

Environmental Health

Air Quality -

Vehicle Idling Awareness Raising

Schools Project

Summary Report

March 2025

Executive Summary

Funding provided by the Scottish Government has so far allowed the Highland Council Environmental Health Officers to carry out air quality monitoring and awareness raising projects at 22 Highland Council primary schools between March 2022 to March 2025. This report sets out the air quality monitoring results and awareness raising outcomes at the schools.

The monitoring undertaken was a combination of nitrogen dioxide (NO₂) passive diffusion tube monitoring over three or four months and indicative live EarthSense Zephyr® Unit monitoring of multiple parameters over a few weeks at each site.

Schools were initially selected based upon a combination of location and discussion with the Council's Safer Routes to School Team to identify schools where concerns regarding excess vehicle numbers and vehicle idling had been raised by parents.

Since 2023 the project has focused on schools within the 'Other Urban Area' classification of the Urban-Rural Classifications from the Scottish Government 2020 GIS Dataset (as Highland has no 'Large Urban Areas' by definition).

All primary schools were ranked based on their proximity to potential sources of air pollution such as bus routes, A roads, B roads, local road and railway tracks; and targeted in sets of between 6 to 10 schools per year.

The monitoring locations were selected to use current street furniture in closest proximity to school drop off points or known idling zones.

The monitoring results were adjusted where possible to annual average (AA).

In summary none of the school monitoring locations have exceeded the Scottish Government Air Quality (AA) objective for NO₂, although raw data peaks could be observed to coincide with drop off and pick up times.

The awareness raising element of the project was undertaken through delivery of talks to second stage pupils (P5-7) at all schools who supported access, additional delivery of monitoring data worksheets, and end of project newsletters were provided to each school to share with pupils/staff or parents via school newsletters.

In June 2024, for National Clean Air Day a wider public facing air quality awareness raising event was held in Falcon Square Inverness, supported by organisations including NHS Highland, Hltravel, Cycling UK, and Stagecoach.

The aim for 2025/26 onward with Scottish Government funding (if awarded) is to continue to target the remaining Highland Council prioritised Urban Primary Schools, to keep raising awareness and to undertake further monitoring data capture.

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1 Introduction

Cleaner Air for Scotland 2 - Towards a Better Place for Everyone (Scottish Government, 2021) is Scotland's second air quality strategy, setting out objectives to be achieved for a suite of air pollutants, details of which are described below.

The Local Air Quality Management (LAQM) process, as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents, places an obligation upon all local authorities to regularly review and assess air quality in their areas, and to determine whether (or not) the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA). At present there is one AQMA within Highland, in the centre of Inverness, related to exceedances of the Annual Mean Nitrogen Dioxide objective. The Highland Council are working towards revoking the AQMA in 2025/26 as all monitoring at both automatic and non-automatic (diffusion tubes) locations within the AQMA have achieved compliance since 2020. Further details and Annual Progress Reports on Air Quality in Highland dating back to 2013 can be obtained from the [Air Pollution](#) pages of The Highland Council website.

The Highland Council secured grant funding from the Scottish Government in May 2022 to undertake air quality monitoring and awareness raising at a small number of primary schools within Highland. Environmental Health officers worked in conjunction with the Council's Safer Routes to School team to identify schools where concerns regarding excess vehicle numbers and vehicle idling had been raised by parents. Ten primary schools were contacted in 2022/23 and 6 opted into the project.

Continued Scottish Government funding in 2023/24 and 2024/25 have enabled monitoring and engagement visits to be carried out at a further 16 schools, selected based on their urban locations and proximity to roads and other influencing factors.

To date 22 primary schools have received focused air quality monitoring and most have participated in anti-idling awareness raising talks and workshops with Environmental Health Officers. This report sets out the air quality monitoring results and awareness raising outcomes at the 22 Highland Primary Schools, carried out between May 2022 and March 2025.

2 Air Quality Objectives

The objectives adopted in Scotland for the purpose of Local Air Quality Management are set out in the Air Quality (Scotland) Regulations 2000, the Air Quality (Scotland) Amendment Regulations 2002 and the Air Quality (Scotland) Amendment Regulations 2016.

The Scottish Air Quality objectives for nitrogen dioxide, particulates and ozone are given in **Table 2.1** below:

Pollutant	Air Quality Objective		To be achieved by
	Measured as	Concentration	
Nitrogen Dioxide (NO ₂)	Annual mean	40 µg m ⁻³	31 December 2005
	1-hour mean	200 µg m ⁻³ not to be exceeded more than 18 times a year	31 December 2005
Particles (PM ₁₀) (gravimetric)	Annual mean	18 µg m ⁻³	31 December 2010
	24 Hour mean	50 µg m ⁻³ , not to be exceeded more than 7 times a year	31 December 2010
Particles (PM _{2.5}) (gravimetric)	Annual mean	10 µg m ⁻³ (limit)	31 December 2020
Ozone	8 hourly running	100 µg m ⁻³ not to be exceeded more than 10 times a year	31 December 2005

3 Monitoring Procedure

Monitoring around Primary Schools was undertaken using two methods. Passive diffusion tubes for nitrogen dioxide, and an indicative mobile automatic sensor known as EarthSense Zephyr® for a range of parameters.

3.1 Passive Diffusion Tubes

The passive diffusion tube sample method has the advantage of being relatively cheap and is easy to deploy, the equipment comprising a tube around 75mm long that is clipped to lampposts. The tubes are exposed for a month to provide monthly average nitrogen dioxide concentrations. Several tubes can easily be deployed at once to give a broad geographic spread of monitoring. Quantification of nitrogen dioxide concentration is carried out at an accredited laboratory; results can be annualised and bias adjusted to allow comparison with the annual mean air quality objective.

The main disadvantage of passive diffusion tubes is that the time resolution of the monitoring is coarse (monthly average), so short term increases in pollutant concentration are unlikely to be picked up by this method. Although the monitoring method is less accurate than an approved automatic analyser, the accuracy of the method can be improved by verifying tube performance against an automatic analyser. The Highland Council does this by collocating tubes with the automatic monitors at Telford Street and Queensgate in Inverness. A further limitation of the diffusion tube is that it measures nitrogen dioxide only.

3.2 EarthSense Zephyr® Unit

The EarthSense Zephyr® Unit is an automatic, portable indicative monitoring system. The air quality sensor measures mass concentrations of Nitrogen dioxide (NO₂), Ozone (O₃) and Nitric oxide (NO) as well as mass concentrations of particulate matter with aerodynamic diameters of 1, 2.5 and 10µm (PM1, PM2.5, PM10). Parameters such as humidity, temperature and atmospheric pressure are also recorded.

The monitor actively samples the ambient air, powered by an internal battery, topped up with an external solar panel. Electrochemical sensors (EC) produce an analog response that is converted to a digital signal which is affected by the concentration of the gas of interest as well as other interfering gases (the specific gases and the severity is unique for each EC) and environmental conditions. The retrieved concentration has these effects accounted for, which is validated by both long-term studies and a sensor validation period prior to delivery to the Council. An optical particle counter is used in the Zephyr® sensor to retrieve a mass concentration for PM1, PM2.5 and PM10. A hygroscopy factor is included in the retrieval to correct for humidity interactions with aerosol.

The data is uploaded to the EarthSense web portal where it can be viewed or downloaded for further analysis. The real-time user interface, which includes graphical representations of pollutants, provides an exciting opportunity for children to engage such that they can potentially correlate vehicle numbers with increase of some air pollution parameters over short timeframes (minutes/hours).

The main disadvantage of the Zephyr® is that the technology is less scientifically robust than the established methods used in traditional automatic monitors. At present, a method to annualise and bias adjust the data is not available, and the results are considered indicative only. A further limitation is their cost relative to diffusion tubes, as they are more expensive to purchase and maintain; however, they are significantly cheaper than a fixed automatic analyser and therefore are a valuable as part of the multiple technique monitoring options utilised. Calibration certificates for the Zephyr® sensors used in the project are included in Appendix D.



Photograph 1 – Diffusion tube attached to a lamppost at Crown Primary



Photograph 2 - Zephyr® sensor and solar panel attached to a lamppost at Bishop Eden Primary



4 Monitoring Locations

At each participating school, the busiest road nearest the main entry/exit points of the school grounds was identified from Ordnance Survey mapping and discussion with the school staff. Between four and six lighting columns or signposts were selected for placement of the passive diffusion tubes at approximately 2m+ height to avoid tampering. The tubes were initially deployed in September and changed over in October and November giving three months of data at each location. In 2024/25 a fourth round in December was undertaken at each school to provide a larger dataset for processing, should any individual month be damaged or missing upon collection.

An EarthSense Zephyr® monitor was also fixed to a lighting column at 2m+ height for a minimum of two weeks at each school. The school and monitoring locations plans are included in Appendix A.

4.1 2022/23 Monitoring Locations

In 2022/23 the four Inverness city primary schools - Bishop Eden, Crown, Dalneigh, and Holm took part in the project, as well as a more rural school - Kirkhill, and a town school – Pennyland, Thurso. See **Table 4.1** below:

Name	Council Ward	School Role	Location	
			Easting	Northing
Bishop Eden	14. Inverness Central	25	266212	845399
Crown	16. Inverness Milburn	253	267137	845129
Dalneigh	14. Inverness Central	252	265315	845013
Holm	15. Inverness Ness-side	228	265556	842367
Kirkhill	12. Aird & Loch Ness	144	255595	845595
Pennyland	2. Thurso & NW Caithness	180	310826	968436

4.2 2023/24 Monitoring Locations

In 2023/24 the 6 Inverness city primary schools – Bun-Sgoil Ghàidhlig Inbhir Nis, Central, Cradlehall, Hilton, Merkinch and Muirtown took part in the project, as well two Nairn town schools – Millbank and Rosebank, and two Lochaber Schools – Inverlochry and Lundavra, both in Fort William. See **Table 4.2** below:

Name	Council Ward	School Role	Location	
			Easting	Northing
BSGI	15. Inverness Ness-side	223	266887	842198
Central	13. Inverness West	191	266261	845074
Cradlehall	19. Inverness South	292	270532	844590
Hilton	16. Inverness Milburn	299	267527	843740
Inverlochy	21. Fort William & Ardnamurchan	141	211224	774484
Lundavra	21. Fort William & Ardnamurchan	208	209646	772938
Merkinch	14. Inverness Central	277	265797	845900
Millbank	18. Nairn & Cawdor	261	288347	856166
Muirtown	13. Inverness West	205	265021	845837
Rosebank	18. Nairn & Cawdor	324	288122	856391

4.3 2024/25 Monitoring Locations

In 2024/25 a further 6 Inverness city primary schools took part in the project – Cauldeen, Drakies, Inshes, Kinmylies and Lochardil along with Duncan Forbes, Culloden. See **Table 4.3** below:

Name	Council Ward	School Role	Location	
			Easting	Northing
Cauldeen	15. Inverness Ness-side	217	267023	843064
Drakies	16. Inverness Milburn	231	268262	844118
Duncan Forbes	17. Culloden & Ardersier	274	271764	846584
Inshes	19. Inverness South	353	268681	843681
Kinmylies	13. Inverness West	299	264855	844704
Lochardil	15. Inverness Ness-side	337	266050	842680

5 School Engagement

Schools taking part in the project were sent an Education Information Pack with weblinks to educational resources previously created by the Scottish Government, air quality charities, and the BBC for teaching staff to access and use as part of the project. An example copy of an Education Information Pack is included in Appendix B.1.

Once the monitoring equipment was in place, Officers from Environmental Health attended the school to give a presentation to pupils. Usually these were pupils in Primary Class 6 or 7, or the school Junior Road Safety Officers. The presentation provided explanation of the main air pollutants in the UK, the causes of air pollution, the health impacts of air pollution, and how The Highland Council monitors air quality. The real time Zephyr® information was accessed using the EarthSense website which provides a graphical representation of the on-the-day air quality. The pupils and staff were challenged to observe the air quality outside their school and think of ways to reduce emissions. An example of a presentation is included in Appendix B.2

Each school was provided with a modified Worksheet using the results from their school, to be used as a learning resource by the teacher or incorporated into a workshop session as part of the EH officer talk. This utilised recent data from the Zephyr® at the school, and tube data if available. An example of the worksheet is included in Appendix B.3

Schools were offered a second visit to discuss the outcomes, uptake varied but when undertaken pupils were keen to discuss their findings and describe their solutions to reduce air pollution. Pupil solutions involved walking and cycling to school more frequently, making use of public transport where available, and switching to an electric vehicle if possible. Use of green wall planting at school borders were also suggested. Where transport to or from school by private car was ongoing, it was recognised that vehicle idling had a negative impact on air quality and should be stopped. Some pupils were encouraged to make posters, examples of which are included in Appendix B.4. Feedback provided from the children was positive, with some of their statements also included in Appendix B.4.

A newsletter results summary of the diffusion tube and Zephyr® data was sent to each school which confirmed that the air quality at each school was within objectives for nitrogen dioxide as set out by Scottish Government. Copies of the 22 individual school newsletters provided are included in Appendix B.5.

6 Monitoring Results

A discussion of the monitoring results for both the diffusion tubes and Zephyr® data at each school location is provided below.

The DEFRA document Local Air Quality Management Technical Guidance (TG22) (Defra, 2022) was followed when considering the raw diffusion tube monitoring results.

Ideally, diffusion tube monitoring should be completed for a full calendar year, however to progress the project faster and for a more limited budget the annual DEFRA Diffusion Tube Processing Tool was used each year to provide an annualisation estimate of the annual mean for the three or four months of data captured at each site; and it is this value which is compared with the annual mean nitrogen dioxide objective.

The Diffusion Tube Data Processing Tool also includes the option to apply a bias adjustment factor for the laboratory and analysis preparation method used.

During the annualisation calculations, each tube location was assigned a location classification category of Roadside, Kerbside, Urban Background or Suburban Background dependant on their situation.

The laboratory Gradko Raw diffusion tube data is provided in Appendix C.1, with the bias adjusted and annualisation output summary sheets produced by the Diffusion Tube Processing Tools, issued annually, presented in Appendix C.2

The use of the Zephyr® Unit and other low-cost sensors capable of measuring air pollutants is emerging technology, and DEFRA are developing a specification to standardise their use. In the absence of specific guidance, annualising or bias correction of the Zephyr® data has not been undertaken. Mean calculations of pollutant levels at each site for the period in which the schools were occupied by children have been made. This required filtering the continuous data to consider only Monday-Friday, 9am-4pm with exclusions for school holidays or in-service periods as required.

To allow comparison with other Scottish Air Quality Objectives, the max 24hour concentration for nitrogen dioxide, PM2.5 and PM10 was also determined, as well as the max hourly nitrogen dioxide for the period of operation at each location. As discussed above, these results are not ratified and are for indicative purposes only.

6.1 2022/23 School Monitoring Results Detail

6.1.1 Bishop Eden's Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.1 below.

Table 6.1– Bishop Eden's Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2022 (µg/m ³)	NO ₂ Oct 2022 (µg/m ³)	NO ₂ Nov 2022 (µg/m ³)	NO ₂ Raw data average (µg/m ³)	NO ₂ Bias Adjusted (0.83) and Annualised (µg/m ³)
BE 1	10.0	11.4	15.0	12.1	10.3
BE 2	9.4	11.5	17.5	12.8	10.9
BE 3	9.5	10.7	12.0	10.7	9.1
BE 4	9.1	10.6	15.6	11.8	10.0

The Bishop Eden Zephyr® data for the period operational between 14/09/22 - 03/11/22 is summarised in Table 6.2 below.

Table 6.2 – Bishop Eden Zephyr® Data, Average 1hr, in (µg/m³)

	BE Zephyr® Data (Z585)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	9	3	5	40	10	18
Average Mon-Fri, 9am-4pm	8	2	4			
Max 24hr mean (Raw)			15			50
Max hourly mean (Raw)	49			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the school was advised as such. No further monitoring is considered necessary at this time.

6.1.2 Crown Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.3 below.

Table 6.3 – Crown Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2022 (µg/m ³)	NO ₂ Oct 2022 (µg/m ³)	NO ₂ Nov 2022 (µg/m ³)	NO ₂ Raw data average (µg/m ³)	NO ₂ Bias Adjusted (0.83) and Annualised (µg/m ³)
C1	11.5	12.9	16.6	13.7	11.6
C2	10.5	11.0	17.9	13.1	11.2
C3	9.3	10.4	14.4	11.3	9.7
C4	11.1	12.2	14.4	12.6	10.7
C5	10.8	12.2	18.1	13.7	11.7
C6	10.8	12.3	18.4	13.8	11.8

The Crown Zephyr® data for the period operational between 03/11/22- 28/02/23 is summarised in Table 6.4 below.

Table 6.4 – Crown Zephyr® Data, Average 1hr, in (µg/m³).

	Crown Zephyr® Data (Z442)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	14	7	12	40	10	18
Average Mon-Fri, 9am-4pm	23	6	11			
Max 24hr mean			29			50
Max hourly mean	102			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government objectives and the school was advised as such. No further monitoring of the school was considered necessary at this time.

However, 4 additional diffusion tubes were added to the Council monitoring routine from February 2023 onwards to monitor the general Crown residential area, which is reported in the Annual Progress Reports on the Council website [Measuring air quality | Pollution | The Highland Council](#)

6.1.3 Dalneigh Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.5 below.

Table 6.5 – Dalneigh Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2022 (µg/m ³)	NO ₂ Oct 2022 (µg/m ³)	NO ₂ Nov 2022 (µg/m ³)	NO ₂ Raw data average (µg/m ³)	NO ₂ Bias Adjusted (0.83) and Annualised (µg/m ³)
Dal1	6.2	Missing	10.9	*	**7.1
Dal2	Missing	4.8	Missing	*	**4.0
Dal3	6.5	Missing	11.9	*	**7.6
Dal4	6.6	5.3	11.4	7.6	7.1

*The Diffusion Tube Data Processing Tool used by DEFRA will not calculate an average or bias adjusted and annualised figure for datasets of < three calendar months.

**Author calculated average with 0.83 bias based on calculated Crown Primary factor applied.

The Dalneigh Zephyr® data for the period operational between 17/06/22- 18/10/22 is summarised in Table 6.6 below.

Table 6.6 – Dalneigh Zephyr® Data, Average 1hr, in (µg/m³)

	Dalneigh Zephyr® Data (Z506)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	5	7	7	40	10	18
Average Mon-Fri, 9am-4pm	3	7	8			
Max 24hr mean			22			50
Max hourly mean	40			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.1.4 Holm Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.7 below.

Table 6.7 – Holm Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2022 (µg/m ³)	NO ₂ Oct 2022 (µg/m ³)	NO ₂ Nov 2022 (µg/m ³)	NO ₂ Raw data average (µg/m ³)	NO ₂ Bias Adjusted (0.83) and Annualised (µg/m ³)
Holm1	4.3	5.7	9.6	6.5	5.4
Holm2	4.2	5.5	9.2	6.3	5.2
Holm3	4.3	5.5	9.2	6.3	5.2
Holm4	4.3	3.0	8.4	5.2	4.3
Holm5	4.1	5.6	8.1	5.9	4.9

The Holm Zephyr[®] data for the period operational between 03/11/2022 to 02/02/2023 is summarised in Table 6.8 below.

Table 6.8 – Holm Zephyr[®] Data, Average 1hr, in (µg/m³)

	Holm Zephyr [®] Data (Z585)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	7	3	6	40	10	18
Average Mon-Fri, 9am-4pm	11	3	6			
Max 24hr mean			14			50
Max hourly mean	68			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.1.5 Kirkhill Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.9 below.

Table 6.9 – Kirkhill Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2022 (µg/m ³)	NO ₂ Oct 2022 (µg/m ³)	NO ₂ Nov 2022 (µg/m ³)	NO ₂ Raw data average (µg/m ³)	NO ₂ Bias Adjusted (0.83) and Annualised (µg/m ³)
Kirk1	3.6	Streetlamp gone	n/a	*	**3.0
Kirk2	3.4	4.7	Missing	*	**3.4
Kirk3	3.1	Missing	6.8	*	**4.2
Kirk4	3.4	3.9	6.7	*	**3.9
Kirk5	2.6	3.3	6.1	*	**3.3
Kirk6	2.9	3.8	6.7	*	**3.7

*The Diffusion Tube Data Processing Tool used by DEFRA will not calculate an average or bias adjusted and annualised figure for datasets of < three calendar months.

**Author calculated average with 0.83 bias based on Crown Primary factor applied.

The Kirkhill Zephyr[®] data for the period operational between 22/09/2022 to 03/11/2022 is summarised in Table 6.10 below.

Table 6.10 – Kirkhill Zephyr[®] Data, Average 1hr, in (µg/m³)

	Kirkhill Zephyr [®] Data (Z442)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	7	4	8	40	10	18
Average Mon-Fri, 9am-4pm	7	4	6			
Max 24hr mean			14			50
Max hourly mean	26			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.1.6 Thurso Pennyland Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.11 below.

Table 6.11 – Thurso Pennyland Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2022 (µg/m ³)	NO ₂ Oct 2022 (µg/m ³)	NO ₂ Nov 2022 (µg/m ³)	NO ₂ Raw data average (µg/m ³)	NO ₂ Bias Adjusted (0.83) and Annualised (µg/m ³)
Pen1	2.5	4.0	5.5	4.0	3.1
Pen2	2.7	Missing	6.2	*	**3.7
Pen3	2.2	3.8	6.4	4.2	3.2
Pen4	2.1	3.4	5.9	3.9	3.0
Pen5	2.5	3.4	5.8	3.9	3.0

*The Diffusion Tube Data Processing Tool used by DEFRA will not calculate an average or bias adjusted and annualised figure for datasets of < three calendar months.

**Author calculated average with 0.83 bias based on calculated Crown Primary factor applied.

The Thurso Pennyland Zephyr® data for the period operational between 07/11/2022 to 17/02/2023 is summarised in Table 6.12 below.

Table 6.12 – Thurso Pennyland Zephyr® Data, Average 1hr, in (µg/m³)

	Pennyland Zephyr® Data (Z647)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	3	6	6	40	10	18
Average Mon-Fri, 9am-4pm	4	6	7			
Max 24hr mean			22			50
Max hourly mean	36			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2 2023/24 School Monitoring Results Detail

6.2.1 Bun-Sgoil Ghàidhlig Inbhir Nis (BSGI) Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.13 below.

Table 6.13– BSGI Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
BSG1	13.1	15.1	22.0	17.1	11.8
BSG2	6.9	10.4	15.3	11.2	7.7
BSG3	5.1	8.1	14.5	9.6	6.6
BSG4	4.9	7.2	13.9	9.0	6.2
BSG5	4.4	6.9	13.9	8.8	6.1

The BSGI Zephyr[®] data for the period operational between 10/03/24 - 31/05/24 is summarised in Table 6. 14 below.

Table 6.14 – BSGI zephyr[®] Data, Average 1hr, in (µg/m³)

	BSGI Zephyr [®] Data (Z481)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	14	5	8	40	10	18
Average Mon-Fri, 9am-4pm	13	5	7			
Max 24hr mean			27			50
Max hourly mean	43			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.2 Central Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.15 below.

