal Canal was itself elevated at the M50, as it crosses the M50 on a bridge, and the emission sources within 200m adjusted to the appropriate (as supplied by TII) relative elevation.

In addition, upon detailed review of the model a number of the road edge ecological receptors were noted to be considered on the road by the model. This was refined within the model and the modelled receptors have been moved to the road edge, which more accurately reflect their actual location. The result of this is that the peak concentration is reduced.

3 Updated TII Modelling Methodology

The TII guidance (Section 3.5.2 of PE-ENV-01107 and Section 4.7 of PE-ENV-01106) considers ecologically designated sites (Irish and European designations) as highly sensitive air quality receptors.

In accordance with updated TII guidance, the following screening criteria should be used to determine whether an assessment for nitrogen and acid deposition should be conducted. A sensitive designated habitat has been identified within 200 m of the affected road network (ARN). An ARN can be considered:

- Road alignment will change by 5 meters (m) or more; or
- Annual average daily traffic (AADT) flows will change by 1,000 or more; or
- Heavy duty vehicle (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- Daily average speed change by 10 kph or more; or
- Peak hour speed will change by 20 kph or more.

For "affected" roads within 200m of a designated habitat, individual ecological receptors along a transect at 10m intervals are modelled. Ecological receptors are modelled up to a maximum distance of 200m regardless of whether the habitat extends beyond 200m (see Figure 4.8 of PE-ENV-01106). It is considered that the greatest impacts will have occurred in proximity to the road. The TII guidance (PE-ENV-01106) (TII, 2022a) notes that only sites that are sensitive to nitrogen and acid deposition need to be included in the assessment, it is not necessary to include sites for example that have been designated as a geological feature or water course (see Section 4.6 of PE-ENV-01106). The ecological receptors along the 200m transect are modelled using the methodology for sensitive human receptors in see Section 16.3.6.3 of the EIAR. With further details in the Ecology Assessment in Section 16.3.6.6.

The Air Quality Regulations outline an annual critical level for NO_X for the protection of vegetation and natural ecosystems in general. The CAFE Directive defines 'Critical Levels' as *'a level fixed on the basis of scientific knowledge, above which direct adverse effects may occur on some receptors, such as trees, other plants or natural ecosystems but not on humans.*'

For the ecology assessment the following critical loads for NO_x and NH_3 have been utilised. Due to greater variance in critical loads for nitrogen deposition for each habitat, they are considered by the Project Ecologist within the AA Update Report and the EIAR Biodiversity Update Report rather than in this Addendum. In accordance with Section 4.7.1 of PE-ENV-01106 and Section 3.6.6.1 of PE-ENV-01107, consultation with the Project Ecologist has occurred regarding the scoping of sensitive designated habitats to be included in the assessment, in particular with respect to sites are sensitive to acid deposition. This consultation has confirmed the absence on sensitive designated habitats with associated critical loads with respect to acid deposition. For robustness, acid deposition calculations have been completed but no critical loads are applied.

The below critical loads have been broadly applied for comparison however, the site-specific critical loads for NO_x and NH_3 have been considered for the ecological receptors in the AA Update Report and EIAR Biodiversity Update Report, as relevant:

- NO_x: 30 µg/m^3
  - Upper/lower critical load 30 µg/m^3
- NH_3:
  - Upper critical load 3 µg/m^3

- Lower critical load 1 µg/m^3

The TII guidance (TII, 2022a) outlines a methodology to derive the road contribution to dry deposition and thereafter to compare with the published critical loads for the appropriate habitat. In order to calculate the nitrogen deposition, the NO_X / NO_2 concentration determined through modelling including the background concentration must be converted firstly into a dry deposition flux using the equation below which is taken from UK Environment Agency publication 'AGTAG06 – Technical Guidance on Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air' (EA, 2014):

Dry deposition flux (µg/m^2/s) = ground-level concentration (µg/m^3) x deposition velocity (m/s)

Deposition velocities are provided in both the PE-ENV-01106 and AGTAG06 (EA, 2014) guidance for NO_2 and NH_3 in grassland and forestry.

Once the dry deposition flux (µg/m^2/s) is calculated it must then be converted to nitrogen deposition and nitrogen equivalent acidification flux, k_{eq}/ha/year, where k_{eq} is a unit of equivalents (a measure of how acidifying the chemical species can be) for comparison with critical loads.

In order to convert the dry deposition flux from units of µg/m^2/s to units of nitrogen deposition (kg/ha/year) the dry deposition flux is multiplied by the conversion factors shown in Table 3-1, and provided in AGTAG06 (EA, 2014). For NO_2 this factor is 95.9 and for NH_3 the factor is 260.

Nitrogen (N) deposition (kg/ha/yr) = Dry deposition flux (µg/m^2/s) x N deposition conversion factor

To avoid confusion, it should be noted that Figure 4.9 of PE-ENV-01106 combine the deposition velocity (m/s) (see Table 3-1) and Dry Deposition Flux conversion factors to a single factor (i.e. 0.0015 *95.9 = 0.14 kg N/ha/yr for grassland and similar habitats).

In order to convert the dry deposition flux from units of µg/m^2/s to units of acid deposition (k_{eq}/ha/year) the dry deposition flux is multiplied by the conversion factor (0.071429 k_{eq}/ha/yr) shown in Table 3-1.

Acid (N) deposition (k_{eq}/ha/yr) = Dry deposition flux (µg/m^2/s) x Acid deposition conversion factor

Nitrogen deposition and acid deposition is calculated in this manner for both NO_2 and NH_3, and these are then summed for total nitrogen deposition and acid deposition at each sensitive designated habitat.

Table 3-1 Dry Deposition, Nitrogen and Acid Deposition Fluxes for NO_2 and NH_3

Chemical Species	Habitat Type	Recommended Deposition Velocity (m/s)	Dry Deposition Flux (µg/m^2/s) Conversion Factor to N Deposition Flux (kg/ha/yr)	Dry Deposition Flux (µg/m^2/s) Conversion Factor to Acid Deposition Flux (keq/ha/yr)
NO_2 (as N)	Grassland	0.0115	95.9	0.071429
NO_2 (as N)	Forest	0.003		
NH_3 (as N)	Grassland	0.02	260	
NH_3 (as N)	Forest	0.03		

3.1 Construction Phase Ecology

3.1.1 Northern Peak

An assessment of the impact of the Proposed Project during the Northern Construction Peak in 2028 has been undertaken using the approach outlined in the updated TII guidance (PE-ENV-01107 and PE-ENV-01106). An assessment of the ecologically sensitive sites has been carried out which are within 200m of an affected road network (ARN) (See Section 3) and Section 16.5.2.10 of the EIAR.