Table 6.15 – Central Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
CE1	6.3	10.6	14.8	10.9	7.5
CE2	7.8	12.9	15.1	12.2	8.4
CE3	14.7	18.9	22.2	18.9	13.0
CE4	15.0	21.6	21.8	19.6	13.5
CE5	16.4	18.9	23.6	19.9	13.7

The Central Zephyr® data for the period operational between 08/03/2024 - 28/03/2024 is summarised in Table 6.16 below.

Table 6.16 – Central Zephyr® Data, Average 1hr, in (µg/m³).

	Central Zephyr® Data (Z585)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	21	4	6	40	10	18
Average Mon-Fri, 9am-4pm	19	3	5			
Max 24hr mean (Raw)			25			50
Max hourly mean (Raw)	61			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government objectives and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.3 Cradlehall Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.17 below.

Table 6.17 – Cradlehall Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
CH1	3.7	4.6	10.2	6.5	4.5
CH2	3.6	4.4	9.3	6.0	4.2
CH3	4.0	4.7	10.3	6.6	4.6
CH4	5.5	5.6	12.6	8.2	5.7
CH5	9.0	6.1	12.1	9.4	6.5

The Cradlehall Zephyr® data for the period operational between 28/03/2024 – 27/05/2024 is summarised in Table 6.18 below.

Table 6.18 – Cradlehall Zephyr® Data, Average 1hr, in (µg/m³)

	Cradlehall Zephyr® Data (Z585)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	13	5	8	40	10	18
Average Mon-Fri, 9am-4pm	12	6	8			
Max 24hr mean (Raw)			26			50
Max hourly mean (Raw)	37			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.4 Hilton Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.19 below.

Table 6.19 – Hilton Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
HL1	5.0	7.8	14.7	9.6	6.6
HL2	Missing	7.5	15.0	*	**9.1
HL3	5.0	7.2	14.8	9.4	6.5
HL4	5.4	8.4	16.2	10.5	7.2
HL5	6.4	9.4	16.7	11.3	7.8

*The Diffusion Tube Data Processing Tool used by DEFRA will not calculate an average or bias adjusted and annualised figure for datasets of < three calendar months.

**Author calculated average with 0.81 bias based on calculated Central Primary factor applied.

The Hilton Zephyr® data for the period operational between 07/03/2024 – 27/05/2024 is summarised in Table 6.20 below.

Table 6.20 – Hilton Zephyr® Data, Average 1 hr, in (µg/m³)

	Hilton Zephyr® Data (Z442)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	15	5	8	40	10	18
Average Mon-Fri, 9am-4pm	14	5	7			
Max 24hr mean (Raw)			25			50
Max hourly mean (Raw)	41			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.5 Inverlochry Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.21 below.

Table 6.21 – Inverlochry Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
NV1	6.9	9.2	17	14.0	11.3
NV2	8.1	8.9	16.4	14.0	11.3
NV3	6.6	8.6	16.4	13.3	10.8
NV4	7.6	8.7	17.1	14.0	11.4
NV5	5.1	6.8	14.4	*	**7.1

*The Diffusion Tube Data Processing Tool used by DEFRA will not calculate an average or bias adjusted and annualised figure for datasets of < three calendar months.

**Author calculated average with 0.81 bias based on calculated Central Primary factor applied.

The Inverlochry Zephyr[®] data for the period operational between 29/02/2024 – 27/05/2024 is summarised in Table 6.22 below.

Table 6.22 – Inverlochry Zephyr[®] Data, Average 1hr, in (µg/m³)

	Inverlochry Zephyr [®] Data (Z647)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	7	8	9	40	10	18
Average Mon-Fri, 9am-4pm	8	8	9			
Max 24hr mean (Raw)			22			50
Max hourly mean (Raw)	39			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.6 Lundavra Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.23 below.

Table 6.23 – Lundavra Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
LV1	3.4	5.5	13.3	7.7	6.2
LV2	5.2	6.9	13.6	8.8	7.1
LV3	4.8	6.2	12.0	7.8	6.3
LV4	3.9	5.9	11.8	7.5	6.0
LV5	4.1	6.1	13.7	8.2	6.6

The Lundavra Zephyr[®] data for the period operational between 05/10/2023 – 27/02/2024 (excluding an intermittent power period between 22/12/2023-26/12/2023) is summarised in Table 6.24 below.

Table 6.24 – Lundavra Zephyr[®] Data, Average 1hr, in (µg/m³)

	Lundavra Zephyr [®] Data (Z647)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	5	7	8	40	10	18
Average Mon-Fri, 9am-4pm	6	7	8			
Max 24hr mean (Raw)			20			50
Max hourly mean (Raw)	56			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.7 Merkinch Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.25 below.

Table 6.25 – Merkinch Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
MK1	8.9	11.2	17.2	12.8	8.8
MK2	8.2	Missing	17.0	*	**10.2
MK3	8.9	12.3	15.8	12.6	8.7
MK4	9.2	Missing	19.2	*	**11.5
MK5	9.2	12.3	17.4	13.3	9.2

*The Diffusion Tube Data Processing Tool used by DEFRA will not calculate an average or bias adjusted and annualised figure for datasets of < three calendar months.

**Author calculated average with 0.81 bias based on calculated Central Primary factor applied.

The Merkinch Zephyr® data for the period operational between 04/09/23 - 31/01/24 (excluding an intermittent power period between 12/12/23 6am to 28/12/23 10am) is summarised in Table 6.26 below.

Table 6.26 – Merkinch Zephyr® Data, Average 1hr, in (µg/m³)

	Merkinch Zephyr® Data (Z585)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	11	4	6	40	10	18
Average Mon-Fri, 9am-4pm	13	4	6			
Max 24hr mean			19			50
Max hourly mean	57			200		

With the exception of one marginally elevated hourly NO₂ reading in a period of low natural light and power irregularity at the unit (on 24/12/2023 in the school holidays) all parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.8 Millbank Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.27 below.

Table 6.27 – Millbank Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
MB1	5.2	6.7	10.7	7.8	5.4
MB2	5.1	6.6	11.6	8.0	5.5
MB3	5.2	6.7	12.2	8.3	5.7
MB4	6.7	8.5	16.0	10.8	7.4
MB5	4.7	5.7	9.0	6.7	4.6

The Millbank Zephyr® data for the period operational between 01/05/24 - 27/05/24 is summarised in Table 6.28 below

Table 6.28 – Millbank Zephyr® Data, Average 1hr, in (µg/m³).

	Millbank Zephyr® Data (Z608)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	13	8	12	40	10	18
Average Mon-Fri, 9am-4pm	11	8	11			
Max 24hr mean (Raw)			23			50
Max hourly mean (Raw)	34			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government objectives and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.9 Muirtown Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.29 below.

Table 6.29 – Muirtown Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
MT1	5.4	Missing	12.5	*	**7.2
MT2	15.3	16.1	19.1	17.0	11.7
MT3	Missing	Missing	19.1	*	**15.5
MT4	15.7	17.2	19.3	17.5	12.1
MT5	16.3	17.3	18.8	17.6	12.1

*The Diffusion Tube Data Processing Tool used by DEFRA will not calculate an average or bias adjusted and annualised figure for datasets of < three calendar months.

**Author calculated average with 0.81 bias based on calculated Central Primary factor applied.

The Muirtown Zephyr® data for the period operational between 01/02/24 - 07/03/24 (excluding 12/02/2024-16/02/2024 due to no records) is summarised in Table 6.30 below.

Table 6.30 – Muirtown Zephyr® Data, Average 1hr, in (µg/m³)

	Muirtown Zephyr® Data (Z585)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	14	3	6	40	10	18
Average Mon-Fri, 9am-4pm	17	3	5			
Max 24hr mean			15			50
Max hourly mean	65			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.2.10 Rosebank Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.31 below.

Table 6.31 – Rosebank Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2023 (µg/m ³)	NO ₂ Oct 2023 (µg/m ³)	NO ₂ Nov 2023 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
RB1	15.1	16.9	23.6	18.9	13.0
RB2	14.0	22.7	22.4	19.9	13.7
RB3	5.6	9.1	16.2	10.7	7.4
RB4	6.8	9.7	15.4	11.0	7.6
RB5	7.0	7.9	13.5	9.8	6.8

The Rosebank Zephyr® data for the period operational between 08/09/23 - 07/01/24 (excluding 24/10/2023 –07/11/2023 and 11/12/2023-30/12/2023 due to intermittent records) is summarised in Table 6.32 below.

Table 6.32 – Rosebank Zephyr® Data, Average 1hr, in (µg/m³)

	Rosebank Zephyr® Data (Z506)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	9	7	8	40	10	18
Average Mon-Fri, 9am-4pm	12	7	8			
Max 24hr mean			23			50
Max hourly mean	54			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were well below current Scottish Government targets and the school was advised as such, and no further monitoring is considered necessary at this time.

6.3 2024/25 School Monitoring Results Detail

6.3.1 Cauldeen Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.33 below.

Table 6.33– Cauldeen Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2024 (µg/m ³)	NO ₂ Oct 2024 (µg/m ³)	NO ₂ Nov 2024 (µg/m ³)	NO ₂ Dec 2024 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
CDP1	5.1	5.6	7.6	5.1	5.8	3.9
CDP2	5.7	6.3	7.1	4.7	5.9	3.9
CDP3	6.4	7.1	8.6	5.6	6.9	4.6
CDP4	6.0	5.5	Missing	4.6	5.3	4.0
CDP5	6.7	7.0	9.2	5.8	7.2	4.8

The Cauldeen Zephyr[®] data for the period operational between 14/11/24 - 23/11/24 is summarised in Table 6.34 below. The monitoring period was reduced from planned due to equipment damage leading to failure.

Table 6.34 – Cauldeen Zephyr[®] Data, Average 1hr, in (µg/m³)

	Cauldeen Zephyr [®] Data (Z442)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	18	2	4	40	10	18
Average Mon-Fri, 9am-4pm	18	1	4			
Max 24hr mean			7			50
Max hourly mean	48			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the schools were advised as such, and no further monitoring is considered necessary at this time.

6.3.2 Drakies Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.35 below.

Table 6.35– Drakies Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2024 (µg/m ³)	NO ₂ Oct 2024 (µg/m ³)	NO ₂ Nov 2024 (µg/m ³)	NO ₂ Dec 2024 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
DRP1	10.9	9.3	12.2	6.7	9.8	6.5
DRP2	5.9	6.7	8.2	5.0	6.4	4.3
DRP3	5.6	5.4	8.4	5.6	6.2	4.1
DRP4	6.2	7.0	8.0	4.8	6.5	4.3
DRP5	9.1	9.7	11.0	8.5	9.6	6.4

The Drakies Zephyr® data for the period operational between 09/09/24 - 12/12/24 is summarised in Table 6.36 below.

Table 6.36 – Drakies Zephyr® Data, Average 1hr, in (µg/m³)

	Drakies Zephyr® Data (Z585)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	17	3	6	40	10	18
Average Mon-Fri, 9am-4pm	18	3	5			
Max 24hr mean (Raw)			18			50
Max hourly mean (Raw)	80			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the schools were advised as such, and no further monitoring is considered necessary at this time.

6.3.3 Duncan Forbes Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.37 below.

Table 6.37– Duncan Forbes Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2024 (µg/m ³)	NO ₂ Oct 2024 (µg/m ³)	NO ₂ Nov 2024 (µg/m ³)	NO ₂ Dec 2024 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
DFP1	4.9	5.6	7.9	6.1	6.1	4.1
DFP2	4.9	5.4	7.8	6.0	6.0	4.0
DFP3	4.8	6.4	8.3	6.2	6.4	4.3
DFP4	4.8	Missing	7.5	6.7	6.3	4.0
DFP5	4.8	5.9	8.1	5.4	6.0	4.0

The Duncan Forbes Zephyr® data for the period operational between 04/10/24 - 12/12/24 is summarised in Table 6.38 below.

Table 6.38 – Duncan Forbes Zephyr® Data, Average 1hr, in (µg/m³)

	Duncan Forbes Zephyr® Data (Z647)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	4	6	6	40	10	18
Average Mon-Fri, 9am-4pm	6	5	6			
Max 24hr mean (Raw)			14			50
Max hourly mean (Raw)	17			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the schools were advised as such, and no further monitoring is considered necessary at this time.

6.3.4 Inshes Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.39 below.

Table 6.39 – Inshes Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2024 (µg/m ³)	NO ₂ Oct 2024 (µg/m ³)	NO ₂ Nov 2024 (µg/m ³)	NO ₂ Dec 2024 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
INP1	7.0	Missing	Missing	6.0	6.5	5.3
INP2	7.6	5.9	8.1	5.7	6.8	4.5
INP3	Missing	6.9	9.8	6.7	7.8	4.7
INP4	5.9	4.6	6.1	4.6	5.3	3.5
INP5	5.6	5.0	7.4	5.0	5.8	3.8

The Inshes Zephyr[®] data for the period operational between 04/09/24 - 14/11/24 is summarised in Table 6.40 below.

Table 6.40 – Inshes[®] Zephyr Data, Average 1hr, in (µg/m³)

	Inshes Zephyr [®] Data (Z442)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	17	3	5	40	10	18
Average Mon-Fri, 9am-4pm	17	2	5			
Max 24hr mean (Raw)			18			50
Max hourly mean (Raw)	57			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the schools were advised as such, and no further monitoring is considered necessary at this time.

6.3.5 Kinmylies Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.41 below.

Table 6.41 – Kinmylies Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2024 (µg/m ³)	NO ₂ Oct 2024 (µg/m ³)	NO ₂ Nov 2024 (µg/m ³)	NO ₂ Dec 2024 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
KM1	5.8	6.6	9.5	6.2	7.0	4.7
KM2	7.0	8.9	9.6	6.2	7.9	5.3
KM3	6.6	8.0	10.6	6.1	7.8	5.2
KM4	5.7	7.0	8.2	5.3	6.5	4.3
KM5	5.2	6.0	7.7	5.6	6.1	4.1

The Kinmylies Zephyr® data for the period operational between 04/10/24 - 12/12/24 is summarised in Table 6.42 below.

Table 6.42 – Kinmylies Zephyr® Data, Average 1hr, in (µg/m³)

	Kinmylies Zephyr® Data (Z506)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	14	2	4	40	10	18
Average Mon-Fri, 9am-4pm	16	2	4			
Max 24hr mean (Raw)			12			50
Max hourly mean (Raw)	52			200		

All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the schools were advised as such, and no further monitoring is considered necessary at this time.

6.3.6 Lochardil Primary

The nitrogen dioxide passive diffusion tube monitoring data is summarised in Table 6.43 below.

Table 6.43 – Lochardil Primary Passive Diffusion Tube Data

Location	NO ₂ Sep 2024 (µg/m ³)	NO ₂ Oct 2024 (µg/m ³)	NO ₂ Nov 2024 (µg/m ³)	NO ₂ Dec 2024 (µg/m ³)	NO ₂ Time Adjusted Raw data average (µg/m ³)	NO ₂ Time & Bias Adjusted (0.81) and Annualised (µg/m ³)
LOP1	4.3	5.0	6.7	4.5	5.1	3.4
LOP2	4.6	5.2	5.8	4.2	5.0	3.3
LOP3	5.0	4.9	5.9	4.2	5.0	3.3
LOP4	4.3	5.2	6.7	4.3	5.1	3.4
LOP5	4.2	5.2	6.1	4.2	4.9	3.3

The Lochardil Zephyr[®] data for the period operational between 09/09/24 - 12/12/24, is summarised in Table 6.44 below.

Table 6.44 – Lochardil Zephyr[®] Data, Average 1hr, in (µg/m³)

	Lochardil Zephyr [®] Data (Z481)			Scottish Objective		
	NO ₂	PM _{2.5}	PM ₁₀	NO ₂	PM _{2.5}	PM ₁₀
Raw data average	11	3	6	40	10	18
Average Mon-Fri, 9am-4pm	10	2	4			
Max 24hr mean (Raw)			18			50
Max hourly mean (Raw)	52			200		

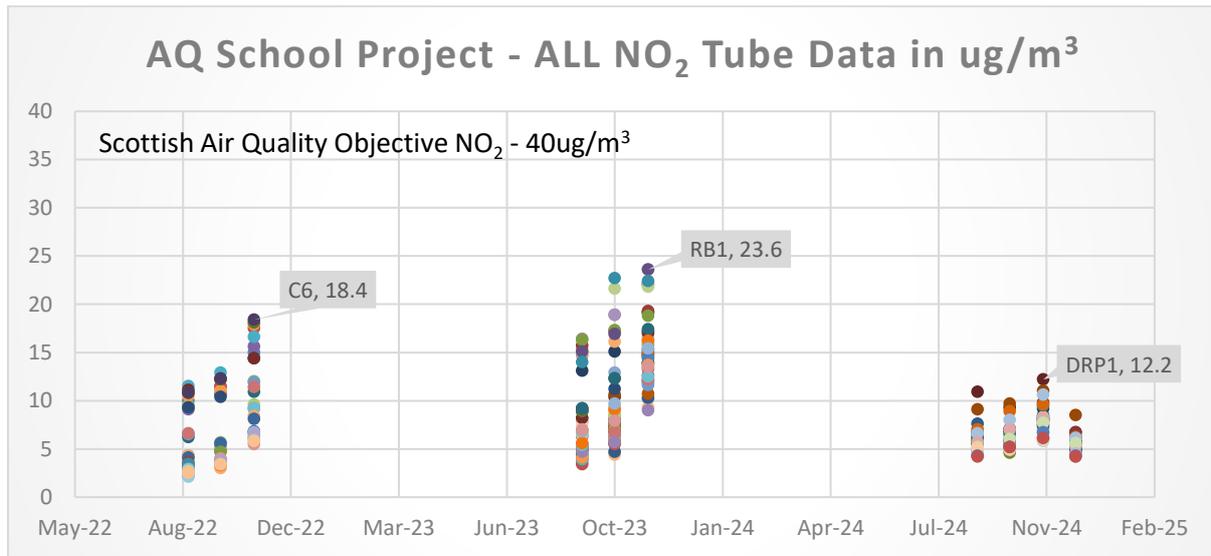
All parameters monitored (NO₂, PM_{2.5} and PM₁₀) were below current Scottish Government objectives and the schools were advised as such, and no further monitoring is considered necessary at this time.

7 Conclusions

7.1 Nitrogen Dioxide

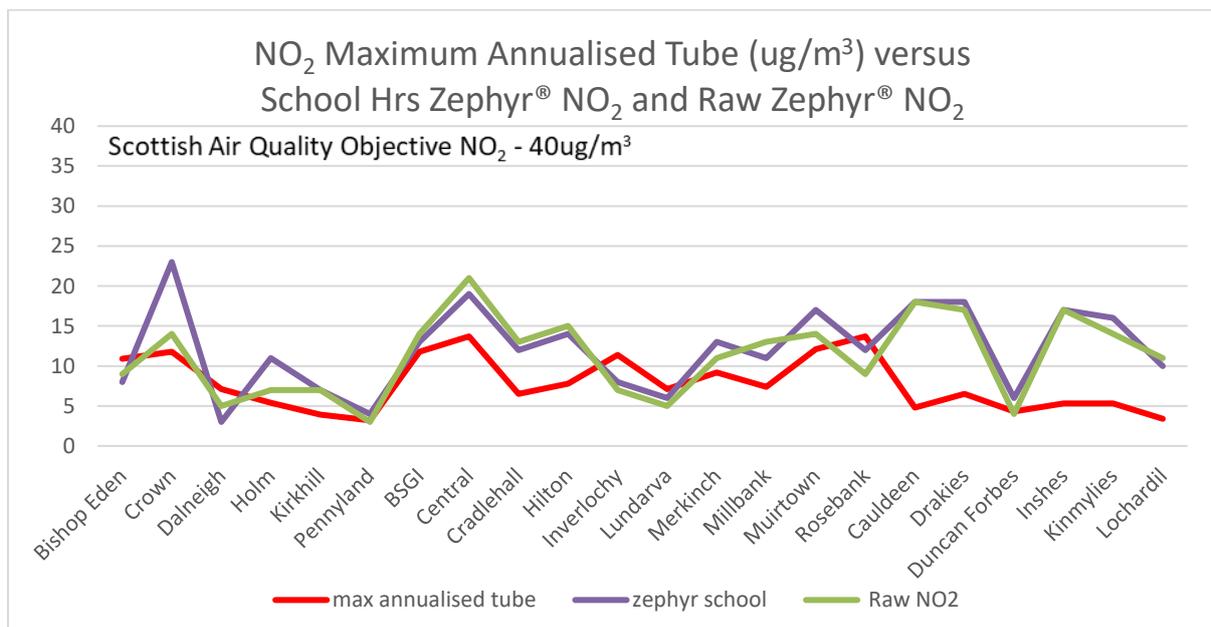
The passive diffusion tube data for each location confirmed that there are no exceedances of the Scottish annual air quality objective of 40 $\mu\text{g}/\text{m}^3$ nitrogen dioxide at any monitoring location, with 98% (332/340) of the readings recorded under half the objective.

Figure 7.1.1 - All NO₂ Diffusion Tube Results in $\mu\text{g}/\text{m}^3$



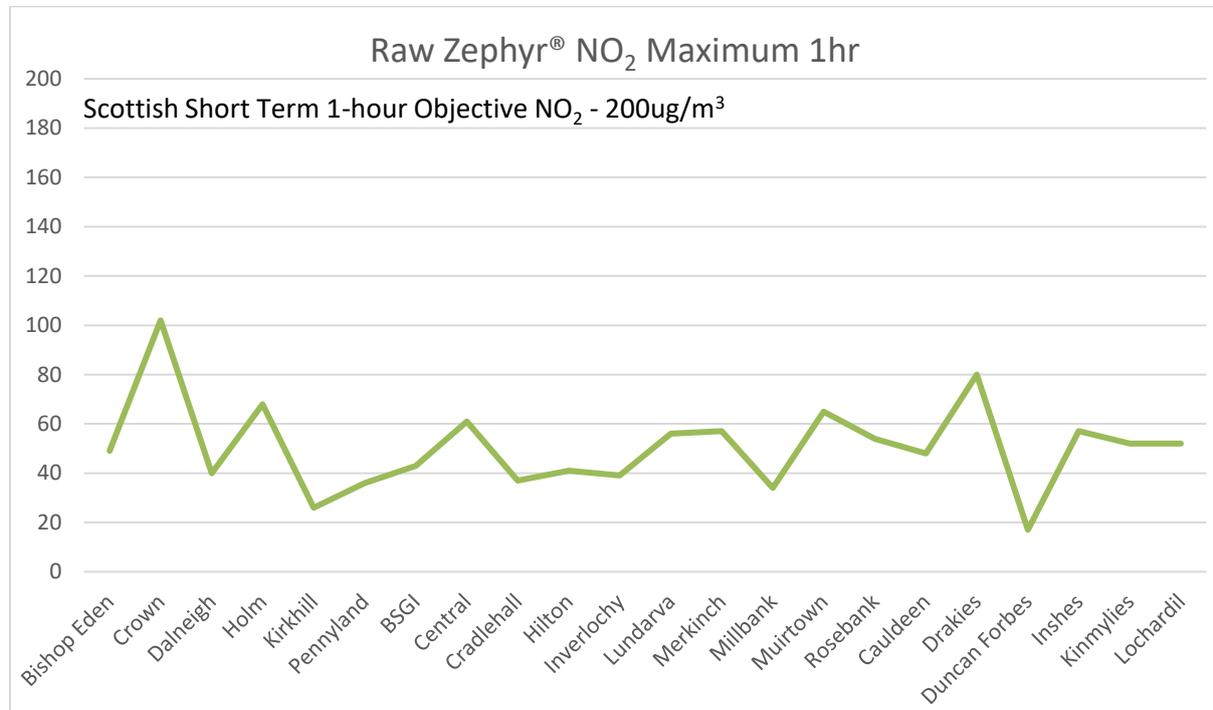
The Zephyr[®] data from each school, although reading higher in value in most cases, generally had a good trend agreement with the maximum diffusion tube data for each site, see below.

Figure 7.1.2 – Maximum NO₂ Tube per location correlation with Zephyr Unit Data



The mean nitrogen dioxide concentration Zephyr® data also did not exceed the Scottish annual air quality objective and in addition, the Scottish 1-hour short term objective of 200 µg/m³ was not exceeded at any location.

Figure 7.1.3 – Zephyr Unit Maximum NO₂ Short Term Objective Data



The school which had the highest concentrations of nitrogen dioxide in year 2022/23 was Crown Primary which was expected given its urban location within the centre of Inverness, and proximity to Kingmills Road. It was notable that calculations from the Zephyr® indicated that the school time air quality, calculated to be Monday-Friday 9am-4pm, had a higher concentration of nitrogen dioxide than the annualised air quality using the diffusion tubes. However, there were still no exceedance of the Scottish annual air quality objective or short term one hour objective.

Since completion of the School Project monitoring at Crown Primary in 2023, four additional diffusion tube locations have been added to the monthly monitoring rounds reported in the Council Air Quality Management Strategy (AQMS), Annual Progress Report (APR) [Measuring air quality | Pollution | The Highland Council](#) published on the Council webpage. Locations IV22A, IV22B, IV22C and IV22D are located to monitor the main Kingsmills/Southside Rd junction. Their annual average results reported in the 2023 APR were 11.3, 10.8, 9.5, and 9.4 µg/m³ respectively, which do not exceed the Scottish annual air quality objective of 40 µg/m³.

The schools which had the highest concentrations of nitrogen dioxide in year 2023/24 were Central and Rosebank Primaries which was also expected given their respective locations within the centre of Inverness in close proximity to the Kenneth/Tomnahurich St junction;

and centre of Nairn and location adjacent to the busy Academy Street (A96). No additional long term monitoring was recommended at either of these locations as both locations have been previously monitored and not found to be an ongoing concern, or are continued to be monitored below the objective, as part of the Council annual air quality APR reporting, linked above.

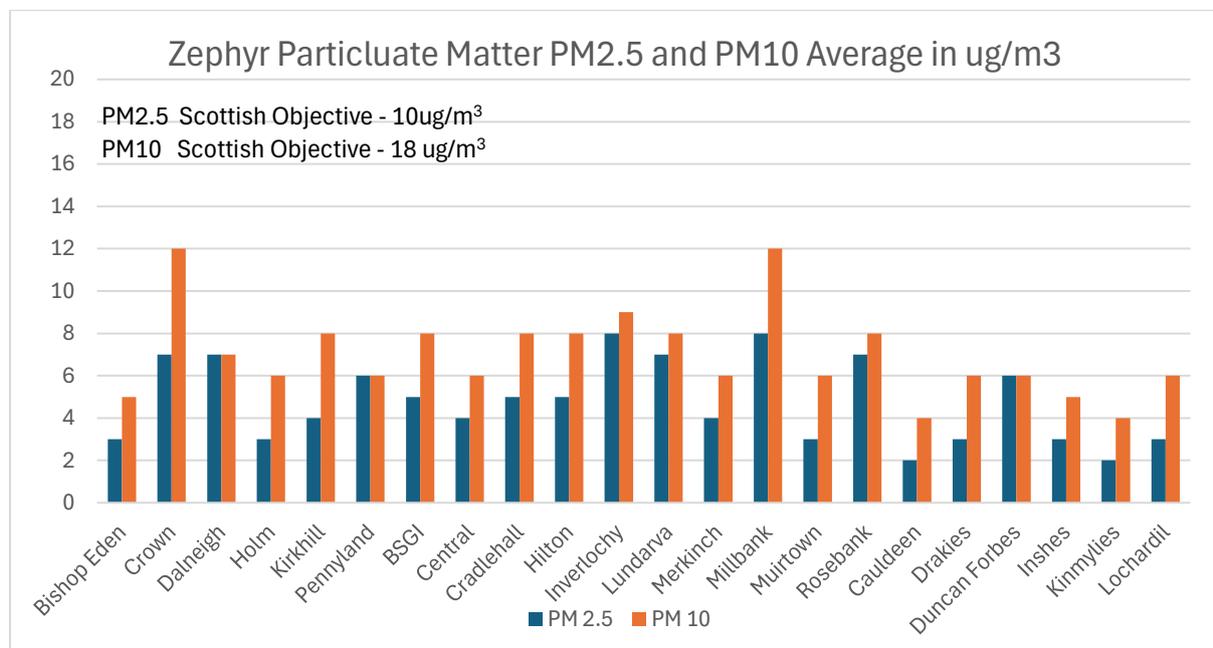
The school which had the highest concentration of nitrogen dioxide in year 2024/25 of the project was Drakies Primary. However, with the maximum tube annualised average being less than a quarter of the Scottish objective no further monitoring is considered necessary. Officers noted a gas leak was under investigation near the Drakies Primary Zephyr location during the monitoring period and the repair works may have temporarily altered the recordings from a more typical background level.

NOTE: The maximum NO₂ tube results in year 2024/25 being lower than previous years suggests the prioritisation calculation used to order the school visits had some value for NO₂ monitoring.

7.2 Particulates

Although indicative only, the Zephyr® data mean PM10 and PM2.5 at each school location did not exceed the Scottish Annual Air Quality Objectives.

Figure 7.2.1 – Zephyr Unit Particulate Matter Data, all Schools.



7.3 School Awareness Raising Conclusions

Twenty-two primary schools have taken part in the awareness raising project, with presentations delivered to P6/7 classes of approximately 25 pupils per visit, and two schools opting to present to entire year groups (P5/P6/P7). The approximate number of second stage P5-7 children and staff reached is estimated to be 700+.

Overall children were found to be interested in the subject, many raising their own health concerns regarding air quality; and some were keen to think of ideas to help alleviate the problem.

The graphical outputs of the EarthSense Zephyr® data and the live web-based portal allow for a better understanding of daily air quality cycles at drop-off and pick-up times; however, with the known exception of two schools this data may not have been independently used by the schools. Interaction with and manipulation of the real-time Zephyr® data using the EarthSense website, via the Council login to date has been restricted to staff supervision due to the complexity and potential for changing settings.

In 2024/25 EarthSense has added to their portal layout, and the development of a Highland Council live 'view only' output screen if undertaken, could enable the children to view their local data including weather without the need for such close staff supervision. Such a step would require software development costs, but if undertaken could potentially provide a web-based output that would enable greater engagement in the schools and with the wider public. A 'view only' dashboard could also be utilised to raise anti-idling awareness across other populations in Highland such as public screens at population centres or at events such as clean air day; as well as on the Council website.

NOTE: At present the public can only access measured air quality data in Highland online via the Scottish Air Quality web portal [Home page | Scottish Air Quality](#), which streams the fixed monitoring information from AURN and the AQMA units in Inverness Telford (NO_x and PM), Inverness Queensgate (NO_x), and AURN units in Fort William (NO_x, O₃) and Strathvaich (O₃).

8 Consideration of 'FUTURE' Air Quality Objectives

8.1 WHO 2021 Air Quality Guidelines (AQG)

The World Health Organization (World Health Organization, 2021) published updated global Air Quality Guidelines for certain pollutants, recognising the evidence of negative impacts to health from lower concentrations than previously understood. These recommended Air Quality Guideline (AQG) Levels and interim targets are shown in the **Table 8.1** below:

Pollutant	Averaging time	Interim target				WHO (2021) AQG level
		1	2	3	4	
NO ₂ , µg/m ³	Annual mean	40	30	20	-	10
	24-hour ^a	120	50	-	-	25
PM ₁₀ , µg/m ³	Annual mean	70	50	30	20	15
	24-hour ^a	150	100	75	50	45
PM _{2.5} , µg/m ³	Annual mean	35	25	15	10	5
	24-hour ^a	75	50	37.5	25	15
O ₃ , µg/m ³	Peak Season ^b	100	70			60
	8-hour ^a	160	120			100

^a99th percentile (i.e. 3-4 exceedance days per year)

^bAverage of daily maximum 8-hour mean O₃ concentration in the six consecutive months, with the highest six-month running-average O₃ concentration.

As can be seen from the comparison table below, the World Health Organization AQGs are significantly **lower** than the current Scottish Objectives (see **Table 2.1**), particularly for nitrogen dioxide NO₂ and PM_{2.5}, see Table 8.2 below:

Table 8.2 Air Quality Standard Comparison Table

Pollutant		Current Air Quality Objective	Potential future more stringent standard WHO (2021) AQG Level
Nitrogen Dioxide (NO₂)	Annual mean	40 µg m ⁻³	10 µg m ⁻³
	1-hour mean	200 µg m ⁻³ not more than 18 times a year	25 µg m ⁻³
Particles (PM₁₀) (gravimetric)	Annual mean	18 µg m ⁻³	15 µg m ⁻³
	24 Hour mean	50 µg m ⁻³ , not more than 7 times a year	45 µg m ⁻³
Particles (PM_{2.5}) (gravimetric)	Annual mean	10 µg m ⁻³ (limit)	5 µg m ⁻³
Ozone	8 hourly running	100 µg m ⁻³ not more than 10 times a year	100 µg m ⁻³

8.2 EU Directive on ambient air quality and cleaner air for Europe

Following publication of the WHO 2021 Air Quality guidelines, the EU has revised the Ambient Air Quality Directives which date back to 2008. In April 2024, the EU (Council of the European Union, 2024) reached a provisional agreement to the standards, and the revised Ambient Air Quality Directive, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202402881 entered into force on the 10th December 2024. The revised directive aligns the 2030 EU air standards more closely with the recommendation of the World Health Organisation (WHO).

The limit values to be attained by 2030 for selected pollutants are shown in Table 8.3 below:

Table 8.3 EU Council limits values for selected pollutants to be met by 2030

Pollutant	Timeframe	Limit Value	Notes	Current Air Quality Objective
NO ₂ , µg/m ³	Year Annual Mean	20		40 µg m ⁻³
	Day	50	Not to be exceeded >18 times per year	
	Hour	200	Not to be exceeded >3 times per year	200 µg m ⁻³ not more than 18 times a year
PM ₁₀ , µg/m ³	Year Annual Mean	20		18 µg m ⁻³
	Day	45	Not to be exceeded >18 times per year	50 µg m ⁻³ , not more than 7 times a year
PM _{2.5} , µg/m ³	Year Annual Mean	10		10 µg m ⁻³ (limit)
	Day	25	Not to be exceeded >18 times per year	
Ozone, µg/m ³	Max daily 8hour mean	120	Not to be exceeded >18 times per year averaged over 3 years	100 µg m ⁻³ not more than 10 times a year

Additional standards were set for SO₂, Benzene, CO, Pb, As, Cd, Ni, B(a)P but are not considered in this report as not monitored using the equipment available.

The Scottish Government published updated local air quality management policy guidance PG(S)23 (Scottish Government, 2023) in which it reaffirmed the Scottish Government's commitment to maintain or exceed EU standards. It would therefore be reasonable to assume that the Scottish Government may in future amend the Air Quality Objectives to align with the proposed revised EU standards. Of most note for future planning is the potential reduction of the NO₂ annual average objective by half to 20µg/m³.

If that were to happen, it is worth noting that the NO₂ diffusion tube air quality information collated to date at all the primary schools monitored would achieve compliance for the new lower NO₂ proposed EU standard.

NOTE: Reliance on other parameter data collected via the Zephyr® Units, at present is trend only and not considered sufficient for such future standard comparison.

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Highland Council. (2024) Air Quality Management Strategy, Annual Progress Reporting. [Measuring air quality | Pollution | The Highland Council](#)

Appendix

Appendix A - School and Monitoring Location Plans

Appendix B – School Engagement Information

- Education Information Pack

- Example School Presentation

- Example School Worksheet

- School Engagement Feedback

- Newsletter Summary Sheet for each school

Appendix C – Monitoring Results

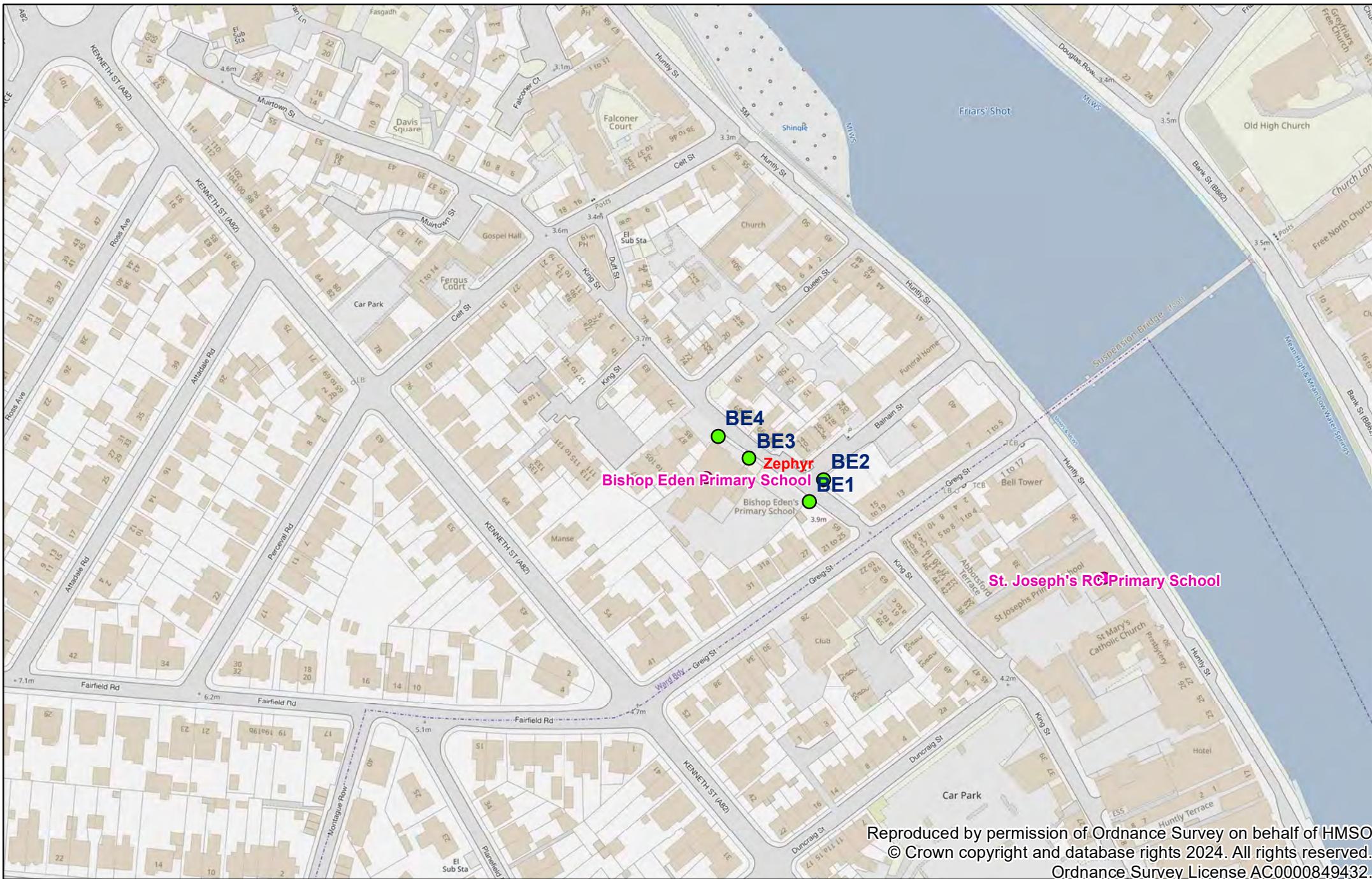
- Diffusion Tube laboratory Results

- Diffusion Tube Data Processing Tool Outputs

Appendix D – Zephyr® Calibration Certificates

Appendix A - School and Monitoring Location Plans





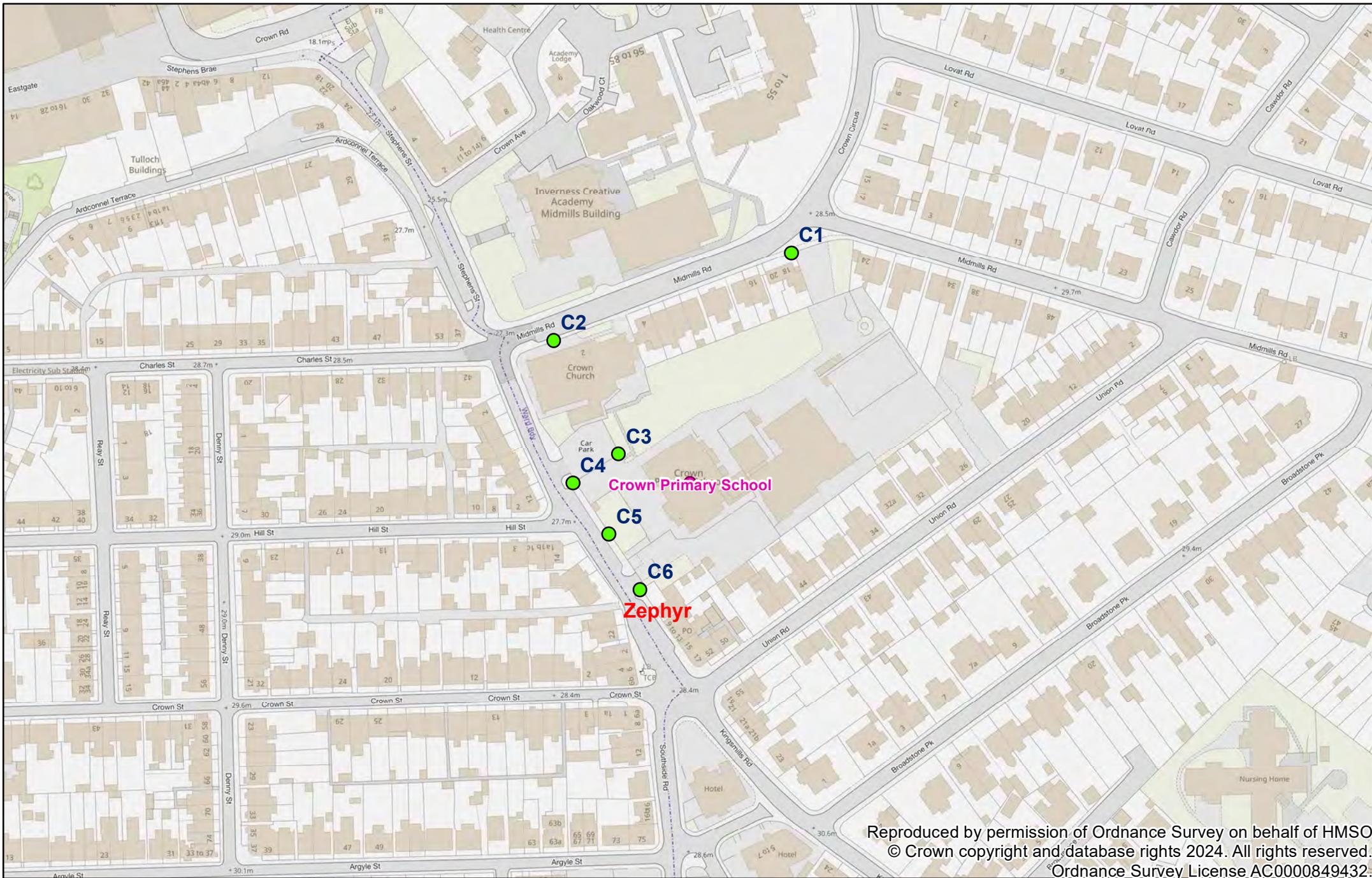
Bishop Eden AQ Tube Location 2022-2023

Date: 11/07/2024

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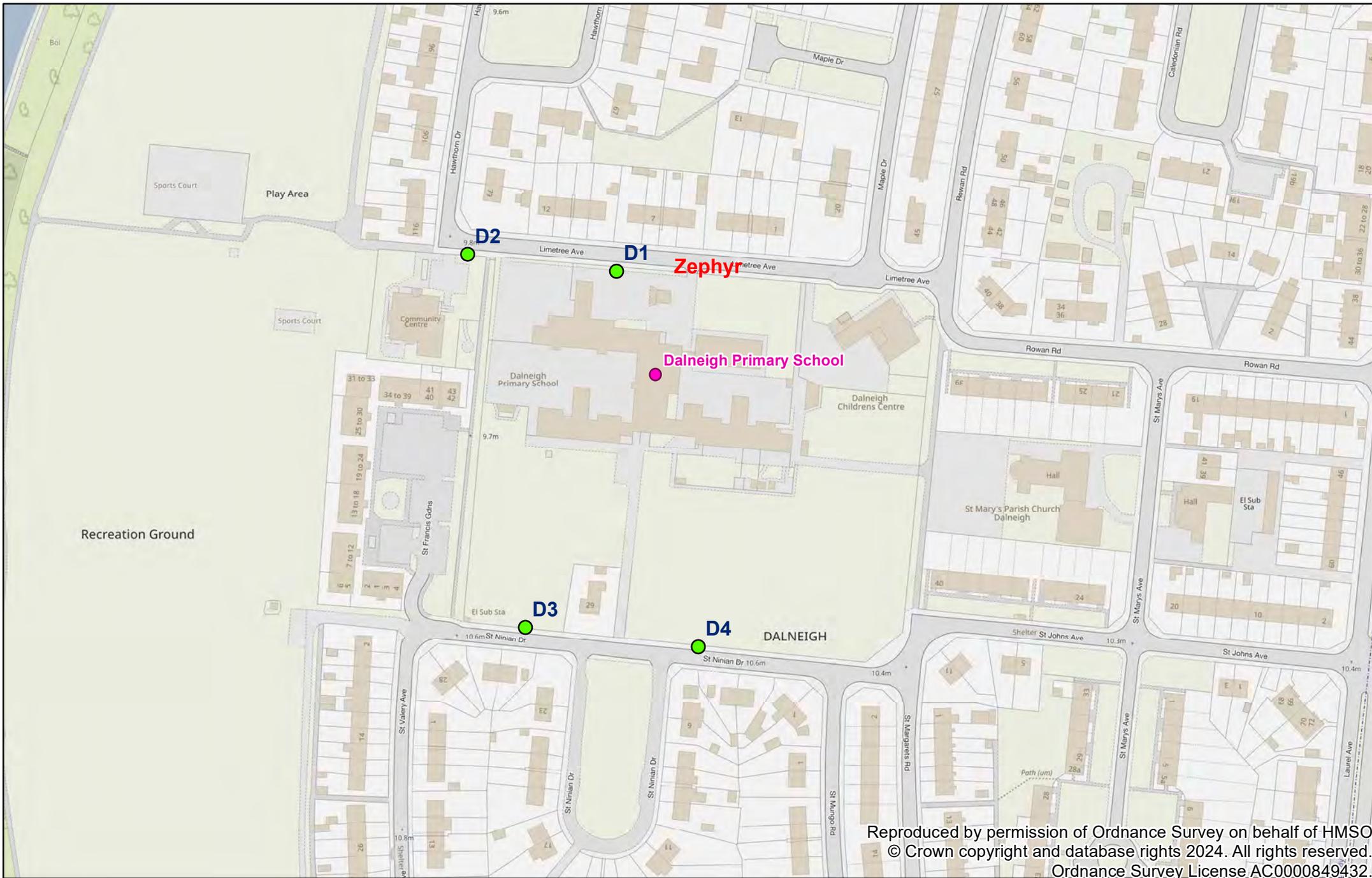
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Crown AQ Tube Location 2022-2023