Annual mean NO_x and NH_3 concentrations, as well as nitrogen and acid deposition levels have been compared to the relevant critical levels and loads in Table 3-2 for the worst-case ecologically sensitive receptors. The ground level concentrations, nitrogen deposition flux and acid deposition flux are presented for the closest locations within the ecological sites to the nearest road. Backgrounds can be found in Table 1-1. The construction phase results model the worst-case month of construction traffic for a full year and therefore are conservative in nature.

Table 3-2: Impacts at Key Ecological Receptors for the Construction Phase Northern Peak Scenario (2028)

Northern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Malahide Estuary SPA SAC pNHA (Eastern Side)						
Do- Minimum	7.87	0.52	20.07	2.12	8.74	0.62
Do-Something	8.13	0.66	20.33	2.26	9.46	0.68
Difference between Do-Something and Do-Minimum	0.25	0.14	0.25	0.14	0.72	0.05
Change relative to lower critical load (%) Note 2	0.8%	13.7%	0.8%	13.7%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		4.6%		4.6%		
Malahide Estuary SPA SAC pNHA (Western Side)						
Do- Minimum	6.77	0.43	18.97	2.03	8.17	0.58
Do-Something	6.95	0.54	19.15	2.14	8.74	0.62
Difference between Do-Something and Do-Minimum	0.18	0.11	0.18	0.11	0.57	0.04
Change relative to lower critical load (%) Note 2	0.6%	10.7%	0.6%	10.7%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		3.6%		3.6%		
Royal Canal pNHA (Drumcondra Eastern Side)						
Do- Minimum	35.41	1.88	54.71	3.38	26.65	1.90
Do-Something	35.26	1.88	54.56	3.38	26.65	1.90
Difference between Do-Something	-0.15	0.00	-0.15	0.00	0.00	0.00

Northern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
and Do-Minimum						
Change relative to lower critical load (%) Note 2	-0.5%	0.3%	-0.5%	0.3%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.1%		0.1%		
Royal Canal pNHA (Drumcondra Western Side)						
Do- Minimum	32.92	1.75	52.22	3.25	25.28	1.81
Do-Something	32.79	1.75	52.09	3.25	25.29	1.81
Difference between Do-Something and Do-Minimum	-0.13	0.00	-0.13	0.00	0.00	0.00
Change relative to lower critical load (%) Note 2	-0.4%	0.3%	-0.4%	0.3%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.1%		0.1%		
Royal Canal pNHA (Glasnevin Eastern Side)						
Do- Minimum	28.36	1.78	47.86	3.28	24.87	1.78
Do-Something	28.55	1.82	48.05	3.32	25.23	1.80
Difference between Do-Something and Do-Minimum	0.19	0.04	0.19	0.04	0.37	0.03
Change relative to lower critical load (%) Note 2	0.6%	4.4%	0.6%	4.4%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		1.5%		1.5%		
Royal Canal pNHA (Glasnevin Western Side)						
Do- Minimum	22.24	1.31	41.74	2.81	20.36	1.45
Do-Something	22.40	1.34	41.90	2.84	20.62	1.47
Difference between Do-Something and Do-Minimum	0.16	0.03	0.16	0.03	0.26	0.02
Change relative to lower critical load (%) Note 2	0.5%	3.1%	0.5%	3.1%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		1.0%		1.0%		

Note 1: See Table 1-1 for Backgrounds.

Note 2: See Section 3 for Critical Loads used in Comparison.

The annual mean NO_X concentrations (including background) does not exceed the critical level of 30 µg/m^3 at modelled locations with an adverse impact due to the MetroLink with the exception of the Royal Canal at Glasnevin. However, the exceedance is below the critical value by 30 m from the R108 road crossing. This location also exceeds the upper critical value of 3 µg/m^3 for NH_3 (including background) for the first 10m from the road and the nitrogen deposition levels (including background) 20 KgN/ha/yr exceeded for up to 20m from the roads edge.

Nitrogen deposition is considered in detail for the habitats present in the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

All outputs of this assessment, including nitrogen deposition, have been considered within the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

In accordance with the EPA Guidelines (EPA, 2022) the ecological impacts associated with the construction phase traffic emissions are overall direct, short-term, negative and slight.

3.1.2 Southern Peak

An assessment of the impact of the Proposed Project during the Southern Construction Peak in 2028 has been undertaken using the approach outlined in the updated TII guidance (PE-ENV-01107 and PE-ENV-01106). An assessment of the ecologically sensitive sites has been carried out which are within 200m of an affected road network (ARN) (See Section 3) and Section 16.5.2.5 of the EIAR.

Annual mean NO_x and NH_3 concentrations, as well as nitrogen and acid deposition levels have been compared to the relevant critical levels and loads in Table 3-3 for the worst-case ecologically sensitive receptors. The ground level concentrations, nitrogen deposition flux and acid deposition flux are presented for the closest locations within the ecological sites to the nearest road. Backgrounds can be found in Table 1-1. The construction phase results model the worst-case month of construction traffic for a full year and therefore are conservative in nature.