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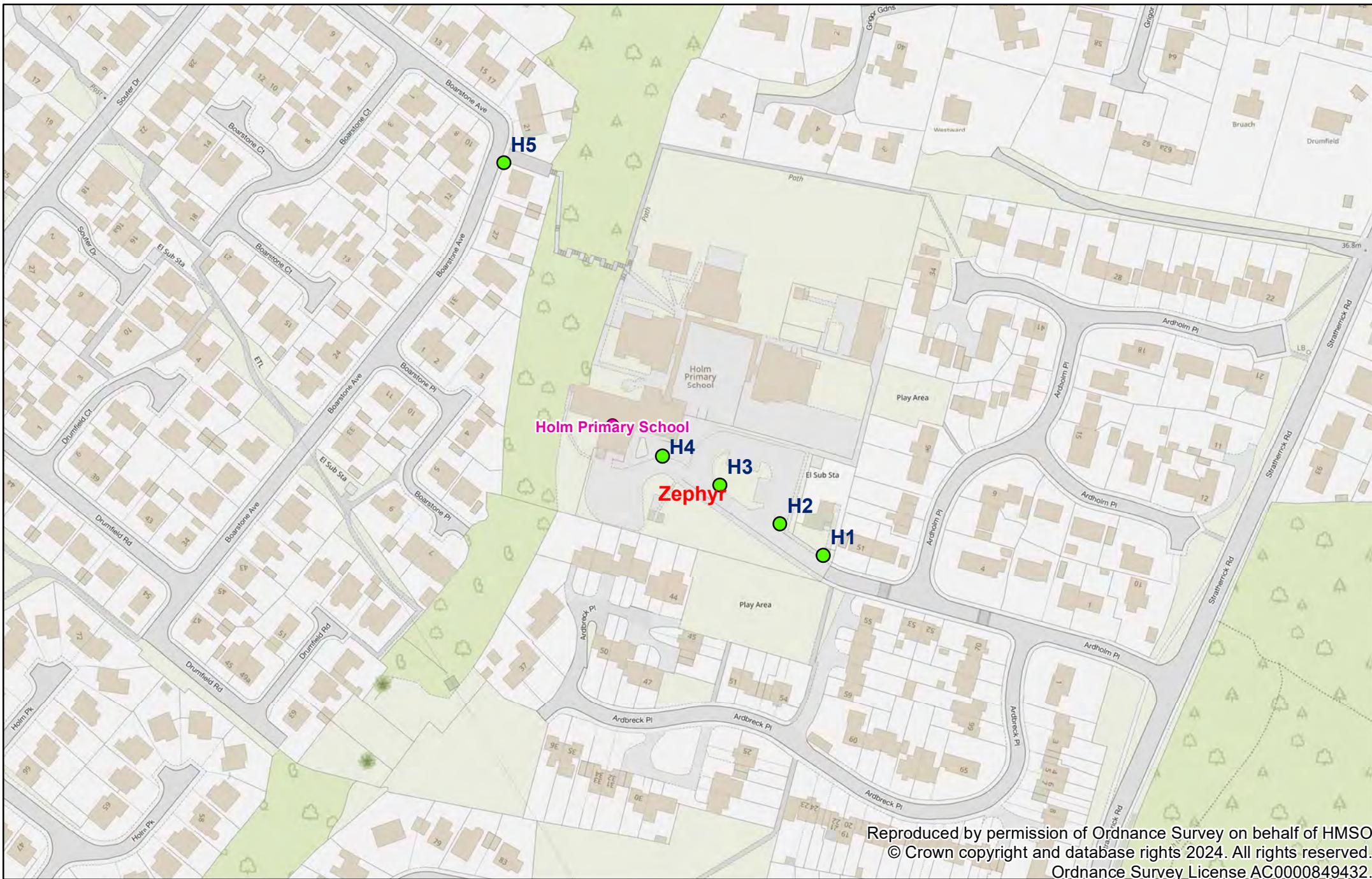
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Dalneigh Primary AQ Tube Location 2022-2023

Date:11/07/2024

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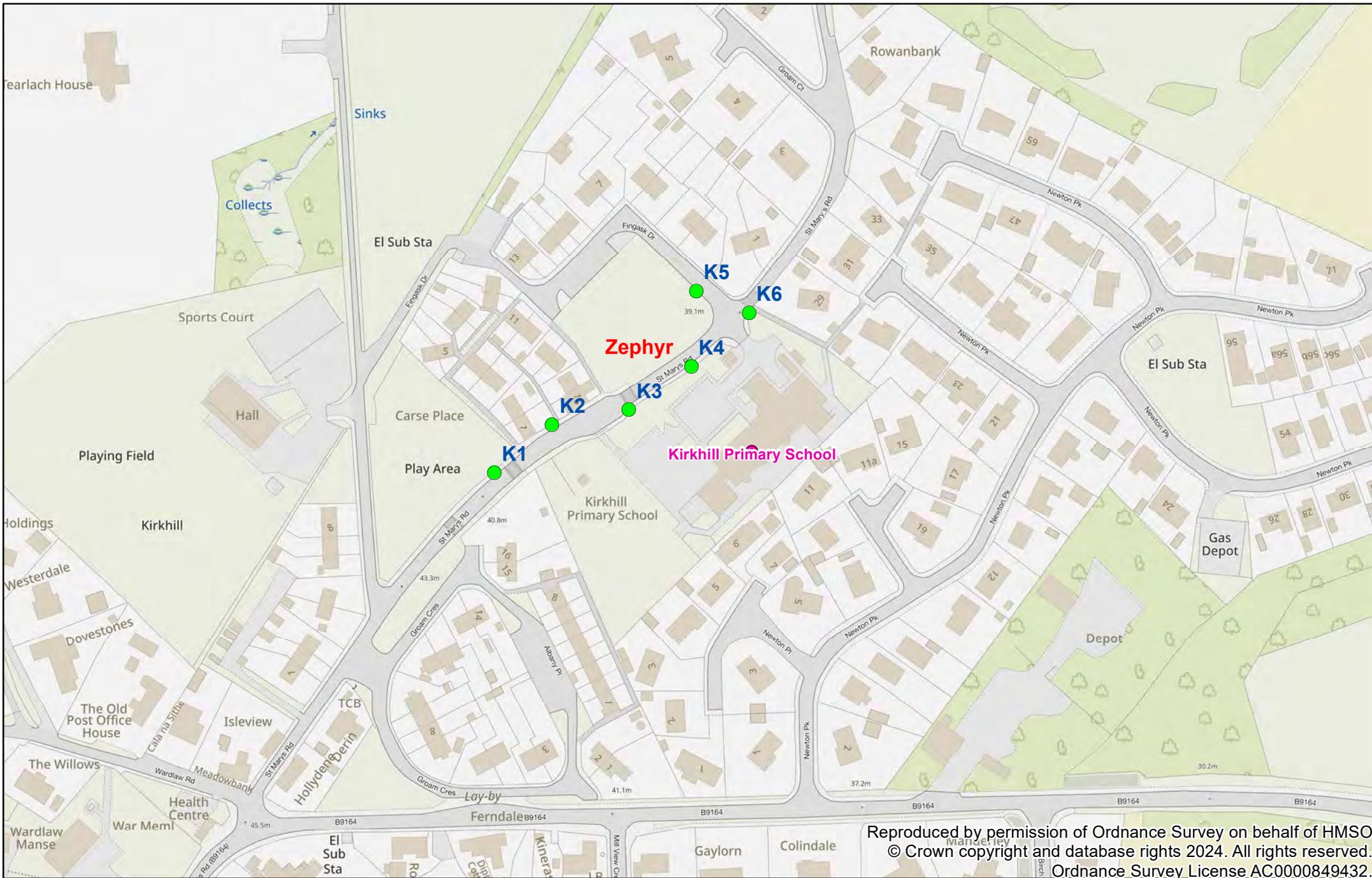


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Holm AQ Tube Location 2022-2023

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Kirkhill AQ Tube Location 2022-2023

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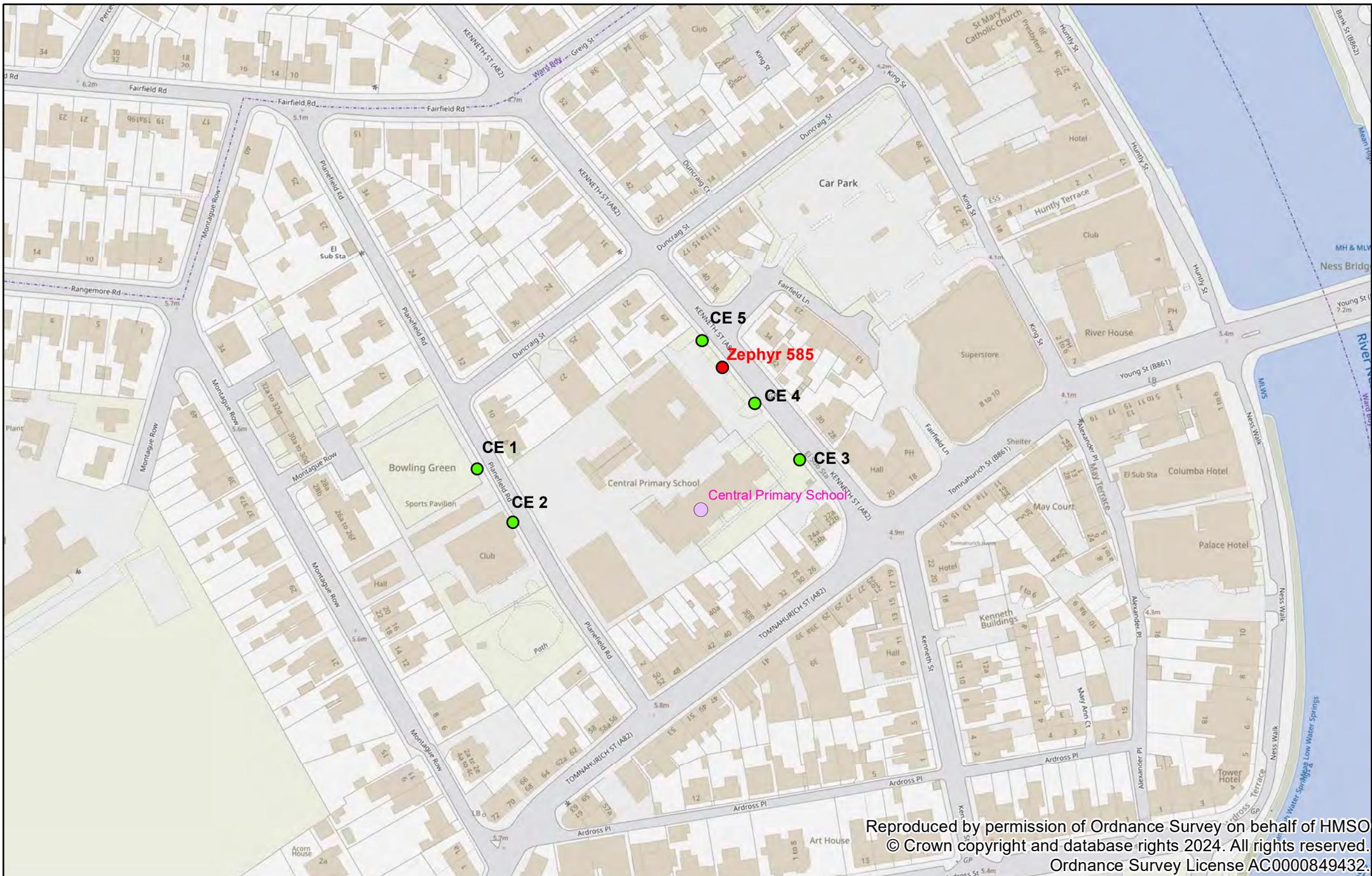
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Pennyland AQ Tube Location 2022-2023

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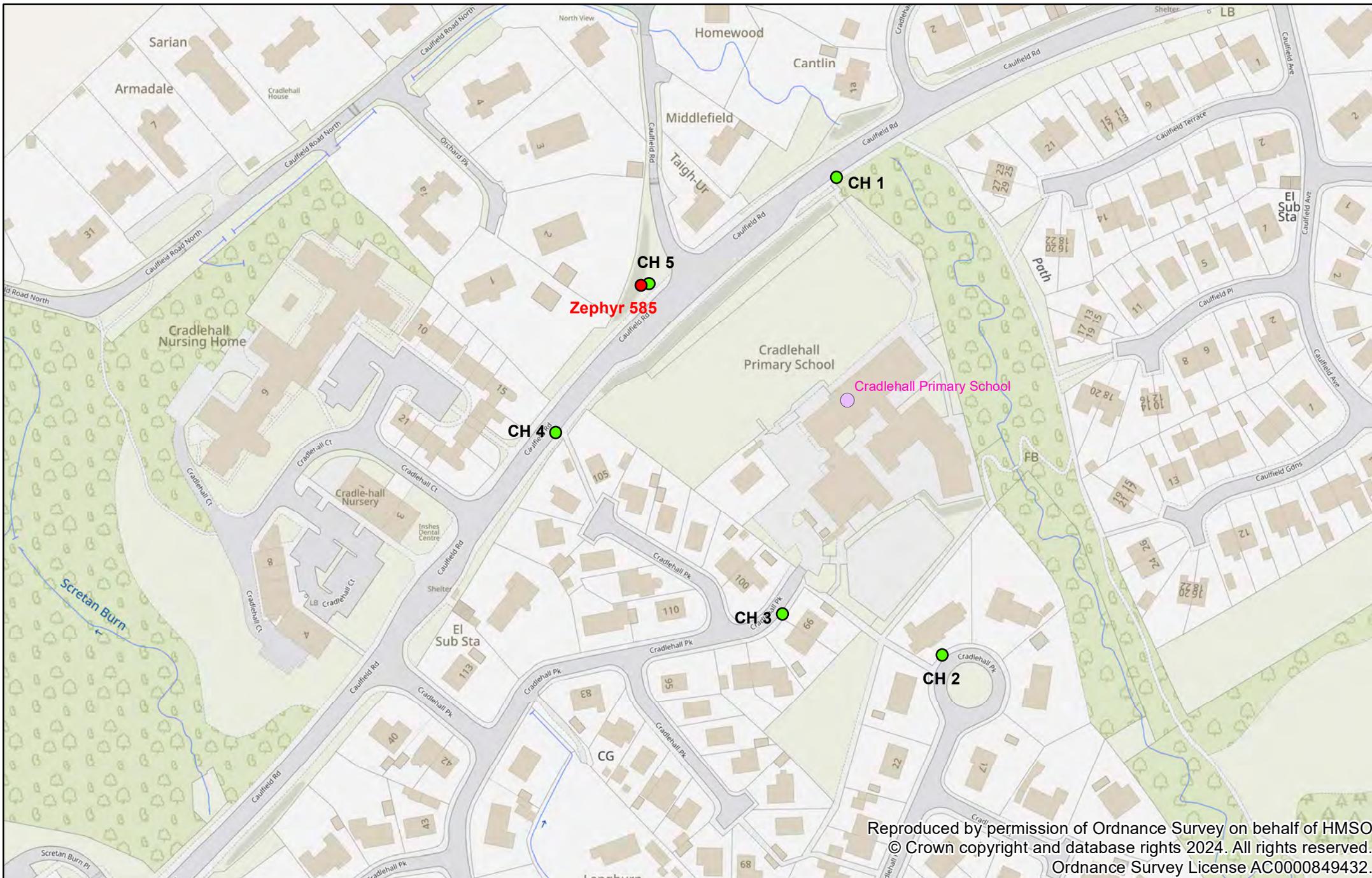
Central Primary AQ Tube Location Plan 2023-24

Date: 14/03/2025



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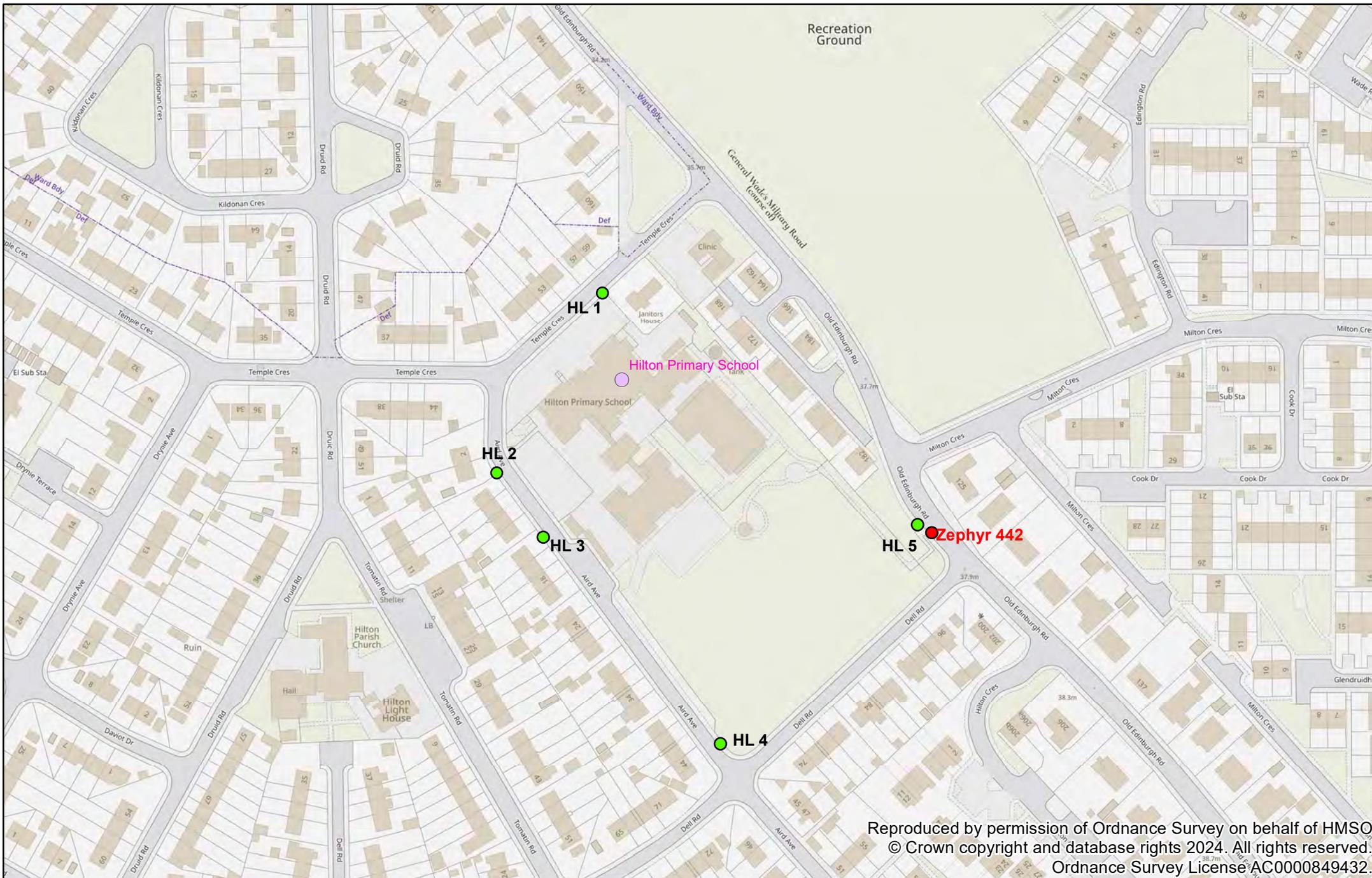
Cradlehall Primary AQ Tube Location Plan 2023-24

Date: 14/03/2025



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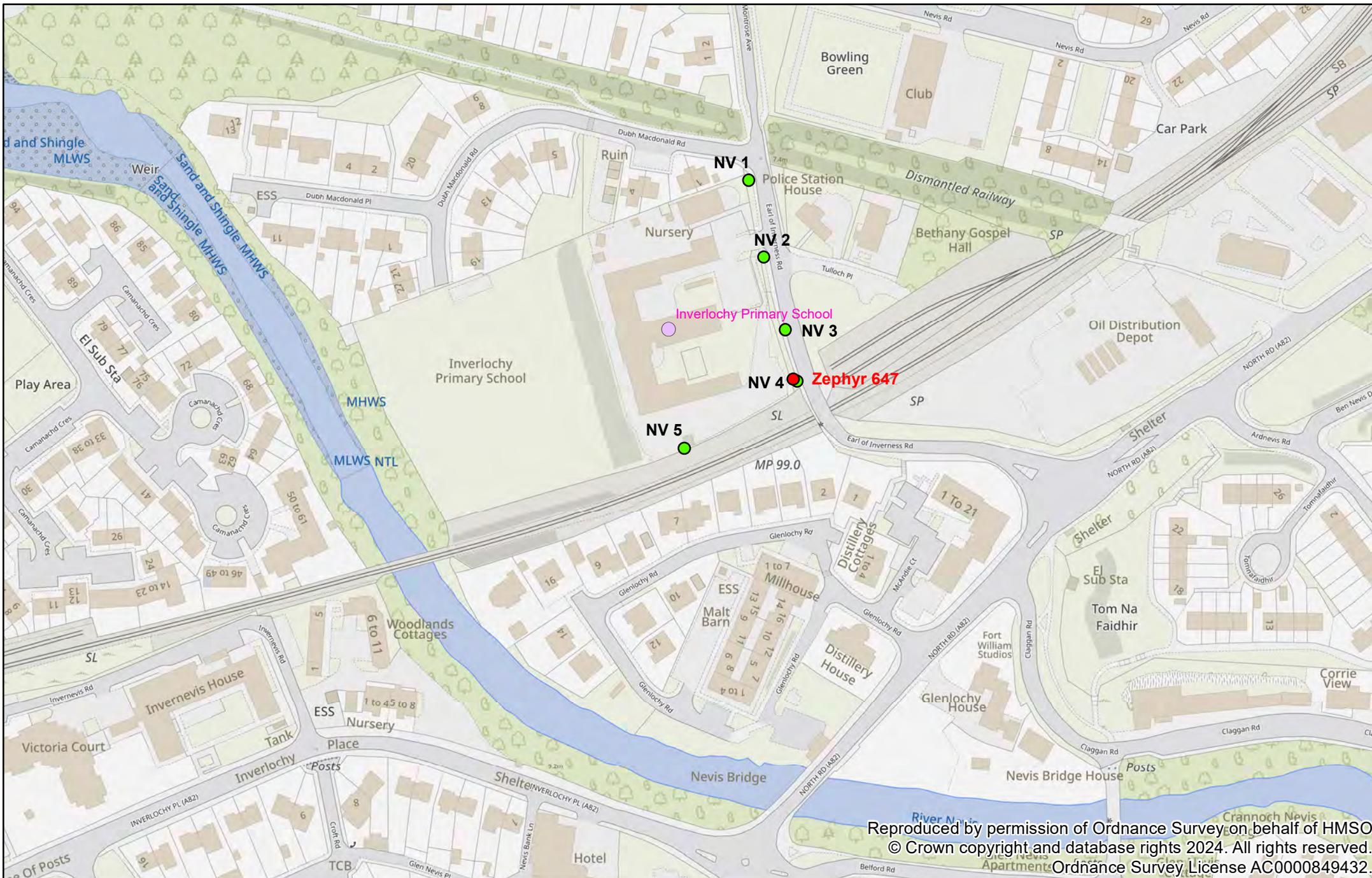
Hilton Primary AQ Tube Location Plan 2023-24