Table 3-3: Impacts at Key Ecological Receptors for the Construction Phase Southern Peak Scenario (2028)

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m^3	Predicted Ground Level NH_3 Concentration (excluding background) µg/m^3	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m^3	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m^3	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Malahide Estuary SPA SAC pNHA (Eastern Side)						
Do- Minimum	7.59	0.64	19.79	2.24	9.30	0.66
Do-Something	7.62	0.64	19.82	2.24	9.34	0.67
Difference between Do-Something and Do-Minimum	0.02	0.01	0.02	0.01	0.04	0.00
Change relative to lower critical load (%) Note 2	0.1%	0.8%	0.1%	0.8%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.3%		0.3%		
Malahide Estuary SPA SAC pNHA (Western Side)						
Do- Minimum	6.48	0.52	18.68	2.12	8.62	0.62
Do-Something	6.50	0.53	18.70	2.13	8.65	0.62

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Difference between Do-Something and Do-Minimum	0.02	0.01	0.02	0.01	0.03	0.00
Change relative to lower critical load (%) Note 2	0.1%	0.7%	0.1%	0.7%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.2%		0.2%		
Royal Canal pNHA (Glasnevin Western Side)						
Do- Minimum	24.30	1.40	43.80	2.90	15.93	1.14
Do-Something	24.48	1.41	43.98	2.91	15.97	1.14
Difference between Do-Something and Do-Minimum	0.18	0.01	0.18	0.01	0.04	0.00
Change relative to lower critical load (%) Note 2	0.6%	0.9%	0.6%	0.9%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.3%		0.3%		
Royal Canal pNHA (Glasnevin Eastern Side)						
Do- Minimum	30.63	1.89	50.13	3.39	18.91	1.35
Do-Something	30.87	1.90	50.37	3.40	18.96	1.35
Difference between Do-Something and Do-Minimum	0.24	0.01	0.24	0.01	0.06	0.00
Change relative to lower critical load (%) Note 2	0.8%	1.2%	0.8%	1.2%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.4%		0.4%		
Royal Canal pNHA (Drumcondra Western Side)						
Do- Minimum	36.98	1.91	56.28	3.41	19.43	1.39
Do-Something	37.21	1.92	56.51	3.42	19.45	1.39
Difference between Do-Something and Do-Minimum	0.23	0.01	0.23	0.01	0.02	0.00
Change relative to lower critical load (%) Note 2	0.8%	0.7%	0.8%	0.7%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to		0.2%		0.2%		

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
upper critical load (%) Note 2						
Royal Canal pNHA (Drumcondra Eastern Side)						
Do- Minimum	38.67	2.00	57.97	3.50	20.03	1.43
Do-Something	38.92	2.01	58.22	3.51	20.05	1.43
Difference between Do-Something and Do-Minimum	0.25	0.01	0.25	0.01	0.02	0.00
Change relative to lower critical load (%) Note 2	0.8%	0.7%	0.8%	0.7%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.2%		0.2%		
Grand Canal pNHA (M50 Viaduct Eastern Side)						
Do- Minimum	25.08	3.55	41.98	5.35	26.77	1.91
Do-Something	25.09	3.57	41.99	5.37	26.81	1.92
Difference between Do-Something and Do-Minimum	0.01	0.01	0.01	0.01	0.04	0.00
Change relative to lower critical load (%) Note 2	0.0%	1.2%	0.0%	1.2%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.4%		0.4%		
Grand Canal pNHA (M50 Viaduct Western Side)						
Do- Minimum	18.06	2.53	34.96	4.33	20.95	1.50
Do-Something	18.07	2.54	34.97	4.34	20.99	1.50
Difference between Do-Something and Do-Minimum	0.02	0.01	0.02	0.01	0.04	0.00
Change relative to lower critical load (%) Note 2	0.1%	1.0%	0.1%	1.0%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.3%		0.3%		
Liffey Valley pNHA (M50 Western Side)						
Do- Minimum	3.43	0.30	17.03	2.10	8.21	0.59
Do-Something	3.43	0.30	17.03	2.10	8.22	0.59
Difference between Do-Something and Do-Minimum	0.01	0.00	0.01	0.00	0.01	0.00
Change relative to	0.0%	0.2%	0.0%	0.2%	Considered in the EIAR	N/A

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
lower critical load (%) Note 2					Biodiversity Update Report by the Project Ecologist.	
Change relative to upper critical load (%) Note 2		0.1%		0.1%		
Liffey Valley pNHA (M50 Eastern Side)						
Do- Minimum	3.71	0.34	17.31	2.14	8.45	0.60
Do-Something	3.72	0.34	17.32	2.14	8.46	0.60
Difference between Do-Something and Do-Minimum	0.01	0.00	0.01	0.00	0.01	0.00
Change relative to lower critical load (%) Note 2	0.0%	0.2%	0.0%	0.2%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.1%		0.1%		
Royal Canal pNHA (M50 Western Side)						
Do- Minimum	10.89	1.31	22.79	3.11	13.87	0.99
Do-Something	11.19	1.36	23.09	3.16	14.13	1.01
Difference between Do-Something and Do-Minimum	0.30	0.05	0.30	0.05	0.26	0.02
Change relative to lower critical load (%) Note 2	1.0%	4.7%	1.0%	4.7%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		1.6%		1.6%		
Royal Canal pNHA (M50 Eastern Side)						
Do- Minimum	10.96	1.20	22.86	3.00	13.32	0.95
Do-Something	11.27	1.25	23.17	3.05	13.57	0.97
Difference between Do-Something and Do-Minimum	0.32	0.05	0.32	0.05	0.26	0.02
Change relative to lower critical load (%) Note 2	1.1%	4.6%	1.1%	4.6%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		1.5%		1.5%		
Royal Canal pNHA (Emmett Bridge Eastern Side)						
Do- Minimum	39.39	1.90	51.29	3.40	19.28	1.38
Do-Something	39.53	1.90	51.43	3.40	19.29	1.38
Difference between Do-Something	0.14	0.01	0.14	0.01	0.00	0.00

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
and Do-Minimum						
Change relative to lower critical load (%) Note 2	0.5%	0.5%	0.5%	0.5%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.2%		0.2%		
Royal Canal pNHA (Emmett Bridge Western Side)						
Do- Minimum	33.98	1.66	45.88	3.16	17.68	1.26
Do-Something	34.10	1.67	46.00	3.17	17.69	1.26
Difference between Do-Something and Do-Minimum	0.13	0.01	0.13	0.01	0.01	0.00
Change relative to lower critical load (%) Note 2	0.4%	0.5%	0.4%	0.5%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.2%		0.2%		
Royal Canal pNHA (Sallys Bridge Eastern Side)						
Do- Minimum	41.55	1.96	54.25	3.46	19.66	1.40
Do-Something	41.50	1.96	54.20	3.46	19.62	1.40
Difference between Do-Something and Do-Minimum	-0.05	0.00	-0.05	0.00	-0.04	0.00
Change relative to lower critical load (%) Note 2	-0.2%	0.0%	-0.2%	0.0%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.0%		0.0%		
Royal Canal pNHA (Sallys Bridge Western Side)						
Do- Minimum	37.51	1.75	50.21	3.25	18.27	1.31
Do-Something	37.46	1.75	50.16	3.25	18.24	1.30
Difference between Do-Something and Do-Minimum	-0.05	0.00	-0.05	0.00	-0.03	0.00
Change relative to lower critical load (%) Note 2	-0.2%	0.0%	-0.2%	0.0%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.0%		0.0%		
Royal Canal pNHA (Dolphins Barn Eastern Side)						
Do- Minimum	24.90	1.46	37.60	2.96	15.87	1.13
Do-Something	25.41	1.48	38.11	2.98	16.02	1.14

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Difference between Do-Something and Do-Minimum	0.51	0.02	0.51	0.02	0.15	0.01
Change relative to lower critical load (%) Note 2	1.7%	2.4%	1.7%	2.4%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.8%		0.8%		
Royal Canal pNHA (Dolphins Barn Western Side)						
Do- Minimum	24.45	1.42	37.15	2.92	15.64	1.12
Do-Something	24.89	1.44	37.59	2.94	15.77	1.13
Difference between Do-Something and Do-Minimum	0.44	0.02	0.44	0.02	0.13	0.01
Change relative to lower critical load (%) Note 2	1.5%	2.3%	1.5%	2.3%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.8%		0.8%		
Grand Canal pNHA (La Touche Bridge Eastern Side)						
Do- Minimum	39.73	1.88	52.13	3.28	19.23	1.37
Do-Something	40.08	1.89	52.48	3.29	19.27	1.38
Difference between Do-Something and Do-Minimum	0.35	0.01	0.35	0.01	0.04	0.00
Change relative to lower critical load (%) Note 2	1.2%	0.9%	1.2%	0.9%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.3%		0.3%		
Grand Canal pNHA (La Touche Bridge Western Side)						
Do- Minimum	28.12	1.39	40.52	2.79	15.85	1.13
Do-Something	28.26	1.40	40.66	2.80	15.88	1.13
Difference between Do-Something and Do-Minimum	0.14	0.01	0.14	0.01	0.02	0.00
Change relative to lower critical load (%) Note 2	0.5%	0.6%	0.5%	0.6%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		0.2%		0.2%		
Santry Demesne pNHA (Northwood Avenue Northern Side)						

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NO_X Concentration (including background Note 1) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (including background Note 1) $\mu g/m^3$	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Do- Minimum	3.88	0.26	20.98	1.76	13.91	0.99
Do-Something	3.61	0.23	20.71	1.73	13.66	0.98
Difference between Do-Something and Do-Minimum	-0.27	-0.03	-0.27	-0.03	-0.25	-0.02
Change relative to lower critical load (%) Note 2	-0.9%	-2.6%	-0.9%	-2.6%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		-0.9%		-0.9%		
Santry Demesne pNHA (Swords Road Western Side)						
Do- Minimum	4.73	0.30	21.73	1.80	14.19	1.01
Do-Something	4.62	0.29	21.62	1.79	14.07	1.01
Difference between Do-Something and Do-Minimum	-0.11	-0.01	-0.11	-0.01	-0.12	-0.01
Change relative to lower critical load (%) Note 2	-0.4%	-1.2%	-0.4%	-1.2%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		-0.4%		-0.4%		
Santry Demesne pNHA (Northwood Avenue Southern Side)						
Do- Minimum	4.68	0.34	21.08	1.84	14.65	1.05
Do-Something	4.31	0.30	20.71	1.80	14.32	1.02
Difference between Do-Something and Do-Minimum	-0.36	-0.03	-0.36	-0.03	-0.33	-0.02
Change relative to lower critical load (%) Note 2	-1.2%	-3.4%	-1.2%	-3.4%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%) Note 2		-1.1%		-1.1%		
Santry Demesne pNHA (Santry Avenue)						
Do- Minimum	7.68	0.58	24.08	2.08	16.53	1.18
Do-Something	7.83	0.60	24.23	2.10	16.69	1.19
Difference between Do-Something and Do-Minimum	0.15	0.02	0.15	0.02	0.16	0.01
Change relative to lower critical load (%) Note 2	0.5%	1.9%	0.5%	1.9%	Considered in the EIAR Biodiversity Update Report by	N/A
Change relative to		0.6%		0.6%		

Southern Peak Construction (2028)	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
upper critical load (%) Note 2					the Project Ecologist.	

Note 1: See Table 1-1 for Backgrounds.

Note 2: See Section 3 for Critical Loads used in Comparison.

The annual mean NO_X concentrations (including background) had an adverse impact due to MetroLink and exceed the critical level of 30 µg/m³ at the following modelled locations:

- Grand Canal pNHA (Dolphins Barn);
- Grand Canal pNHA (Emmett Bridge);
- Grand Canal pNHA (La Touche Bridge);
- Royal Canal pNHA (Glasnevin);
- Royal Canal pNHA (Drumcondra); and
- Grand Canal pNHA (M50 Viaduct).

At the Grand Canal pNHA (M50 Viaduct) the exceedance lasts for up to 90m to the east and 30m to the west, after which the levels drop below 30 µg/m³. However, the contribution due to MetroLink is only 0.01 µg/m³. At Glasnevin the exceedance lasts for up to 30m to east and at Drumcondra the modelled exceedances are for up to 70m east and west of the N1. Concentrations are often higher to the east of roads due to the south westerly prevailing winds. The Grand Canal pNHA runs parallel to the South Circular Road and exceedances occur within 30m of roads crossing the canal at bridges which increases the contribution of NO_x emissions.

Ammonia exceeds the upper critical value of 3 µg/m³ for NH_3 (including background) at the following modelled locations:

- Grand Canal pNHA (Dolphins Barn);
- Grand Canal pNHA (Emmett Bridge);
- Grand Canal pNHA (La Touche Bridge);
- Royal Canal pNHA (Glasnevin);
- Royal Canal pNHA (Drumcondra);
- Royal Canal pNHA (M50): and
- Grand Canal pNHA (M50 Viaduct).