Date: 14/03/2025



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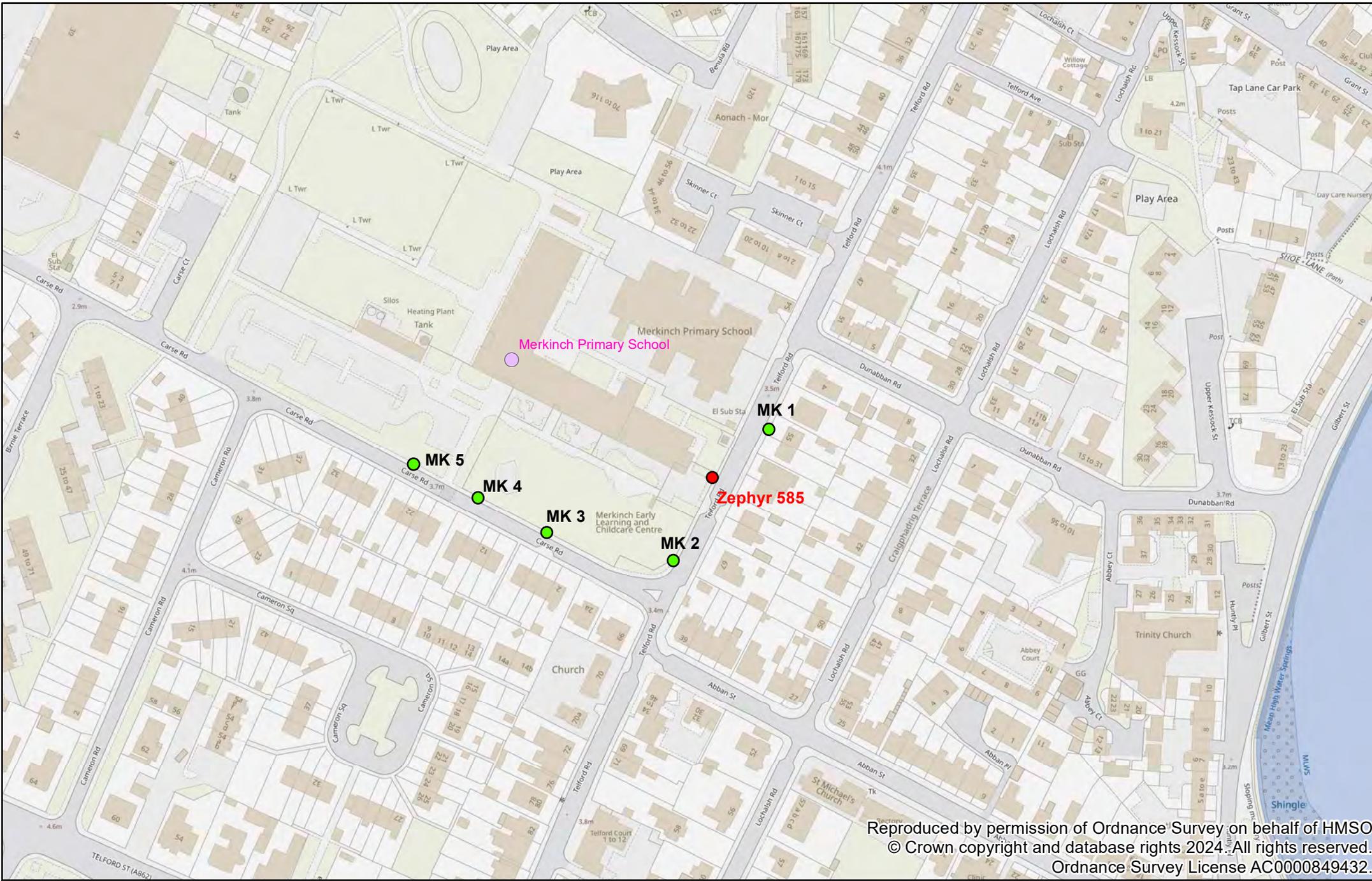
Inverlochy Primary AQ Tube Location Plan 2023-24

Date: 14/03/2025



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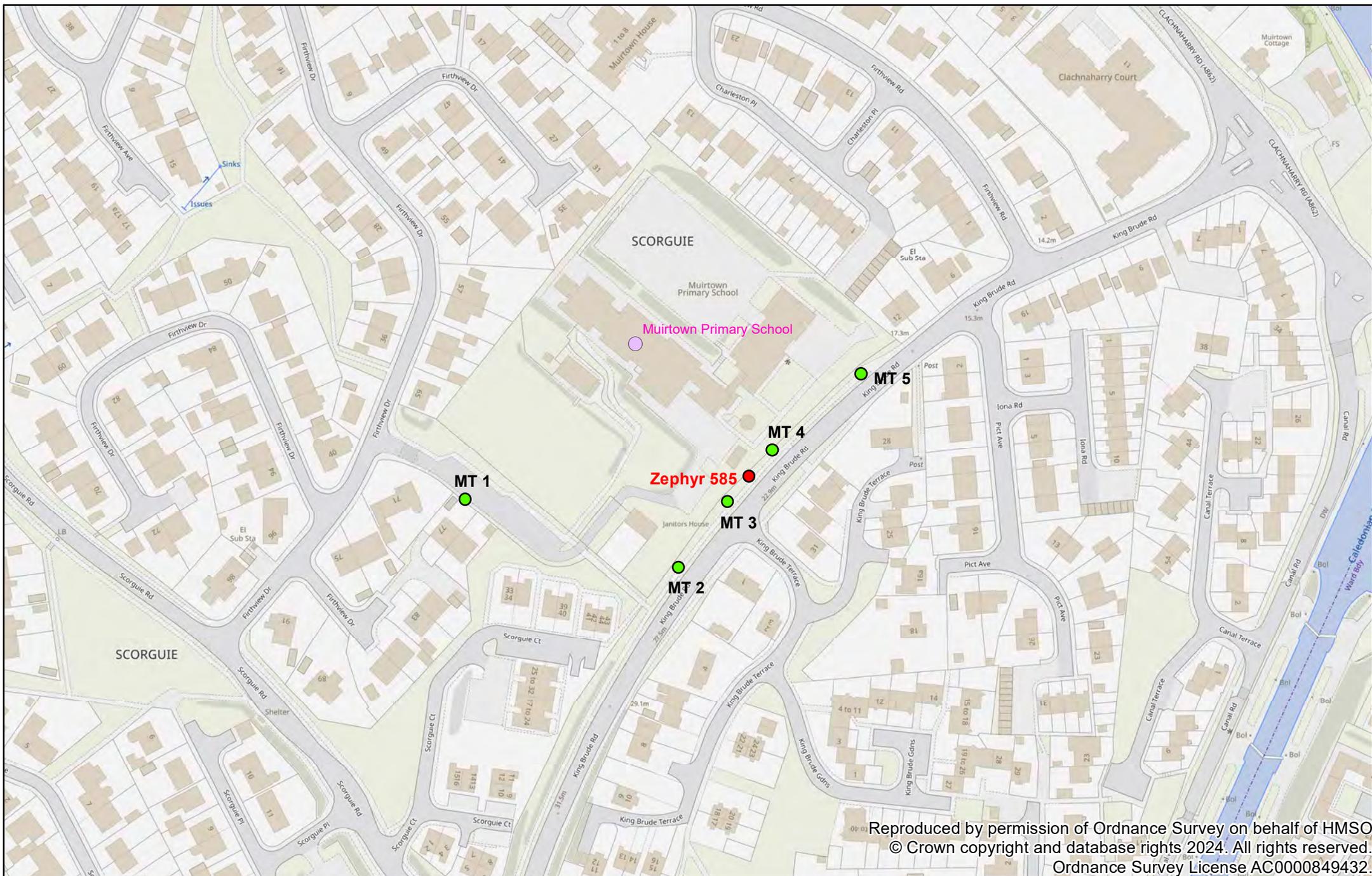
Merkinch Primary AQ Tube Location Plan 2023-24

Date: 14/03/2025



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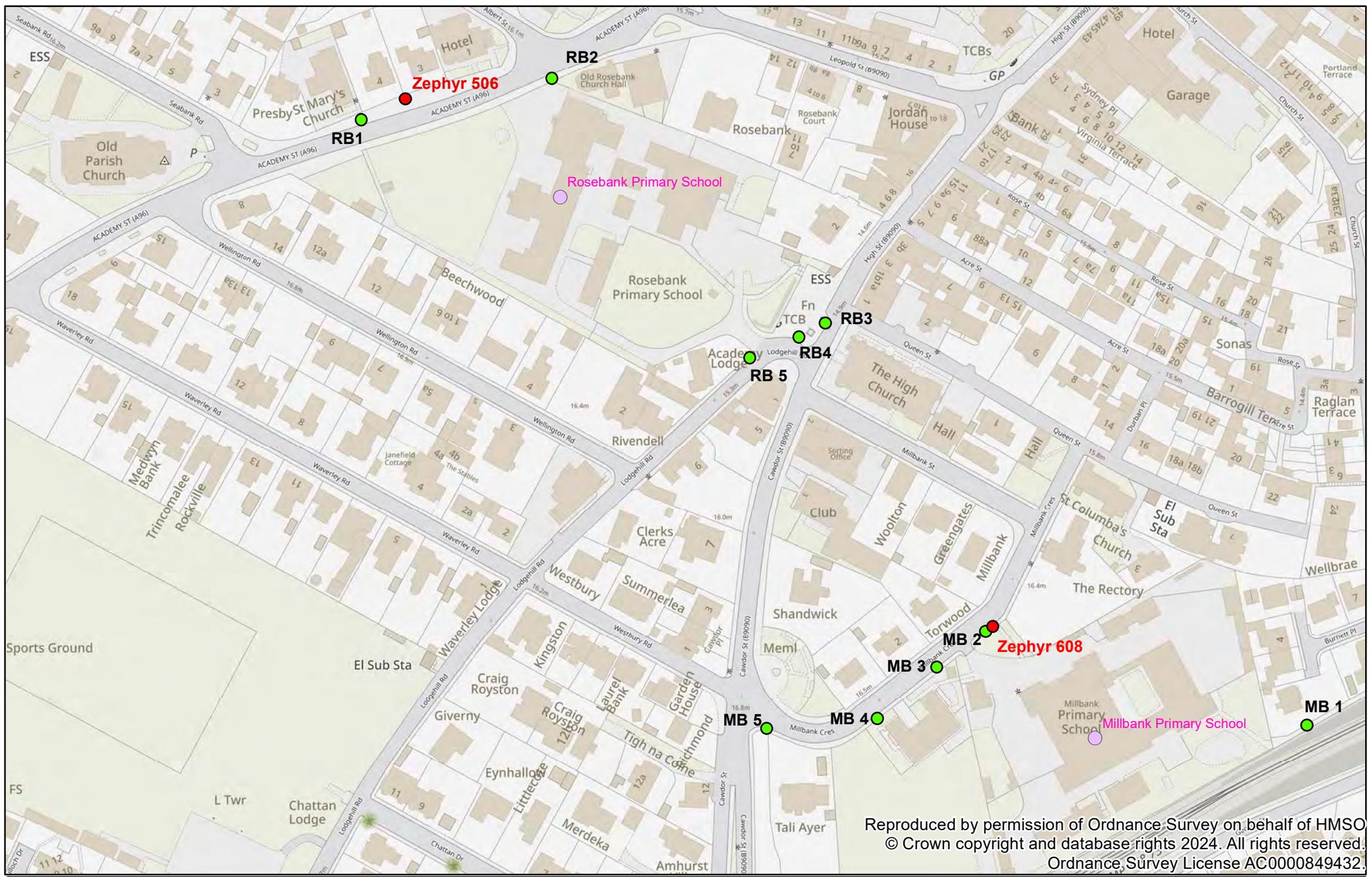
Muirtown Primary AQ Tube Location Plan 2023-24

Date: 14/03/2025



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Millbank and Rosebank AQ Tube Location Plan 2023-24

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Cauldeen Primary School 2024-25 Diffusion Tube Location



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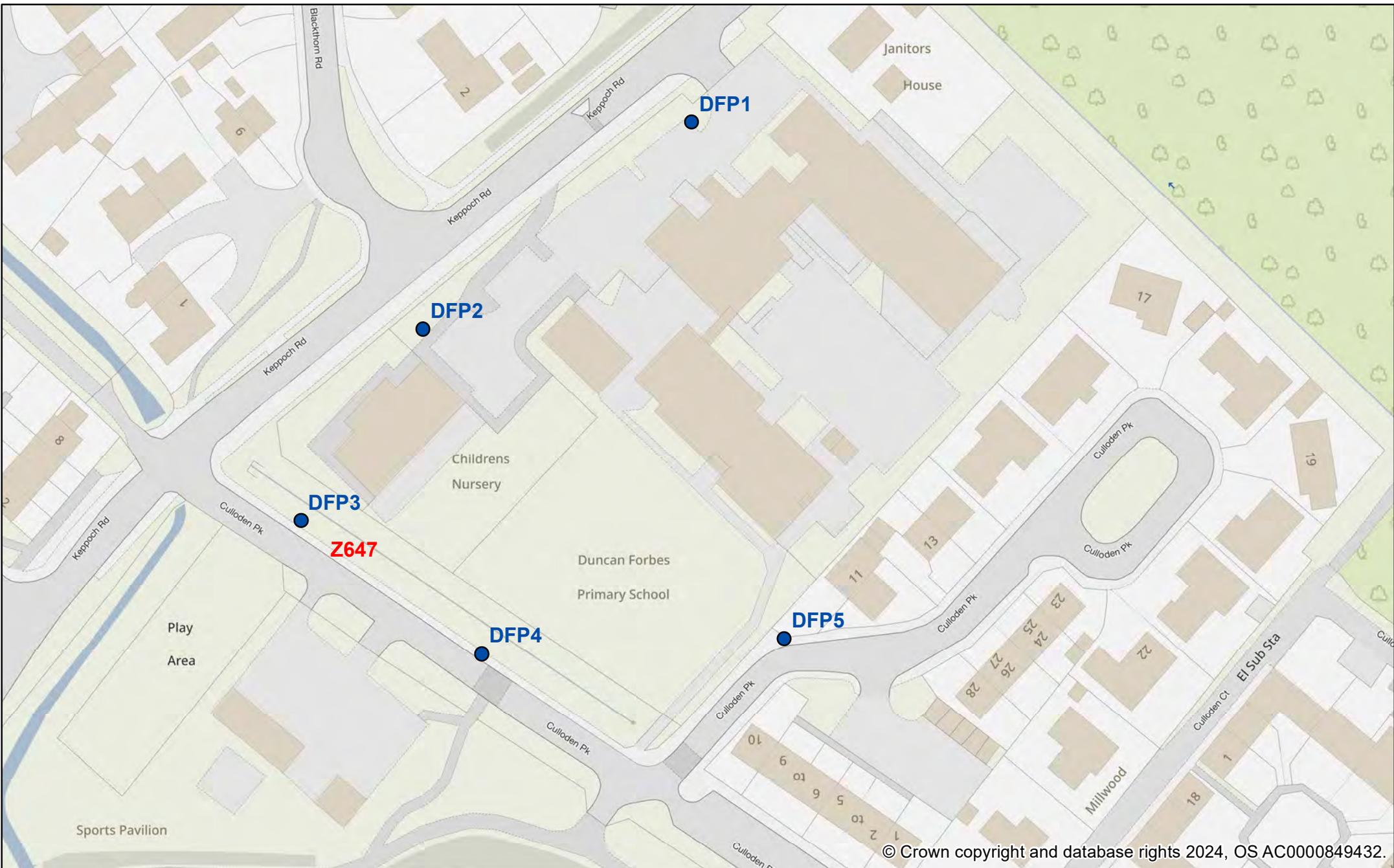
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Drakies Primary School 2024-25 Diffusion Tube Location



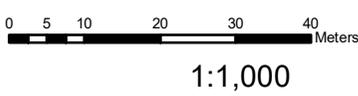
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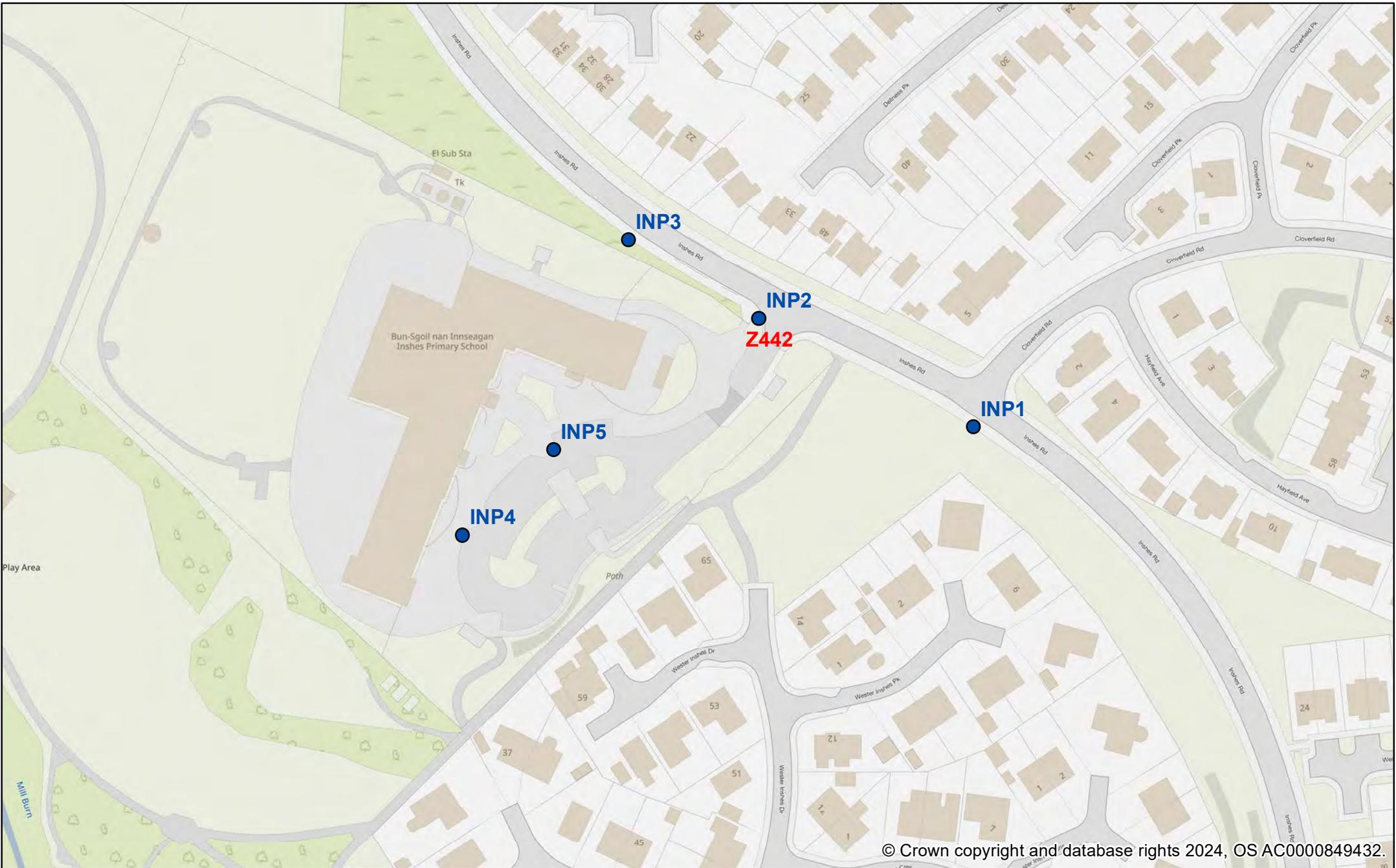




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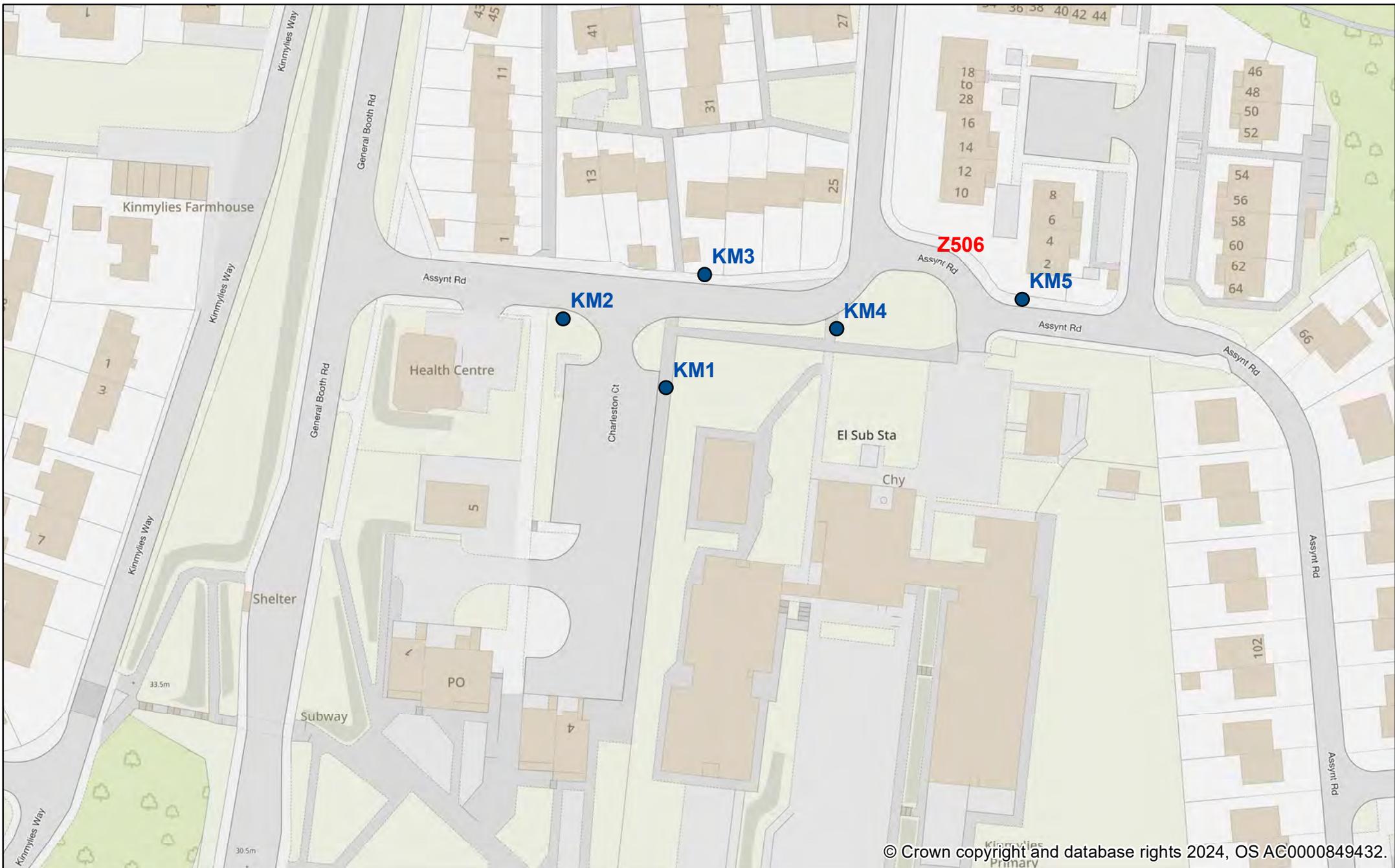
Duncan Forbes Primary School 2024-25 Diffusion Tube Location