However at all these locations the exceedances are below 3 µg/m³ within 10m, with the exception of the Grand Canal at the M50 where the exceedance extends to 70m to the west and 160m to the east the Royal Canal at the M50 where the exceedance extends to 30m to the west and 20m to the east.

Nitrogen deposition is considered in detail for the habitats present in the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

All outputs of this assessment, including nitrogen deposition, have been considered within the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

In accordance with the EPA Guidelines (EPA, 2022) the ecological impacts associated with the construction phase traffic emissions are overall direct, short-term, negative and slight.

3.2 Operational Phase Ecology

As detailed in the EIAR (Section 16.3.6.2) there are two Operational Phase modelling scenarios which are informed by traffic scenarios/modelling, they are:

- Scenario A: The 'Do Committed Minimum' scenario includes additional transport schemes that are under construction or committed to be implemented post the base-year of the East Regional Model (ERM) base (2016). 'Committed' refers to schemes that have planning permission and also have a funding commitment;
- Scenario B: The 'Likely Future' scenario, presents an enhanced transport network scenario which has been developed to understand how usage of the proposed Project may change if other planned infrastructure schemes are delivered during the appraisal period. A scheme bundle approach has been developed to examine the impacts of the enhanced network, with one bundle representing the schemes within the National Development Plan (2018-2027) and the other bundle representing the full build out of the infrastructure and initiatives contained within the NTA's Transport Strategy for the Greater Dublin Area (2016-2035).

3.2.1 Scenario A

An assessment of the impact of the Proposed Project during Opening Year Scenario A has been undertaken using the approach outlined in the updated TII guidance (PE-ENV-01107 and PE-ENV-01106). An assessment of the ecologically sensitive sites has been carried out which are within 200m of an affected road network (ARN) (See Section 3) and Section 16.5.3.4 of the EIAR.

Annual mean NO_x and NH_3 concentrations, as well as nitrogen and acid deposition levels have been compared to the relevant critical levels and loads in Table 3-4 for the worst-case ecologically sensitive receptors. The ground level concentrations, nitrogen deposition flux and acid deposition flux are presented for the closest locations within the ecological sites to the nearest road. Backgrounds can be found in Table 1-1. The construction phase results model the worst-case month of construction traffic for a full year and therefore are conservative in nature.

Table 3-4: Impacts at Key Ecological Receptors for the Operational Phase Scenario A (2035)

Opening Year Scenario A	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Malahide Estuary SPA sac pNHA (Eastern Side)						
Do- Minimum	9.06	0.89	21.26	2.49	10.72	0.77
Do- Something	9.05	0.90	21.25	2.50	10.80	0.77
Difference between Do-Something and Do-Minimum	-0.02	0.01	-0.02	0.01	0.08	0.01
Change relative to lower critical load (%)	-0.1%	1.5%	-0.1%	1.5%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.5%		0.5%		
Malahide Estuary SPA sac pNHA (Western Side)						
Do- Minimum	7.78	0.73	19.98	2.33	9.80	0.70
Do- Something	7.75	0.74	19.95	2.34	9.84	0.70
Difference between Do-Something and Do-Minimum	-0.03	0.01	-0.03	0.01	0.05	0.00

Opening Year Scenario A	Predicted Ground Level NO_X Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NO_X Concentration (including background Note 1) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (including background Note 1) $\mu g/m^3$	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Change relative to lower critical load (%)	-0.1%	0.9%	-0.1%	0.9%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.3%		0.3%		
Rogerstown Estuary SAC & pNHA						
Do- Minimum	13.02	1.30	18.52	3.00	15.26	1.09
Do- Something	13.40	1.34	18.90	3.04	15.50	1.11
Difference between Do-Something and Do-Minimum	0.38	0.04	0.38	0.04	0.24	0.02
Change relative to lower critical load (%)	1.3%	3.9%	1.3%	3.9%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		1.3%		1.3%		
Grand Canal pNHA (M50 Viaduct Eastern Side)						
Do- Minimum	36.84	5.06	53.74	6.86	33.74	2.41
Do- Something	37.33	5.09	54.23	6.89	33.93	2.42
Difference between Do-Something and Do-Minimum	0.49	0.03	0.49	0.03	0.19	0.01
Change relative to lower critical load (%)	1.6%	3.5%	1.6%	3.5%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		1.2%		1.2%		
Grand Canal pNHA (M50 Viaduct Western Side)						
Do- Minimum	25.66	3.48	42.56	5.28	25.24	1.80
Do- Something	25.96	3.51	42.86	5.31	25.36	1.81
Difference between Do-Something and Do-Minimum	0.30	0.02	0.30	0.02	0.13	0.01
Change relative to lower critical load (%)	1.0%	2.2%	1.0%	2.2%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.7%		0.7%		
Liffey Valley pNHA (M50 Eastern Side)						
Do- Minimum	5.67	0.41	19.27	2.21	8.72	0.62
Do- Something	5.72	0.42	19.32	2.22	8.77	0.63
Difference between Do-Something and Do-Minimum	0.49	0.03	0.49	0.03	0.19	0.01
Change relative to lower critical load (%)	1.6%	3.5%	1.6%	3.5%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		1.2%		1.2%		

Opening Year Scenario A	Predicted Ground Level NO_X Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NO_X Concentration (including background Note 1) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (including background Note 1) $\mu g/m^3$	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Liffey Valley pNHA (M50 Western Side)						
Do- Minimum	5.35	0.37	18.95	2.17	8.46	0.60
Do- Something	5.39	0.37	18.99	2.17	8.50	0.61
Difference between Do-Something and Do-Minimum	0.04	0.01	0.04	0.01	0.04	0.00
Change relative to lower critical load (%)	0.1%	0.8%	0.1%	0.8%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.3%		0.3%		
Royal Canal pNHA (M50 Viaduct Eastern Side)						
Do- Minimum	17.20	1.58	29.10	3.38	14.89	1.06
Do- Something	16.82	1.61	28.72	3.41	15.08	1.08
Difference between Do-Something and Do-Minimum	-0.38	0.04	-0.38	0.04	0.19	0.01
Change relative to lower critical load (%)	-1.27%	3.8%	-1.27%	3.8%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		1.3%		1.3%		
Royal Canal pNHA (M50 Viaduct Western Side)						
Do- Minimum	16.22	1.68	28.12	3.48	15.42	1.10
Do- Something	15.41	1.67	27.31	3.47	15.34	1.10
Difference between Do-Something and Do-Minimum	-0.81	-0.01	-0.81	-0.01	-0.08	-0.01
Change relative to lower critical load (%)	-2.71%	-1.0%	-2.71%	-1.0%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		-0.3%		-0.3%		
North Dublin Bay pNHA & South Dublin Bay and River Tolka Estuary SPA						
Do- Minimum	34.90	8.17	62.20	9.47	50.82	3.63
Do- Something	32.76	8.01	60.06	9.31	49.93	3.57
Difference between Do-Something and Do-Minimum	-2.14	-0.16	-2.14	-0.16	-0.89	-0.06
Change relative to lower critical load (%)	-7.1%	-16.0%	-7.1%	-16.0%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		-5.3%		-5.3%		
Santry Demesne pNHA (Swords Road Western Side)						
Do- Minimum	5.63	0.40	22.63	1.90	9.34	0.67
Do- Something	5.21	0.39	22.21	1.89	9.21	0.66
Difference between Do-Something and Do-Minimum	-0.41	-0.02	-0.41	-0.02	-0.12	-0.01
Change relative to lower critical load (%)	-1.4%	-1.8%	-1.4%	-1.8%	Considered in the EIAR Biodiversity	N/A

Opening Year Scenario A	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Change relative to upper critical load (%)		-0.6%		-0.6%	Update Report by the Project Ecologist.	

Note 1: See Table 1-1 for Backgrounds.

Note 2: See Section 3 for Critical Loads used in Comparison.

Note 3: North Dublin Bay pNHA is located at the roads edge, South Dublin Bay and River Tolka Estuary boundary is approximately 170m from the roads edge. Therefore, any impacts are significantly reduced. The road links at this location are scoped out and are not classed as "affected" (see Section 3) during the construction phase.

The annual mean NO_X concentrations (including background) does not exceed the critical level of 30 µg/m³ at modelled locations with an adverse impact due to the MetroLink with the exception of the Grand Canal at the M50. However, the exceedance is below the critical value by 170 m from the Grand Canal pNHA at the M50 to the eastern side and 70m to the western side. The contribution is due to the Proposed Project is less than 1% of the critical value by 100m to the east and 10m to the west of the M50. At Rogerstown Estuary SAC SPA pNHA crossing with the R127 the upper critical value of 3 µg/m³ for NH_3 (including background) was exceeded for 10m from the road. Rogerstown Estuary SAC SPA pNHA was not considered to be with 200m of an "affected" road during construction, however during operation the P&R in causing some increased road traffic on the R127. NH_3 was also exceeded at 200m to the east of the Grand Canal pNHA at the M50, and up to 120 m to the west of the M50, and up to 100 m to the east and 70 m to the west for the Royal Canal pNHA at the M50.

Nitrogen deposition is considered in detail for the habitats present in the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

All outputs of this assessment, including nitrogen deposition, have been considered within the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

In accordance with the EPA Guidelines (EPA, 2022) the ecological impacts associated with the construction phase traffic emissions are overall long-term, negative and not significant.

3.2.2 Scenario B

An assessment of the impact of the Proposed Project during Opening Year Scenario B has been undertaken using the approach outlined in the updated TII guidance (PE-ENV-01107 and PE-ENV-01106). An assessment of the ecologically sensitive sites has been carried out which are within 200m of an affected road network (ARN) (See Section 3) and Section 16.5.3.9 of the EIAR.

Annual mean NO_x and NH_3 concentrations, as well as nitrogen and acid deposition levels have been compared to the relevant critical levels and loads in Table 3-5 for the worst-case ecologically sensitive receptors. The ground level concentrations, nitrogen deposition flux and acid deposition flux are presented for the closest locations within the ecological sites to the nearest road. Backgrounds can be found in Table 1-1. The construction phase results model the worst-case month of construction traffic for a full year and therefore are conservative in nature.

Table 3-5: Impacts at Key Ecological Receptors for the Operational Phase Scenario B (2035)

Opening Year Scenario B	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m3³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Bog of the Ring pNHA (Eastern Side)						
Do- Minimum	34.55	4.20	40.05	6.10	30.84	2.20
Do- Something	35.21	4.28	40.71	6.18	31.27	2.23
Difference between Do-Something and Do-Minimum	0.66	0.07	0.66	0.07	0.43	0.03
Change relative to lower critical load (%)	2.2%	7.3%	2.2%	7.3%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		2.4%		2.4%		
Bog of the Ring pNHA (Western Side)						
Do- Minimum	34.65	4.18	40.15	6.08	30.73	2.20
Do- Something	35.57	4.30	41.07	6.20	31.39	2.24
Difference between Do-Something and Do-Minimum	0.92	0.11	0.92	0.11	0.66	0.05
Change relative to lower critical load (%)	3.1%	11.4%	3.1%	11.4%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		3.8%		3.8%		
Malahide Estuary SPA SAC pNHA (Eastern Side)						
Do- Minimum	9.40	0.88	21.60	2.48	10.72	0.77
Do- Something	9.58	0.91	21.78	2.51	10.85	0.78
Difference between Do-Something and Do-Minimum	0.18	0.02	0.18	0.02	0.14	0.01
Change relative to lower critical load (%)	0.6%	2.4%	0.6%	2.4%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.8%		0.8%		
Malahide Estuary SPA SAC pNHA (Western Side)						
Do- Minimum	8.08	0.73	20.28	2.33	9.80	0.70
Do- Something	8.20	0.74	20.40	2.34	9.89	0.71
Difference between Do-Something and Do-Minimum	0.12	0.02	0.12	0.02	0.09	0.01
Change relative to lower critical load (%)	0.4%	1.6%	0.4%	1.6%	Considered in AA Update Report and the EIAR Biodiversity Update Report by	N/A
Change relative to upper critical load (%)		0.5%		0.5%		