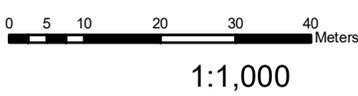
Inshes Primary School 2024-25 Diffusion Tube Location

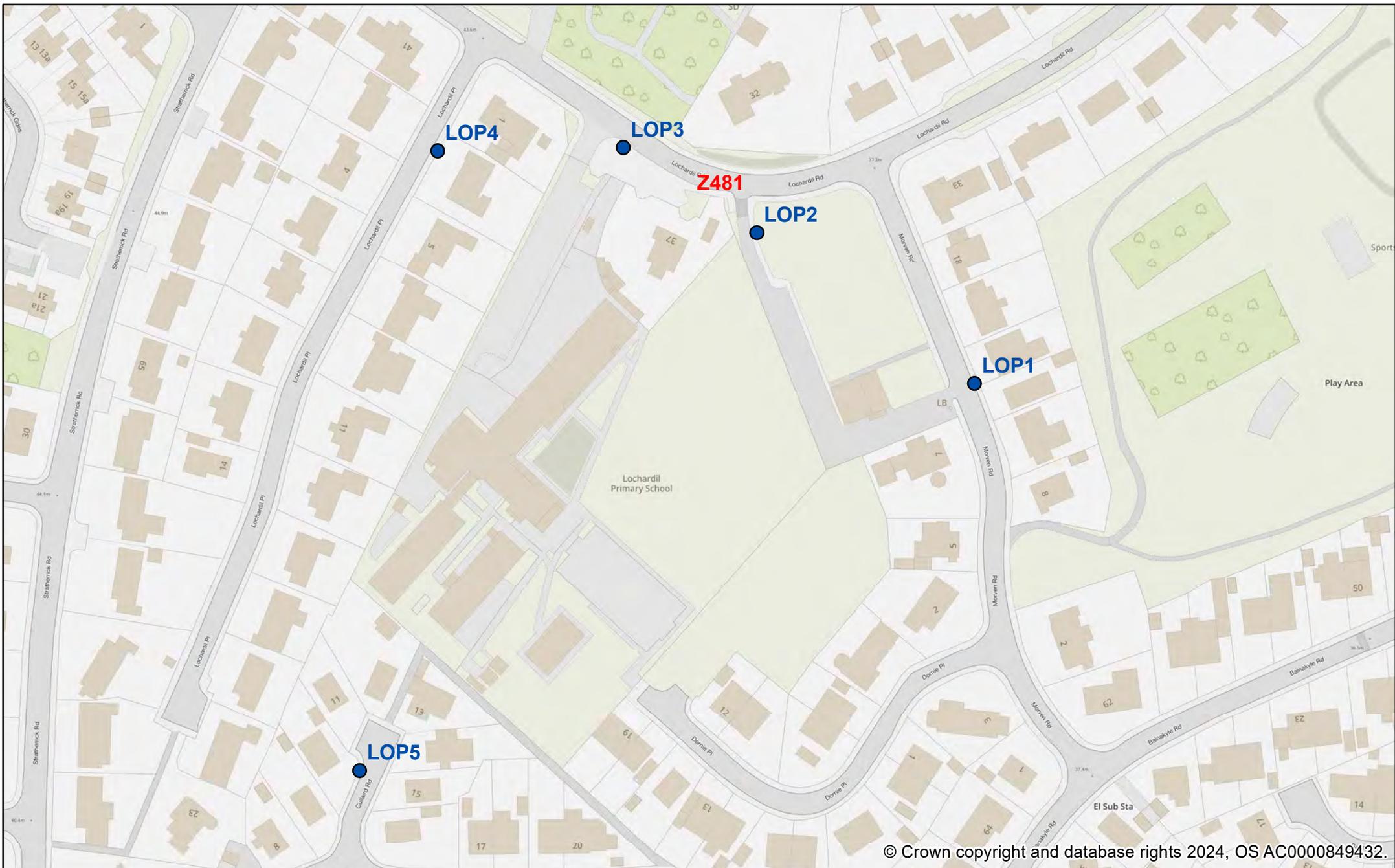




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Kinmylies Primary School 2024-25 Diffusion Tube Location





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Lochardil Primary School 2024-25 Diffusion Tube Location



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Appendix B.1 – School Engagement Information
Education Information Pack



Community & Places – Environmental Health

Air Quality – Raising Awareness of Vehicle Emissions

Primary Schools Project

Project Aim

The main objective is to engage children, staff and parents in the opportunities they have to improve air quality at primary schools through behavioural changes, such as reducing vehicle idling or active travel to school. To improve awareness of the link between vehicle pollution and health matters and the wider benefits of active travel.

Project set-up

Officers from Environmental Health, Highland Council will visit the school and give a short presentation to children (suggested P6/P7). The officers will install a portable air quality monitoring device “Zephyr” providing real-time information on air quality.

Access to the live data-feed will be provided to schools to facilitate projects which can raise awareness in children and their parents.

The zephyrs collect data on a range of pollutants, including nitrogen oxides, ozone, and particulate matter.



Nitrogen dioxide NO₂ is used for the purposes of reporting. The standards set in [The Air Quality \(Scotland\) Regulations 2000](#) are the annual mean concentration of NO₂ must not exceed 40 µg/m³ and that there should be no more than 18 exceedances of the hourly mean limit value (concentrations above 200 µg/m³) in a single year. Most people are exposed to NO₂ through vehicle emissions.



Learning Options

There are many educational resources including lesson plans which can be downloaded to focus on different aspects of air quality linked to varied curricular areas.

<http://children.scottishairquality.scot/>

This website explores air pollution, its causes and what can be done.

People, place and environment - I can discuss the environmental impact of human activity and suggest ways in which we can live in a more environmentally responsible way.

SOC 2-08a



Community & Places – Environmental Health

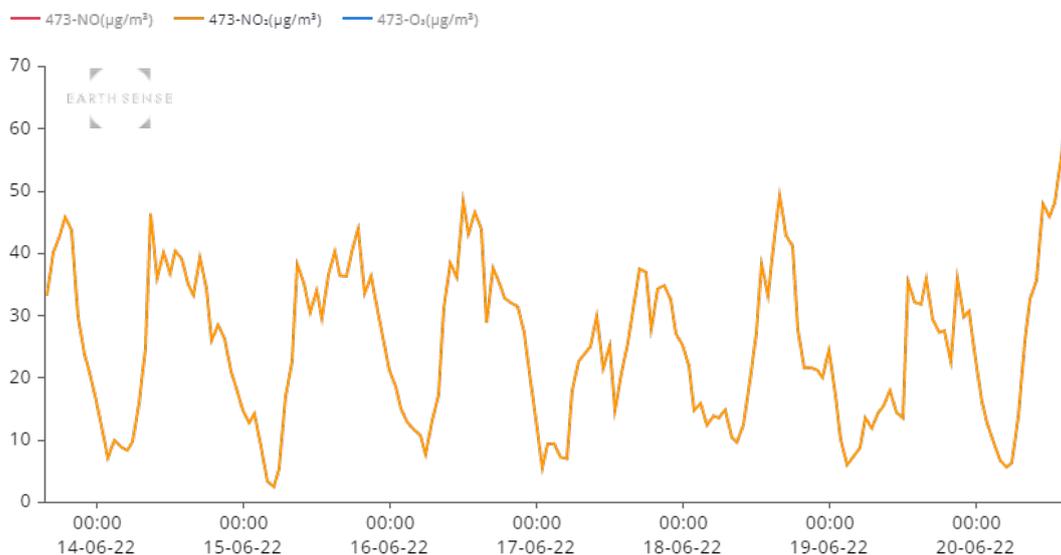
Air Quality – Raising Awareness of Vehicle Emissions

Primary Schools Project



Resources at Newton Rooms include learning about healthy and unhealthy lungs, and pop-up lessons on Health Science can be requested <https://newtonroom.com/sct/find-your-newton-room>
CfE Biological systems **SCN 2-12a**

The zephyrs will record spikes of NO₂ sometimes well over 200 µg/m³ however, averaged over an hour, the NO₂ will meet the standards. The MyAir website allows the user to select data over 24hr to weekly time periods, with variable time averaging. The data can be saved as graphs, or exported to CSV file. The below graph records data from Castle Street Inverness, averaged over hourly periods, with a clear cycle of higher NO₂ in the day compared to night.



Children can record traffic surveys, tallying numbers of cars/vans/buses/HGV, then compare the tally information to the air quality data for the same time period. CfE Information handling **MNU 2-20b**.



<https://www.transform-our-world.org/programmes/clean-air-for-schools>

Free lesson plans and resources for teachers. Having explored the ways journeys can be made, I can consider the advantages and disadvantages of different forms of transport, discussing their impact on the environment. **SOC 2-09a**

Community & Places – Environmental Health

Air Quality – Raising Awareness of Vehicle Emissions

Primary Schools Project

Sustainable Cities and Communities: Clean Air



Traffic in Beijing (Li Lou/World Bank)

Children could research different fuel types, how they are extracted, how they are used in Scotland and globally, and compare impacts.

<https://connecting-classrooms.britishcouncil.org/resources/global-learning-resources/clean-air>

Technological Developments in Society and Business - I can analyse how lifestyles can impact on the environment and Earth's resources and can make suggestions about how to live in a more sustainable way. **TCH 2-06a**

The children will consider how to engage with the wider school community and parents, to present information in a way to inform change.

<https://www.bbc.co.uk/newsround/56802679>

Topical science - **SCN 2-20b**



What's Next?

The Highland Council Officers will come back to discuss the findings with the children. We want to hear and see what the children have done, and what changes they think are important. The children can make use of Highland Council resources such as [Go For It](#) reward incentives. Funding could be available to make walking and cycling to school easier and safer:

https://www.highland.gov.uk/info/20005/roads_and_pavements/87/road_safety/3

The school community could decide to engage with the following initiatives which all have resources freely available to download.

[Clean Air Day](#) in June



[Walk to School](#) week in May



[Bike to School](#) week usually September

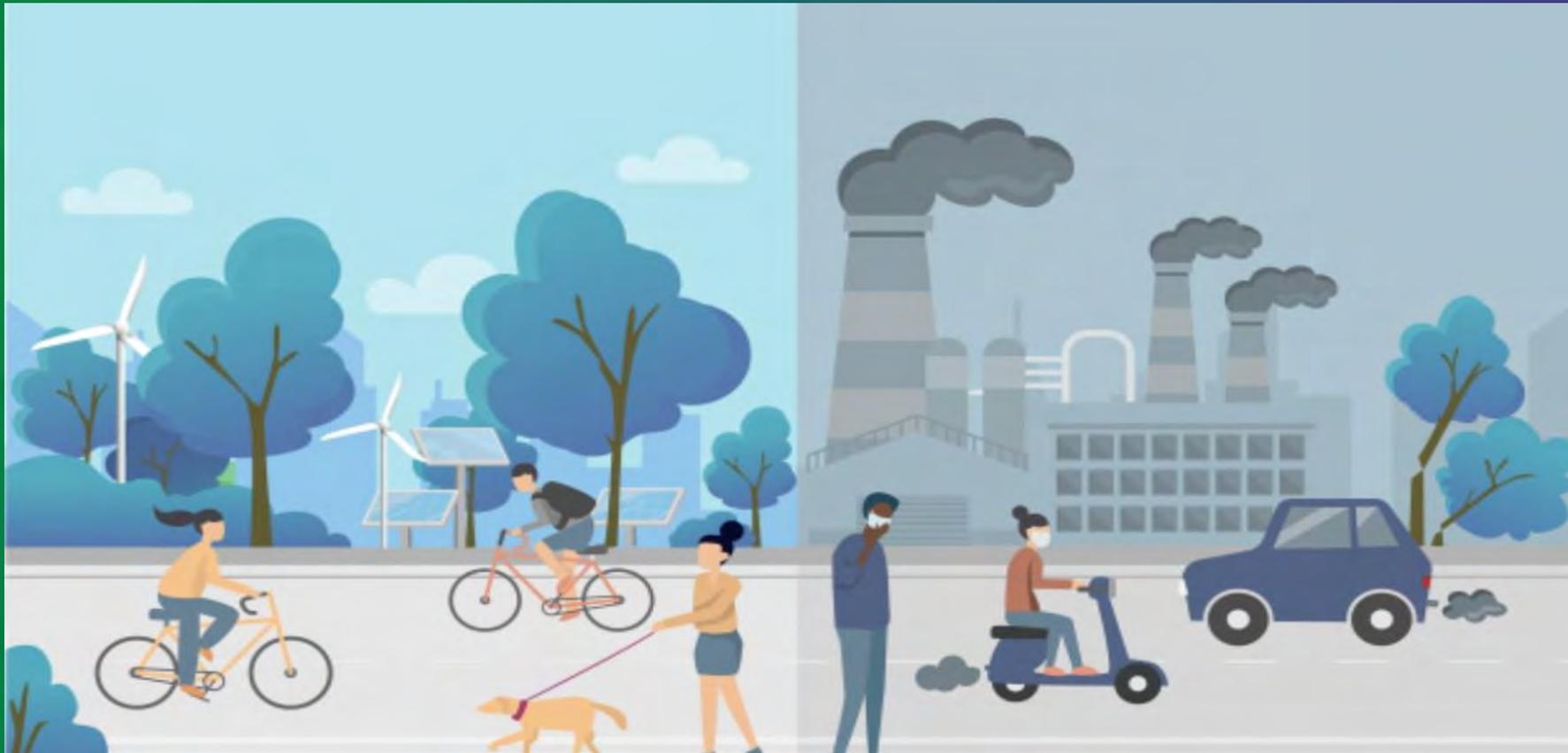


Appendix B.2 – School Engagement Information
Example School Presentation



Air Quality –

Environmental Health



How do you travel to school?

- Walk
- Bike/Scoot
- Car
- Bus



The form of transport we choose to use can have an impact on our environment and our health.

How do vehicles impact air quality?



When petrol and diesel are burnt in the engine, pollutants are given out from the exhaust of the vehicle.



Pollutants include nitrogen oxides, carbon monoxide and particulate matter.



If car engines are left on while parked up (known as **idling**) this creates pollution. If you travel by car, **always turn the engine off when parked.**



Road traffic is one of the biggest sources of pollution in Scotland.

Air Quality Around the World

Globally different countries can have different main causes of air pollution

- Industry
- Solid fuel cooking
- Fossil fuel energy supply
- Burning waste/fires

In Scotland we have Air Quality Guideline for many substances.



How does air pollution affect our health?

- High levels of pollution in the air we breath can be harmful to our health.
- Air pollution can irritate our eyes, throat and lungs.
- People who already have breathing problems like asthma or heart or lung diseases can be very sensitive to air pollution.



Major Pollutants

[VIDEO : Major Pollutants : Learning about Air Quality \(learnaboutair.com\)](http://learnaboutair.com)

- Nitrogen Dioxide – brown gas than smells bad, poisonous and harmful to health
- Carbon Monoxide – no colour, no smell, no taste, toxic at high levels
- Particulate Matter – very small dust particles, that can enter our lungs.

Which are all produced by vehicle engine combustion (burning fuels) and wear and tear of parts.

- Ozone – blue gas, smells funny, protects us when up high from sun rays, but at ground level can irritate airways and eyes
- Sulphur Dioxide – colourless gas, smells horrible, irritates eyes and airways



Monitoring Air Quality – Automatics (AURN)



Air Quality in The Highland Council area is generally good. However, there have been issues within Inverness City Centre with nitrogen dioxide (NO₂) due to heavy traffic in enclosed streets.

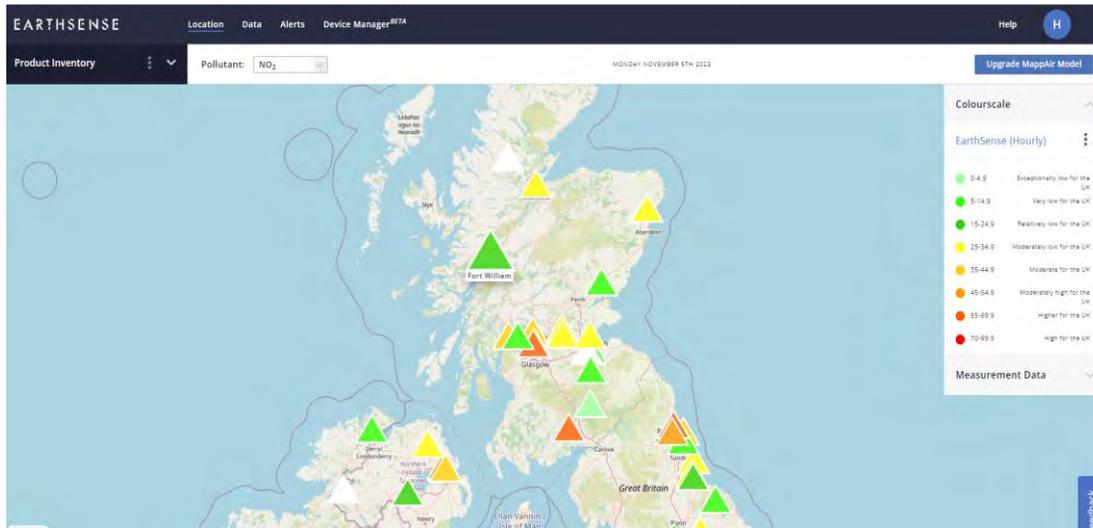
The Council monitors air quality in 4 locations through Automatic Network Stations and there are

- 2 roadside monitors located in **Inverness**,
- 1 rural monitor in Strathvaich (Ross-shire)
- 1 suburban monitor in Fort William (Lochaber).
- **Do you know where these Inverness units are?**

AURN Data Monitoring

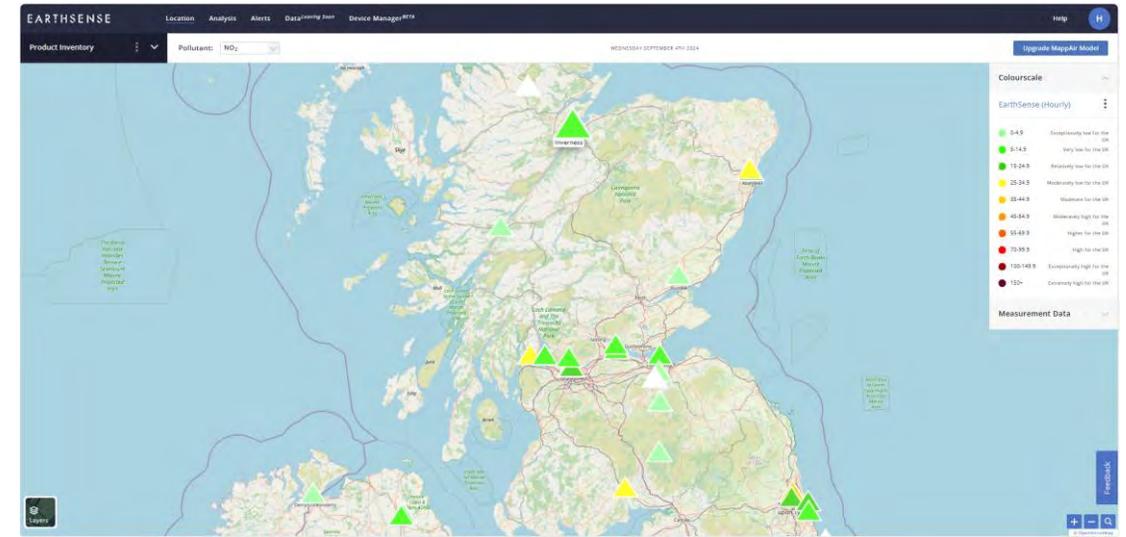
Air Quality in our local area is usually low. Shown as Green/Yellow on these AURN data maps.

We can compare ourselves to cities like Glasgow and Newcastle. **Notice anything different?**



2022

Heavier traffic in large city centers used to cause high pollution levels shown as Orange/Red. But this has improved with the introduction of Glasgow LEZ (06/23) or Newcastle CAZ (01/23).



2024

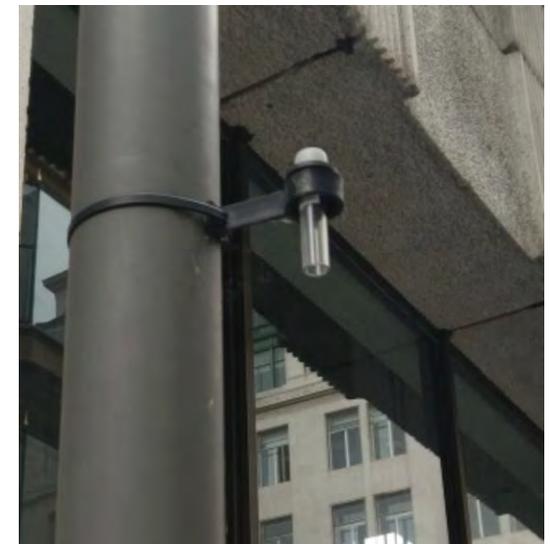
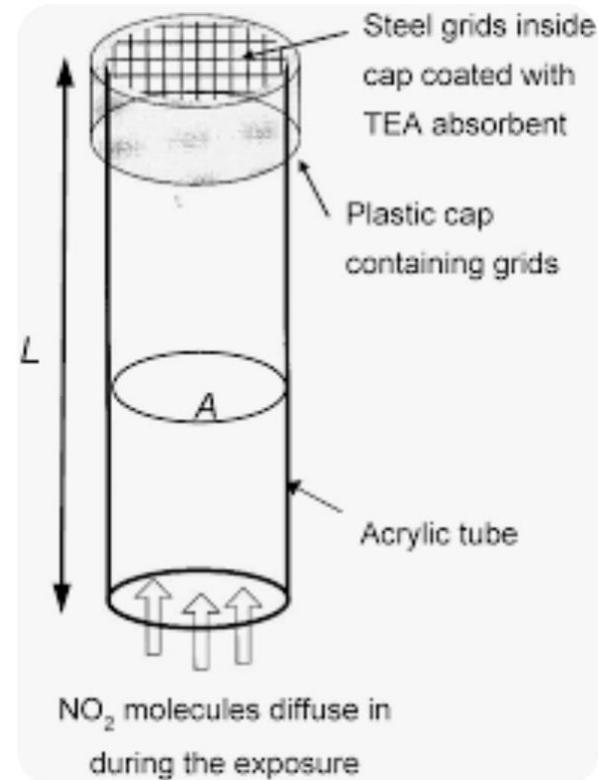
Passive Tubes

Another method of recording air quality is by using small diffusion tubes, which can be seen attached to lampposts.