Opening Year Scenario B	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m3³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
					the Project Ecologist.	
Rogerstown Estuary SAC & pNHA						
Do- Minimum	13.12	1.30	18.62	3.00	15.31	1.09
Do- Something	13.82	1.36	19.32	3.06	15.67	1.12
Difference between Do-Something and Do-Minimum	0.70	0.06	0.70	0.06	0.36	0.03
Change relative to lower critical load (%)	2.3%	5.9%	2.3%	5.9%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		2.0%		2.0%		
Royal Canal pNHA (M50 Viaduct Eastern Side)						
Do- Minimum	15.43	1.43	27.33	3.23	14.81	1.06
Do- Something	15.23	1.43	27.13	3.23	14.78	1.06
Difference between Do-Something and Do-Minimum	-0.20	-0.001	-0.20	-0.001	-0.02	-0.001
Change relative to lower critical load (%)	-0.7%	-0.1%	-0.7%	-0.1%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.0%		0.0%		
Royal Canal pNHA (M50 Viaduct Western Side)						
Do- Minimum	16.58	1.62	28.48	3.42	15.89	1.14
Do- Something	16.27	1.61	28.17	3.41	15.82	1.13
Difference between Do-Something and Do-Minimum	-0.31	-0.01	-0.31	-0.01	-0.07	-0.01
Change relative to lower critical load (%)	-1.0%	-1.0%	-1.0%	-1.0%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		-0.3%		-0.3%		
Liffey Valley pNHA (M50 Eastern Side)						
Do- Minimum	6.49	0.44	20.09	2.24	9.18	0.66
Do- Something	6.42	0.44	20.02	2.24	9.17	0.65
Difference between Do-Something and Do-Minimum	-0.08	-0.00039	-0.08	-0.0004	-0.01	-0.0006
Change relative to lower critical load (%)	-0.3%	-0.039%	-0.3%	-0.04%	Considered in AA Update Report and the EIAR Biodiversity Update Report by	N/A
Change relative to upper critical load (%)		-0.013%		-0.01%		

Opening Year Scenario B	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m3³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
					the Project Ecologist.	
Liffey Valley pNHA (M50 Western Side)						
Do- Minimum	5.86	0.38	19.46	2.18	8.84	0.63
Do- Something	5.79	0.38	19.39	2.18	8.83	0.63
Difference between Do-Something and Do-Minimum	-0.07	0.00	-0.07	-0.0004	-0.01	-0.0006
Change relative to lower critical load (%)	-0.2434%	-0.0420%	-0.2434%	-0.04%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		-0.0140%		-0.01%		
Grand Canal pNHA (M50 Viaduct Eastern Side)						
Do- Minimum	37.43	5.08	54.33	6.88	35.52	2.54
Do- Something	37.11	5.06	54.01	6.86	35.38	2.53
Difference between Do-Something and Do-Minimum	-0.33	-0.02	-0.33	-0.02	-0.14	-0.01
Change relative to lower critical load (%)	-1.1%	-2.3%	-1.1%	-2.3%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		-0.8%		-0.8%		
Grand Canal pNHA (M50 Viaduct Western Side)						
Do- Minimum	26.02	3.50	42.92	5.30	26.50	1.89
Do- Something	25.77	3.48	42.67	5.28	26.40	1.89
Difference between Do-Something and Do-Minimum	-0.25	-0.02	-0.25	-0.02	-0.11	-0.01
Change relative to lower critical load (%)	-0.8%	-1.8%	-0.8%	-1.8%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		-0.6%		-0.6%		
North Dublin Bay pNHA & South Dublin Bay and River Tolka Estuary SPA						
Do- Minimum	33.91	8.11	61.21	9.41	51.96	3.71
Do- Something	32.37	8.05	59.67	9.35	51.56	3.68
Difference between Do-Something and Do-Minimum	-1.53	-0.06	-1.53	-0.06	-0.40	-0.03
Change relative to lower critical load (%)	-5.1%	-5.7%	-5.1%	-5.7%	Considered in AA Update Report and the EIAR Biodiversity Update Report by	N/A
Change relative to upper critical load (%)		-1.9%		-1.9%		

Opening Year Scenario B	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m3³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
					the Project Ecologist.	

Note 1: See Table 1-1 for Backgrounds.

Note 2: See Section 3 for Critical Loads used in Comparison.

Note 3: North Dublin Bay pNHA is located at the roads edge, South Dublin Bay and River Tolka Estuary boundary is approximately 170m from the roads edge. Therefore, any impacts are significantly reduced. The road links at this location are scoped out and are not classed as "affected" (see Section 3) during the construction phase.

The annual mean NO_X concentrations (including background) does not exceed the critical level of 30 µg/m³ at modelled locations with an adverse impact due to the MetroLink with the exception of the Bog of the Ring, where the exceedance is below the critical value by 10 m from the Bog of the Ring pNHA.

At Bog of the Ring pNHA there is an exceedance for up to 60 m to the east and 40m to the west of the M1 of the upper critical value of 3 µg/m³ for NH_3 (including background). However, the contribution due to MetroLink is just 0.11 µg/m³ at the roads edge. At Rogerstown Estuary SAC SPA pNHA crossing with the R127 the upper critical value of 3 µg/m³ for NH_3 (including background) was exceeded for 10m from the road. In addition, at the Royal Canal some roads, including the M50, are beneficially impacted due to the Proposed Project, while others are adversely affected (M3 flyover to M50 southbound). There is an exceedance of the upper critical value for up to 60m to the east of the M50 at the Royal Canal. However, the Proposed Project is less than 1% of the critical value and has an overall beneficial impact at this location.

Nitrogen deposition is considered in detail for the habitats present in the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

All outputs of this assessment, including nitrogen deposition, have been considered within the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

In accordance with the EPA Guidelines (EPA, 2022) the ecological impacts associated with the construction phase traffic emissions are overall long-term, negative and not significant.

4 Additional Sensitivity Analysis

Upon request by the project ecologist Feltrim Hill and Knock Lake pNHA have been included in the modelling assessment. Feltrim Hill pNHA is approximately 530m and Knock Lake pNHA is approximately 400m from the closest "affected" road. Therefore, both were scoped out of the air quality EIAR assessment as they are outside the 200 m zone of influence and therefore not included in the assessment. However, as a precautionary approach due to the Project Ecologists request they were added to the modelling assessment.

During construction, Knock Lake pNHA has not been modelled as the modelled road network does not extend to this area as no roads are considered "affected" in this area. There are no haul roads or areas of redistribution of other road users within 8km of Knock Lake pNHA. For the Operational phase Scenario B has been modelled for Knock Lake pNHA, as in this scenario is the worst-case scenario with respect to changes in traffic in the area of the pNHA.

All outputs of this assessment, including nitrogen deposition, have been considered within the AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.

Table 4-1: Impacts at Feltrim Hill pNHA and Knock Lake pNHA Construction Phase

Scenario	Predicted Ground Level NO_X Concentration (excluding background) µg/m^3	Predicted Ground Level NH_3 Concentration (excluding background) µg/m^3	Predicted Ground Level NO_X Concentration (including background [Note 1]) µg/m^3	Predicted Ground Level NH_3 Concentration (including background [Note 1]) µg/m^3	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Feltrim Hill pNHA Northern Peak Construction 2028						
Do-Minimum	3.77	0.03	9.27	1.93	6.84	0.49
Do-Something	3.74	0.05	9.24	1.95	6.98	0.50
Difference between Do-Something and Do-Minimum	-0.03	0.03	-0.03	0.03	0.14	0.01
Change relative to lower critical load (%)	-0.11%	2.8%	-0.11%	2.8%	Considered in the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.9%		0.9%		
Feltrim Hill pNHA Southern Peak Construction 2028						
Do-Minimum	3.60	0.06	9.10	1.96	6.98	0.50
Do-Something	3.62	0.06	9.12	1.96	6.98	0.50
Difference between Do-Something and Do-Minimum	0.013	0.001	0.013	0.001	0.002	0.000
Change relative to lower critical load (%)	0.04%	0.1%	0.04%	0.1%	Considered in the EIAR Biodiversity Update Report by	N/A

Scenario	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Change relative to upper critical load (%)		0.0%		0.0%	the Project Ecologist.	

Note 1: See Table 1-1 for Backgrounds.

Note 2: See Section 3 for Critical Loads used in Comparison.

Table 4-2: Impacts at Feltrim Hill pNHA and Knock Lake pNHA Operational Phase

Scenario	Predicted Ground Level NO_X Concentration (excluding background) µg/m³	Predicted Ground Level NH_3 Concentration (excluding background) µg/m³	Predicted Ground Level NO_X Concentration (including background Note 1) µg/m³	Predicted Ground Level NH_3 Concentration (including background Note 1) µg/m³	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Feltrim Hill pNHA Scenario A 2035						
Do-Minimum	3.62	0.09	9.12	1.99	7.13	0.51
Do-Something	3.58	0.09	9.08	1.99	7.13	0.51
Difference between Do-Something and Do-Minimum	-0.03	0.001	-0.03	0.001	0.003	0.000
Change relative to lower critical load (%)	-0.1%	0.1%	-0.1%	0.1%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.0%		0.0%		
Knock Lake pNHA Scenario A 2035						
Do-Minimum	2.17	0.00	7.67	1.90	6.58	0.47
Do-Something	2.19	0.00	7.69	1.90	6.58	0.47
Difference between Do-Something and Do-Minimum	0.0187	0.00002	0.0187	0.00002	0.0016	0.0001
Change relative to lower critical load (%)	0.1%	0.0%	0.1%	0.0%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.0%		0.0%		
Feltrim Hill pNHA Scenario B 2035						
Do-Minimum	4.39	0.10	9.89	2.00	7.27	0.52

Scenario	Predicted Ground Level NO_X Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (excluding background) $\mu g/m^3$	Predicted Ground Level NO_X Concentration (including background Note 1) $\mu g/m^3$	Predicted Ground Level NH_3 Concentration (including background Note 1) $\mu g/m^3$	Total Nitrogen Deposition Flux (kg/ha/yr)	Total Acid Deposition Flux (keq/ha/yr)
Do-Something	4.38	0.10	9.88	2.00	7.28	0.52
Difference between Do-Something and Do-Minimum	-0.012	0.002	-0.012	0.002	0.009	0.001
Change relative to lower critical load (%)	0.0%	0.2%	0.0%	0.2%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.1%		0.1%		
Knock Lake pNHA Scenario B 2035						
Do-Minimum	2.25	0.23	7.75	2.13	7.79	0.56
Do-Something	2.30	0.24	7.80	2.14	7.82	0.56
Difference between Do-Something and Do-Minimum	0.045	0.005	0.045	0.005	0.028	0.002
Change relative to lower critical load (%)	0.2%	0.5%	0.2%	0.5%	Considered in AA Update Report and the EIAR Biodiversity Update Report by the Project Ecologist.	N/A
Change relative to upper critical load (%)		0.2%		0.2%		

Note 1: See Table 1-1 for Backgrounds.

Note 2: See Section 3 for Critical Loads used in Comparison.

5 Summary

In December 2022, after the EIAR had been submitted, Transport Infrastructure Ireland (TII) published new guidance documents and standards for the EIAR with respect to Air Quality:

- PE-ENV-01106: Air Quality Assessment of Specified Infrastructure Projects (TII 2022a);
- PE-ENV-01107: Air Quality Assessment Standard for Proposed National Roads (TII 2022b).

These documents updated the methodology for assessing ecological receptors and provided a strategy for the inclusion of NH_3 within modelling of sensitive ecological receptors. In addition, the provision of a 1 km x 1 km grid square background from APIS allowed for a site-specific background to be added.

Finally some model refinements were also completed. This included adding the elevations for bridges at locations along the M50 and M1 to ensure dispersion of vehicle emissions from an elevated position was captured within the model.

The modelling outputs have been shared and reviewed by the project ecologist.

The result of the modelling updates contained in this Addenda was to more accurately model impacts on sensitive ecological receptors.

6 References

Air Quality Consultants (2020) Calculator for Road Emissions of Ammonia CREAM V1A [Online] available from https://www.aqconsultants.co.uk/resources/calculator-for-road-emissions-of-ammonia

Air Pollution Information System (2023) GIS map tool https://www.apis.ac.uk/app

TII (2022a) PE-ENV-01106: Air Quality Assessment of Specified Infrastructure Projects

TII (2022b) PE-ENV-01107: Air Quality Assessment Standard for Proposed National Roads (TII 2022b).

UK Environment Agency (2014) 'AGTAG06 – Technical Guidance on Detailed Modelling Approach For An Appropriate Assessment For Emissions To Air'