We have ~40 of these small tubes located across Highland including in Inverness, Fort Willian, Dingwall, and Nairn.

Tubes are left open at one end and exposed to the air. Nitrogen dioxide (NO_2) is absorbed by mesh coated in a chemical which changes when exposed to NO_2 .

And last term we added 5 to lampposts in and around your school - **Have you spotted them?**



Zephyr Air Quality Monitor

The third method of recording air quality we have is using a 'Zephyr' unit.

It is a little like the AURN in that it records lots of different chemicals (NO_2 , O_3 , $\text{PM}_{2.5}$) and it also records the weather and is a lot more portable.

But it is different in that it isn't quite as accurate. Although it does give us a good idea of air quality trends.

We currently have 6 'live' around Inverness, and in October we also installed one at your school – **Have you spotted it?**



Zephyr Air Quality Monitor | EarthSense
EarthSense

The School AQ Project Year 3 - 2024/25

- This year we are visiting a further 6 primary schools in Inverness to find out about the air quality.
- We identified the busiest traffic area/drop-off points at your school with the help of the school staff.
- We installed 5 passive tubes and one 'live' portable monitor called a Zephyr to record NO₂ and particulate matter PM_{2.5} and PM₁₀
- The Zephyr is powered using a solar panel and it sends the information it collects via WIFI to a website called MyAir where we can see the data.



Zephyr Air Quality Monitor | Earth...
EarthSense

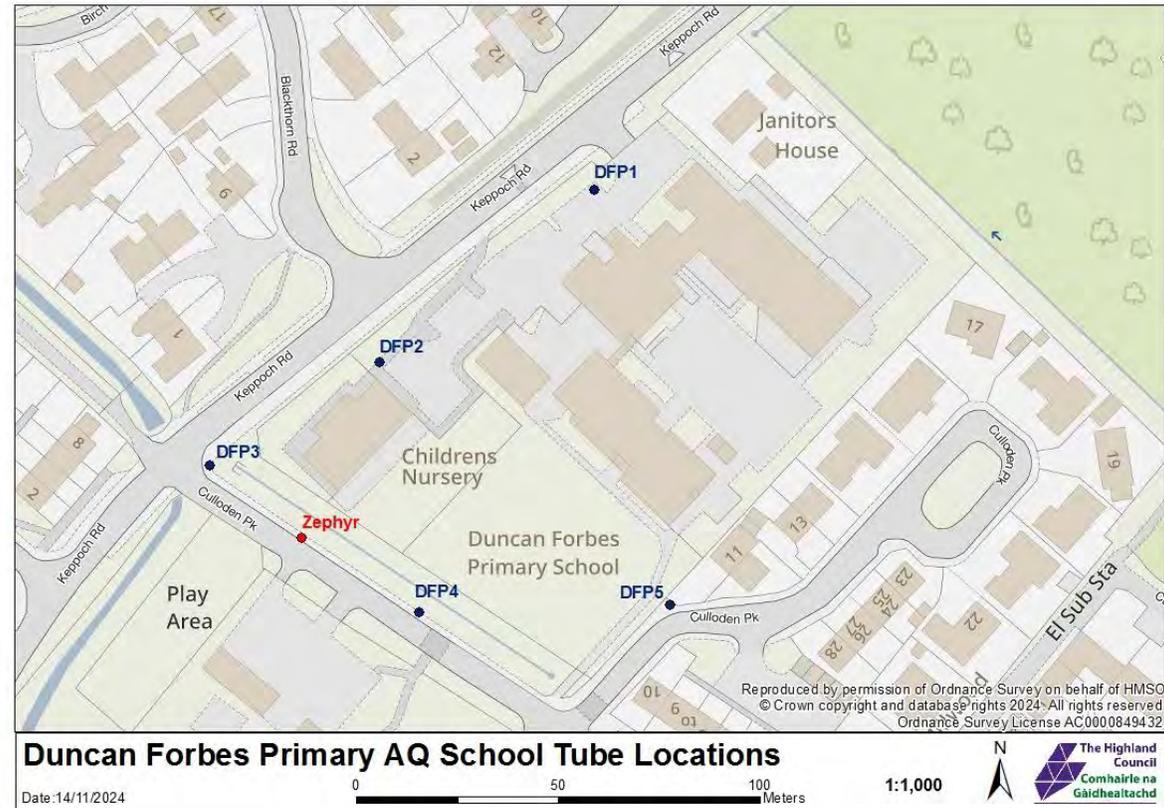
Any Questions?

**Let's go outside and find the
Zephyr and where the 5 passive tubes are...**

DUNCAN FORBES PRIMARY Monitoring Locations

Did everyone find the Zephyr and 5 Passive Tube sites?

[VIDEO : Monitoring and Measurements : Learning about Air Quality \(learnaboutair.com\)](#)



Air Quality - Pollution Summary

- What is it?
 - Nitrogen Dioxide NO₂,
 - Particulate Matter PM_{2.5},
 - Ozone O₃
 - Carbon Monoxide CO
- How does it affect us?
 - Lungs
 - Eyes
 - Other organs – brain, skin, heart
 - Underlying conditions
- How do we monitor
 - Large/expensive AURN (x4)
 - Portable live Zephyr (x6)
 - My Air app
 - Small monthly tubes (x40)
 - Schools Project (30 extra tubes)
- What can we do to reduce it?
 - Active Travel? - Walk, cycle..
 - **TURN OFF car engines during drop off/pick up – no idling**

Air Quality – Duncan Forbes Primary Results

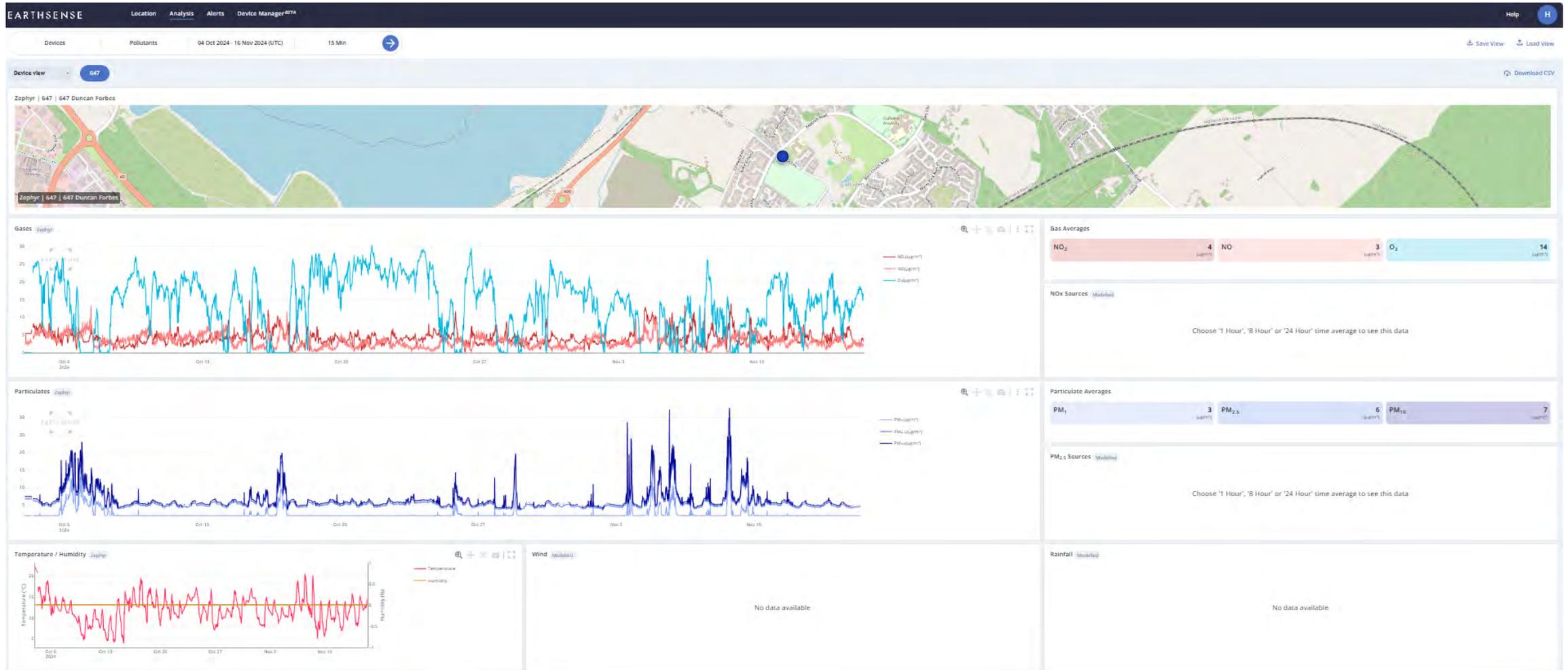
- What has the Zephyr Unit (U647) recorded?
 - Installed from 04th October 2024 to Now (42 days so far)
 - Recording NO, NO₂, O₃, PM₁, PM_{2.5} and PM₁₀ & Weather
 - 24 hr update to My Air App
 - The 6 Highland Council Zephyr Units
 - Highland AURN Units (x4)
 - National AURN data across UK



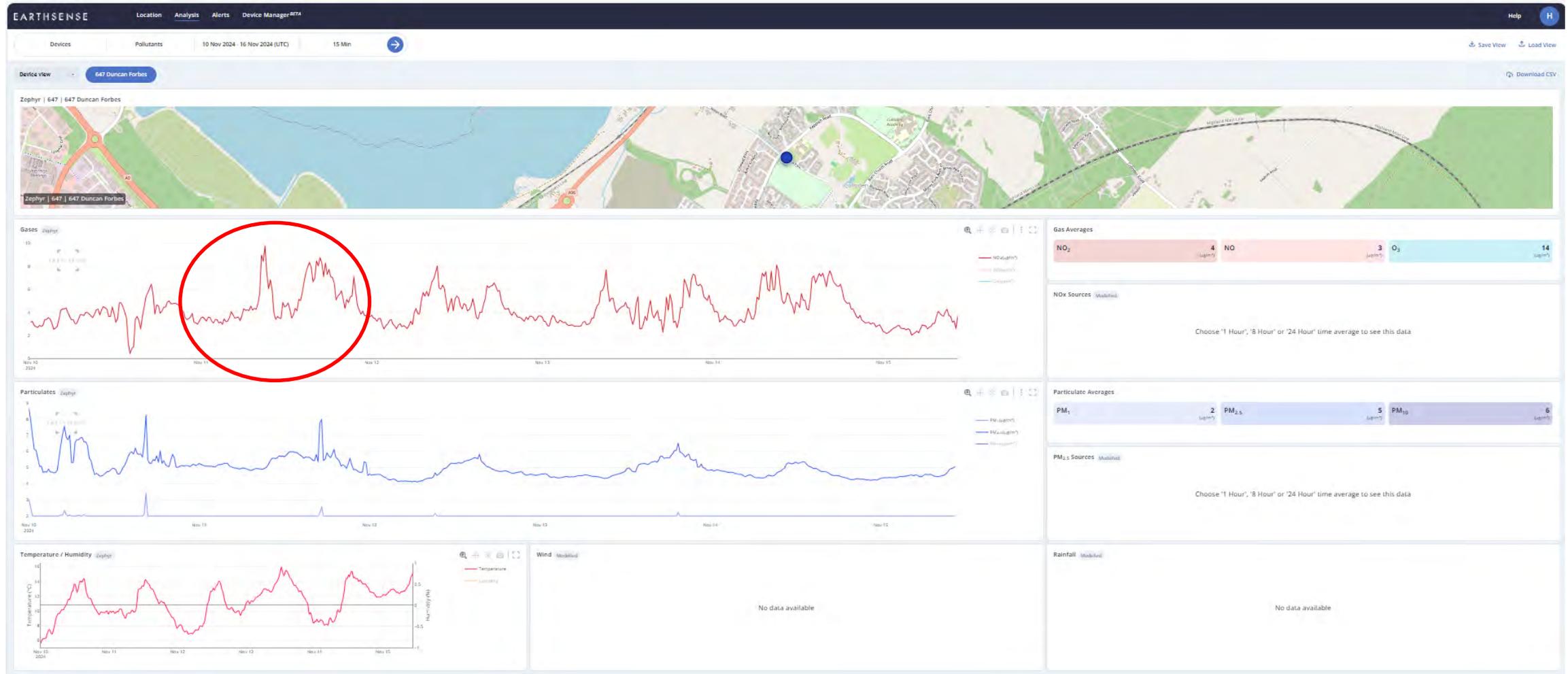
Zephyr Air Quality Monitor | Earth...
EarthSense



Duncan Forbes – month of Live Data (U647)



Duncan Forbes – week of Live Data (U647)



Duncan Forbes – Live Data Monday 11th Nov

- Look at the NO₂ scale on the left vertical axis, and the date and 24hour time along the bottom horizontal axis.
 1. What was the NO₂ values (Range) between 00:00 and 07:30? (min to max)
 2. What and when was the peak between 07:30 and 10:00?
 3. What do you think caused the change?
 4. What was the NO₂ value (Average) between 10:30 and 14:00? (middle or mean)
 5. What happened from 14:30 to 15:00 and why?
 6. What happened to the NO₂ levels from 22:00 onwards & why?



Duncan Forbes – Live Data Monday 11th Nov

- Look at the NO₂ scale on the left vertical axis, and the date and 24hour time along the bottom horizontal axis.
 1. What was the NO₂ values (Range) between 00:00 and 07:30? [3 to 5 ug/m³]
 2. What and when was the peak between 07:30 and 10:00? [9.75ug/m³ at 9:00am]
 3. What do you think caused the change? [we all start to drive to work/school]
 4. What was the NO₂ value (Average) between 10:30 and 14:00? [~ 4 ug/m³]
 5. What happened from 14:30 to 15:00 and why? [levels increased to ~ 8.5 ug/m³]
 6. What happened to the NO₂ levels from 22:00 onwards & why? [drop/sleep]



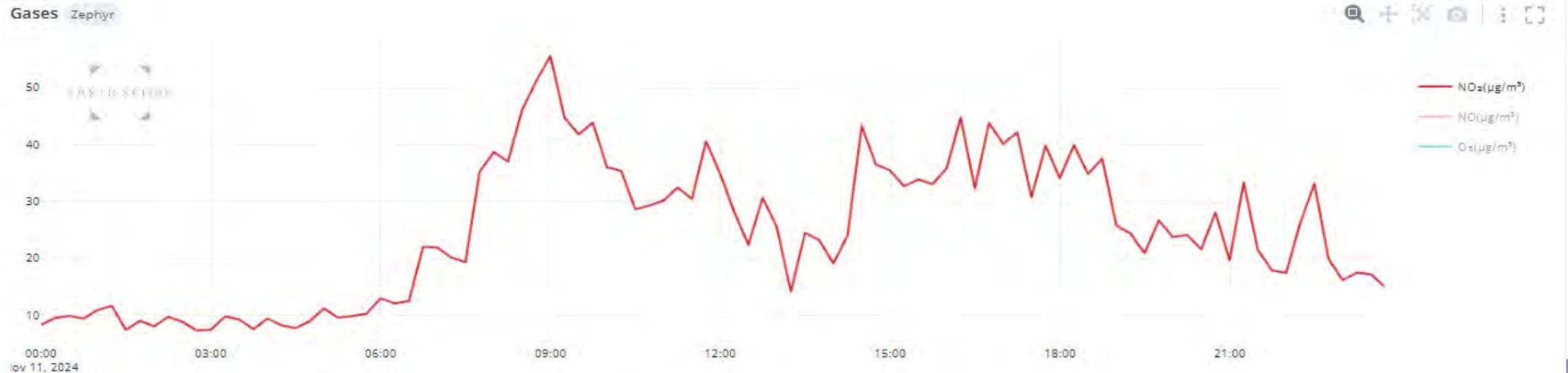
Castle Street Inverness

- Look at this photo from the centre of Inverness, showing the Castle. Can you see a Zephyr Air Quality Monitoring Unit?



Castle Street Inverness - Live Data Mon 11th Nov

- Look at the NO₂ scale on the left vertical axis, and the date and 24hour time along the bottom horizontal axis.
 1. What is different about the left vertical axis scale for Castle Street (v's DFP)?
 2. What was the NO₂ values (Range) between 00:00 and 07:00? (min to max)
 3. What and when was the peak between 07:00 and 10:00?
 4. What was the NO₂ value (Average) between 10:30 and 14:00? (middle or mean)
 5. What happened to the NO₂ levels from 22:30 onwards & why?



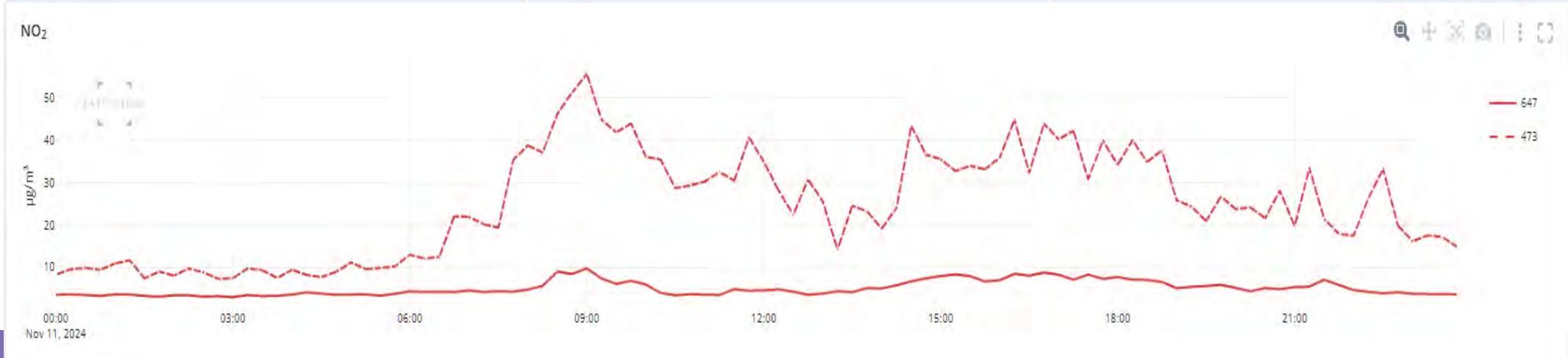
Castle Street Inverness - Live Data Mon 11th Nov

- Look at the NO₂ scale on the left vertical axis, and the date and 24hour time along the bottom horizontal axis.
 - What is different about the vertical axis scale? [larger up to 50 from 10 $\mu\text{g}/\text{m}^3$]
 - What was the NO₂ values (Range) between 00:00 and 07:00? [5-15 $\mu\text{g}/\text{m}^3$]
 - What and when was the peak between 07:00 and 10:00? [55.6 $\mu\text{g}/\text{m}^3$ at 9:00]
 - What was the NO₂ value (Average) between 10:30 and 14:00? [25 $\mu\text{g}/\text{m}^3$]
 - What happened to the NO₂ levels from 22:30 onwards & why? [dropped]



Castle Street v's Duncan Forbes – 11th Nov

Air Quality Results	Duncan Forbes Primary	Castle Street, Inverness
Level between Midnight and 7am	3 to 5 ug/m ³	5 to 15 ug/m ³
Peak between 7 and 10am	9.75ug/m ³ at 9am	55.6 ug/m ³ at 9am
Average between 10:30am and 2pm	4 ug/m ³	25 ug/m ³
Highest levels of Air Pollution	No	YES



Duncan Forbes Primary Monitoring

- **TUBES** - The 5 tubes, will be there for 4 months, being changed out 4 times and sent to a laboratory to measure what they have picked up – Half way through.
- **ZEPHYR** - The Zephyr website is live already, link provided to your teacher, so you can start looking in the mornings for any pattern in the NO₂? At DF or other Inverness Schools or AURN sites.
- **EXPERIMENTS** - Undertake a traffic survey or other SEPA experiments. Think about active travel options and create posters about pollution or travel choices for sharing with the rest of the school?
- **PROJECT FINDINGS?** - FINAL RESULTS - I will send on the full results from the Tubes in early 2025 which can be shared with you, parents, teachers and community, and if you like I could **come back** to visit again in a couple of weeks to hear what you have learnt about pollution? Posters, presentations..



Thank you Mòran taining



@HighlandCouncil

www.facebook.com/highlandcouncil

www.flickr.com/photos/highlandcouncil

www.instagram.com/highlandcouncil

www.youtube.com/TheHighlandCouncil

www.linkedin.com/company/highlandcouncil

Appendix B.3 – School Engagement Information
Example School Worksheet



AIR QUALITY MONITORING – LIVE DATA

KIRK HILL Vs CASTLE STREET INVERNESS

WHAT DOES THE LIVE DATA SHOW US ABOUT POLLUTION AT OUR SCHOOL?

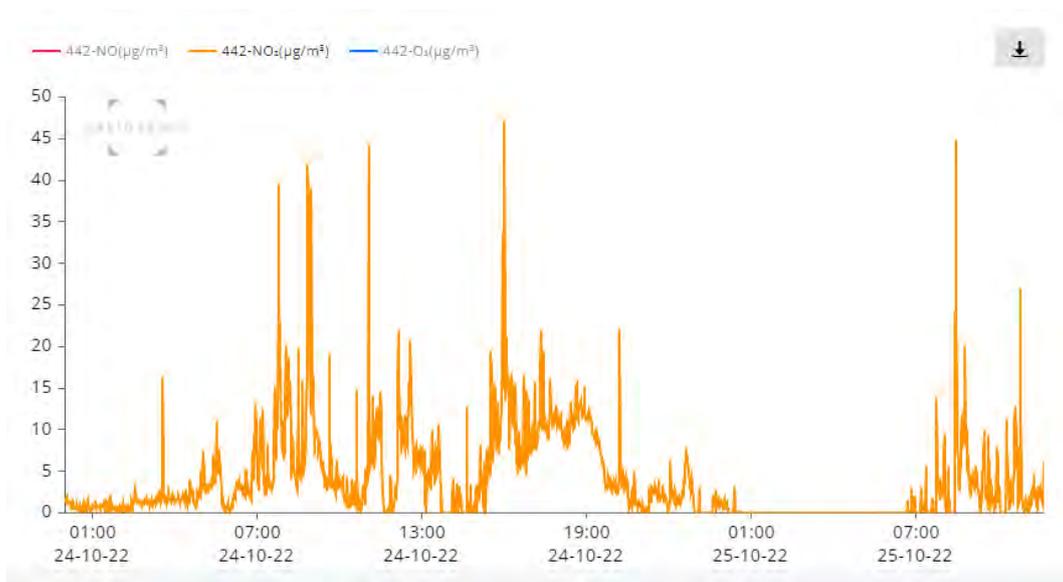
AND

WHAT CAN WE DO TO HELP REDUCE AIR POLLUTION?

KIRK HILL UNIT 442

We need to **LOOK** at the **LIVE NO2** data from our first day back at School after the October holidays.

[Monday 24th October 2022 00:00 to 23:59 can be selected using the custom Time Period with no time averaging – it will be very spiky as there is so many data points, Turn off NO and O3 by using the tick boxes]



1. What were the levels like between 00:00 to 07:00am that day?

ANSWER: mostly between 1-4 ug/m3.

2. What happened between 07:00 to 09:00am? Can you think why?

ANSWER: Values started to increase. People started to commute to school and work.

3. What was the PEAK (maximum) VALUE between 07:00 to 09:00am?

ANSWER: There was a PEAK of 42.09 NO2 at 08:51am.

4. What was the MAXIMUM VALUE that day (Monday 24th Oct 2022)? Can you think why?

ANSWER: The maximum recorded was 47.19 at 16:02 (4pm)

5. Can you spot any other LARGE VALUES? What could have caused them?

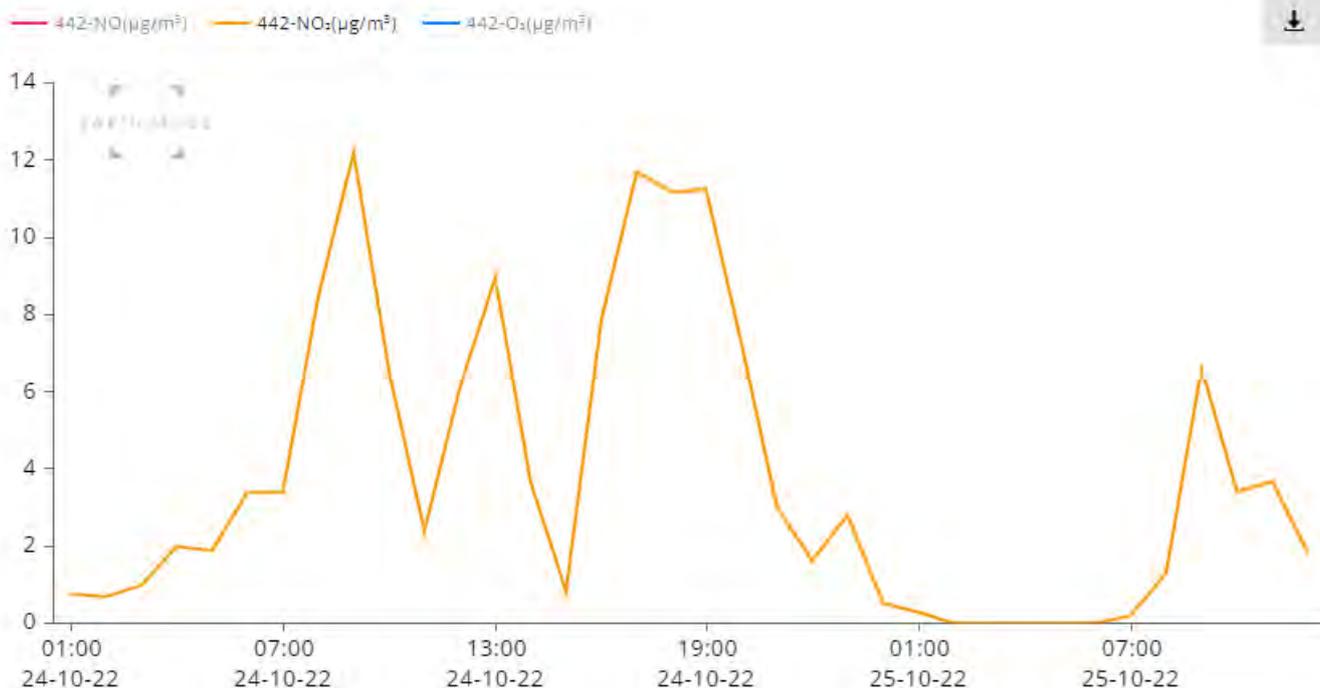
ANSWER: Yes 39.54ug/m3 at 07:48 and 44.24ug/m3 at 11:05. Maybe a lorry or large vehicle passed the school?

6. What happened to the NO2 levels from 19:00 (7pm) to 23:59 (midnight) that night? Any why?

ANSWER: They dropped back down to mostly between 1- 4 ug/m3.

Now we need to LOOK at the same data PERIOD but smoothed out called TIME AVERAGING which is done by the application software for us.

[Monday 24th October 2022 00:00 to 23:59 can be selected using the custom Time Period with Time Averaging set to 1 hour, again turn off the NO and O3 parameters]



The calculated levels of NO2 and PM2.5 have been downloaded and are shown in the table below.

DATE	TIME AVERAGED	442-NO2(ug/m3)	442-PM2.5(ug/m3)
24/10/2022	01:00	0.76	1.86
24/10/2022	02:00	0.69	1.5
24/10/2022	03:00	0.99	1.13
24/10/2022	04:00	1.99	2.08
24/10/2022	05:00	1.89	3.63
24/10/2022	06:00	3.4	3.14
24/10/2022	07:00	3.4	2.57
24/10/2022	08:00	8.45	6.57
24/10/2022	09:00	12.21	4.44
24/10/2022	10:00	6.53	4.07
24/10/2022	11:00	2.39	3.27
24/10/2022	12:00	6.1	3.75
24/10/2022	13:00	8.95	3.58
24/10/2022	14:00	3.67	2.06
24/10/2022	15:00	0.83	2.83
24/10/2022	16:00	7.87	19.31
24/10/2022	17:00	11.7	25.11
24/10/2022	18:00	11.17	6.82
24/10/2022	19:00	11.25	6.81
24/10/2022	20:00	7.26	6.75
24/10/2022	21:00	3.02	8.5
24/10/2022	22:00	1.63	7.28
24/10/2022	23:00	2.8	0.94
25/10/2022	00:00	0.52	1.2

7. Look at the above table and find the NO2 levels at the following times

TIME	NO2 LEVEL
05:00	ANSWER: 1.89
09:00	ANSWER: 12.21
17:00	ANSWER: 11.7
23:00	ANSWER: 2.8

8. Look at the above table and find the PM2.5 levels at the following times

TIME	PM2.5 LEVEL
05:00	ANSWER: 3.63
09:00	ANSWER: 4.44
17:00	ANSWER: 25.11
23:00	ANSWER: 0.94

9. When is PM 2.5 the highest? Can you think why that would be?

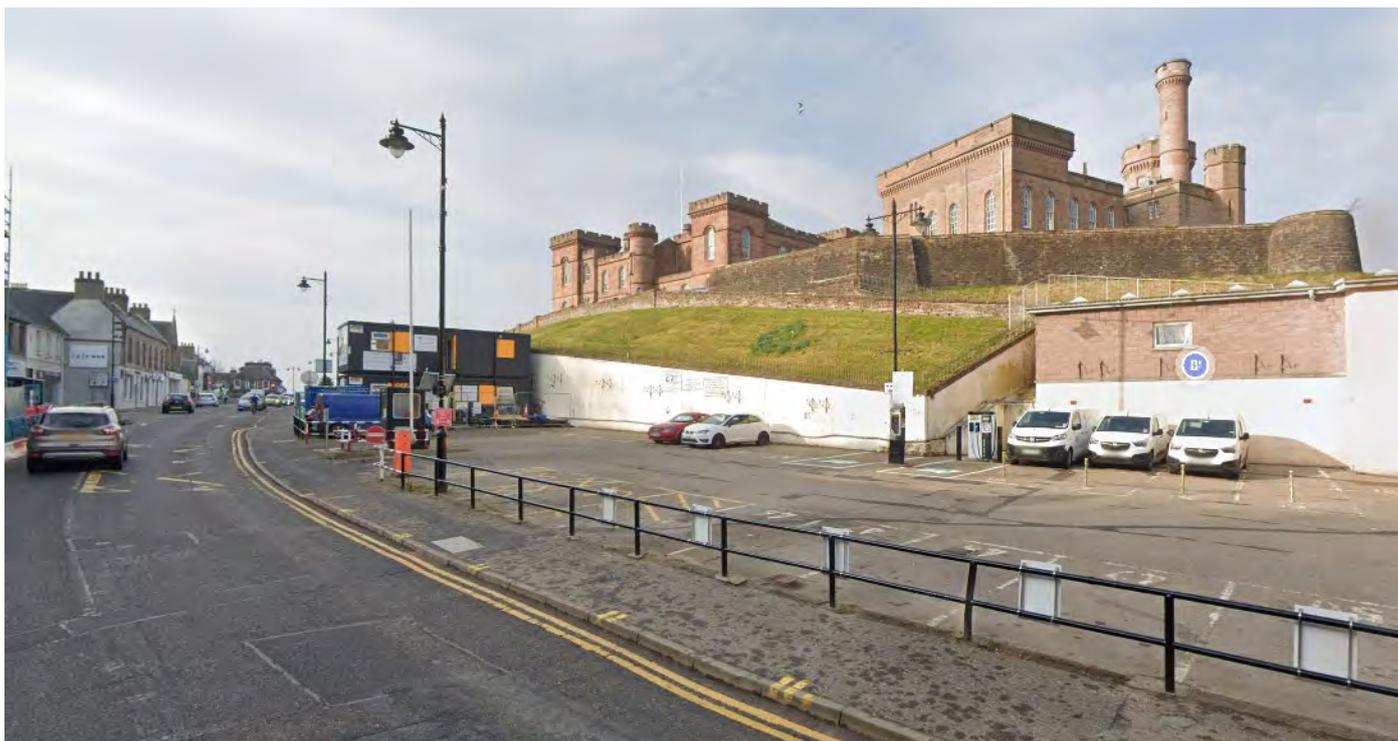
ANSWER: 17:00 (5pm). More traffic as people leave work and return home.

10. Does the PM 2.5 record show similar changes in level as the NO2?

ANSWER: Mostly Yes, the values for both are higher in the daytime and at busy travel/commute times and lower overnight.

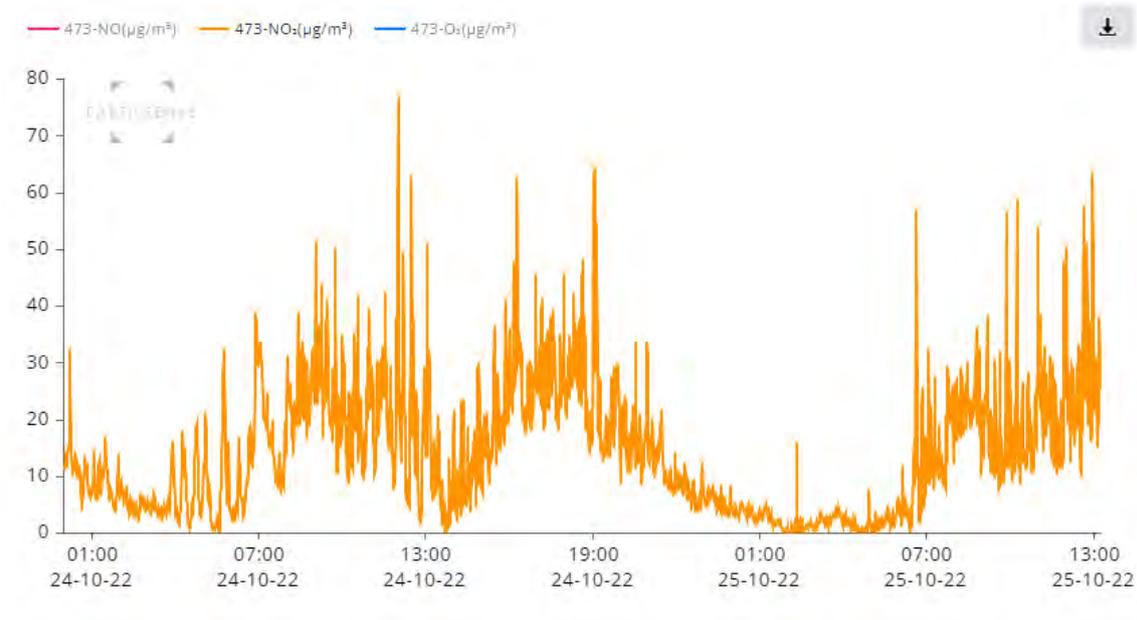
Now we need to look at the same day for **UNIT 473** located in the middle of Inverness town centre.

11. Can you spot our Air Quality Live Monitoring Unit in Castle Street, Inverness in this photo?



CASTLE STREET, INVERNESS UNIT 473

We need to LOOK at the LIVE NO2 data from Castle Street, Inverness on the same day Monday 24th Oct 2022. [Change Unit selection from 442 to 473 and again Monday 24th October 2022 00:00 to 23:59 can be selected using the custom Time Period with no time averaging – it will be very spiky as there is so many data points, Turn off NO and O3 by using the tick boxes]



12. What do you notice about the Left Hand Side SCALE of this graph compared to the one from Kirkhill?

ANSWER: It goes up much higher to 80ug/m3, Kirkhill had a top values of 50ug/m3.

13. What were the levels like between 00:00 to 07:00am that day?

ANSWER: mostly between 4 to 10 ug/m3.

14. What happened between 07:00 to 09:00am? Can you think why?

ANSWER: Values started to increase.

15. What was the PEAK (maximum) VALUE between 07:00 to 09:30am?

ANSWER: There was a PEAK of 51.47 NO2 at 09:04 (9am).

16. What was the MAXIMUM VALUE that day (Monday 24th Oct 2022)? Can you think why?

ANSWER: The maximum recorded was 77.02 at 12:02 (Midday)

17. Can you spot any other LARGE VALUES? What could have caused them?

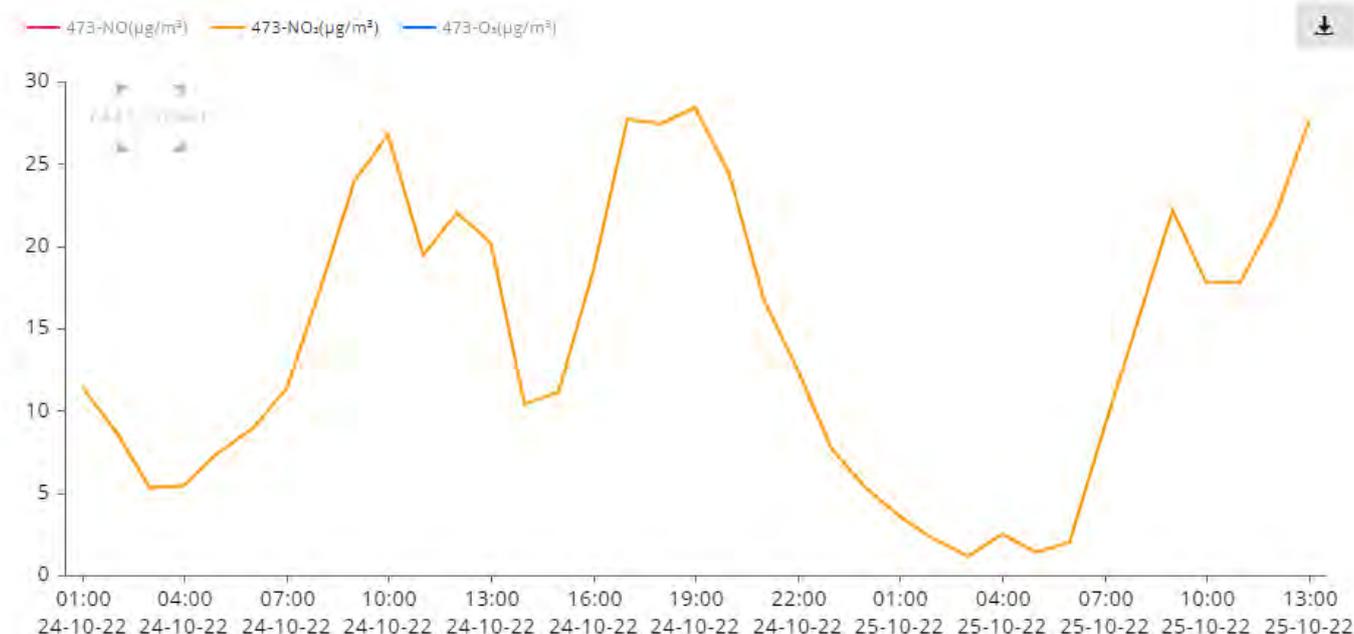
ANSWER: Yes 62.82ug/m3 at 16:18 and 64.37ug/m3 at 19:02. Maybe as workers started going home early or lots of people started going out for the evening?

18. What happened to the NO2 levels from 19:00 (7pm) to 23:59 (midnight) that night? Any why?

ANSWER: They dropped back down to mostly between 4- 10 ug/m3.

Now we need to LOOK at the same data PERIOD but smoothed out called TIME AVERAGING which is done by the application software for us, I have chosen 1 hour average.

[Monday 24th October 2022 00:00 to 23:59 can be selected using the custom Time Period with Time Averaging set to 1 hour, again turn off the NO and O3 parameters]



The calculated levels of NO₂ have been downloaded and are shown in the table below.

DATE	TIME AVERAGED	473-NO ₂ (ug/m ³)
24/10/2022	01:00	11.45
24/10/2022	02:00	8.75
24/10/2022	03:00	5.34
24/10/2022	04:00	5.51
24/10/2022	05:00	7.43
24/10/2022	06:00	8.98
24/10/2022	07:00	11.36
24/10/2022	08:00	17.45
24/10/2022	09:00	23.95
24/10/2022	10:00	26.81
24/10/2022	11:00	19.5
24/10/2022	12:00	22.06
24/10/2022	13:00	20.24
24/10/2022	14:00	10.43
24/10/2022	15:00	11.16
24/10/2022	16:00	18.61
24/10/2022	17:00	27.75
24/10/2022	18:00	27.48
24/10/2022	19:00	28.47
24/10/2022	20:00	24.52
24/10/2022	21:00	16.73
24/10/2022	22:00	12.51
24/10/2022	23:00	7.71
25/10/2022	00:00	5.4

19. Look at the above table and find the NO2 levels at the following times

TIME	NO2 LEVEL
05:00	ANSWER: 7.43
09:00	ANSWER: 23.95
17:00	ANSWER: 27.75
23:00	ANSWER: 7.71

20. How do the NO2 levels recorded at Castle Street, Inverness compare to the levels recorded at Kirkhill Primary for the same day and times?

ANSWER: Levels in Inverness are ALL over double the levels in Kirkhill.

21. The Air Pollution levels for NO2 which the Government has set as acceptable are 200ug/m3 per hour and 40ug/m3 annual average. Do you think the air quality in Kirkhill and Inverness are below these 'safe' levels?

ANSWER: Yes

Appendix B.4 – School Engagement Information
School Posters and Feedback



"We all enjoyed your presentation and appreciated you coming in to talk to us."

"We found reading the results on the graphs very interesting."

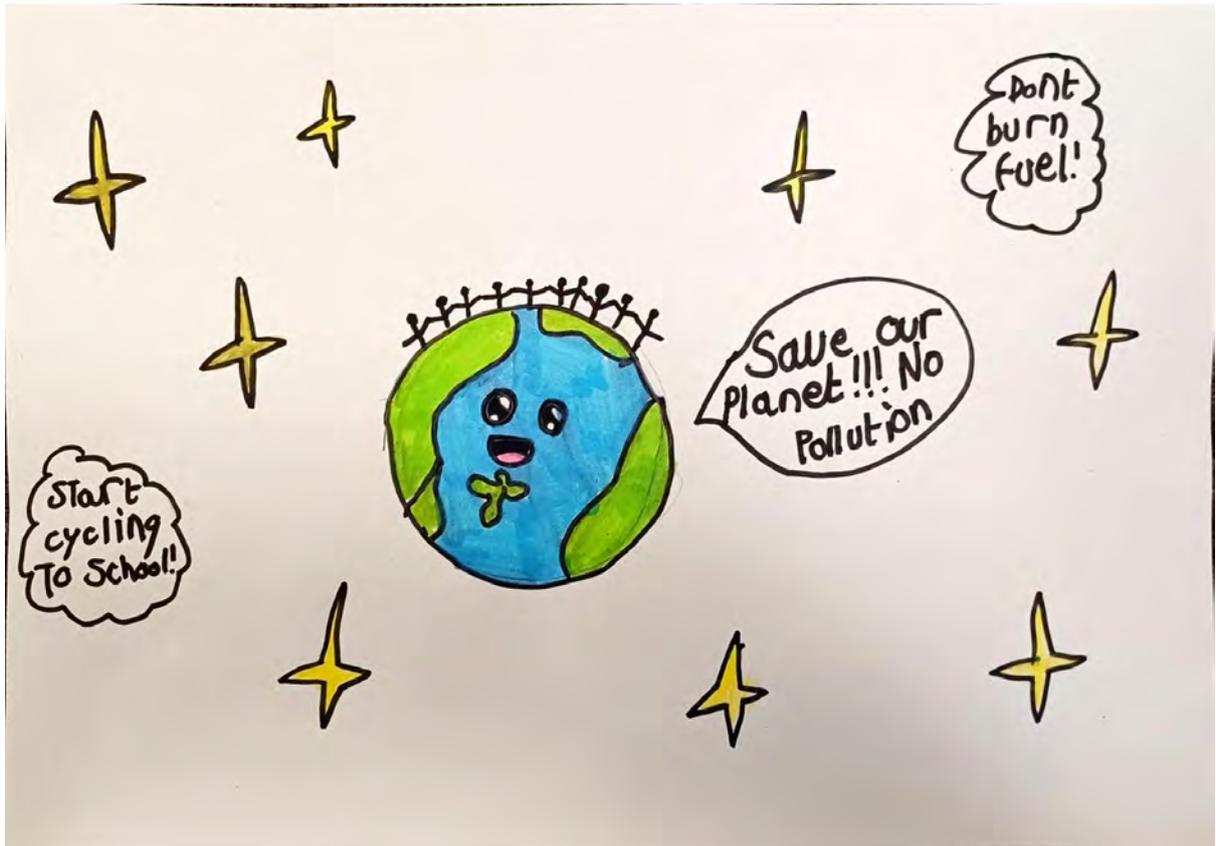
"We found the presentation very interesting."

"We hope you enjoyed visiting our school because we certainly enjoyed having you here."

"Thank you for teaching us about air pollution, especially the air pollution around our school."

"We were pleased you took us around the school to explain what the Zephyr Unit and the passive diffusion tubes were monitoring."

"Thank you for giving us a clear understanding of how clean our air is around our school."



Air Pollution

Cars cause air pollution from the gas especially from old cars. Wildfires also cause air pollution.

Air pollution can be caused by cars, cigarettes, wild fires and factories.



Factories can cause air pollution from all the smoke going directly in to the sky.

Volcanoes can also cause air pollution from when they erupt it creates a lot of smoke spreading all around and makes people cough.

Land

Let's try to not make bad land

road pollution

pollution

Nishes Primary

Walk or Park a stride or cycle or scooter or skate

Land

air school that provide like school

Water

the water will go to the sea and then to the ocean and then to the sky and then to the clouds and then to the rain and then to the water



Air pollution

try not to go in cars as much

Lets stop being pollution



At least 1 in 10 people die from air pollution related diseases

Less than 1% of global land area has safe air pollution levels.

Thermal pollution
☹️

Light pollution
83 percent of the world's people live under light polluted skies

Plastic pollution
22% of waste plastic is littered.

earth



pollution!

Water pollution:
around 70% of industrial waste is dumped into the water.

Noise pollution:
noise pollution impacts millions of people on a daily basis.

Air pollution
air pollution is the 4th most deadly health risk worldwide.

Air Pollution

Air pollution causes people to be sick or die because there are chemicals in the air.

Air pollution can be smoke or gases that come out of cars, factories, and buses.

a way to stop air pollution from happening is spray the air with clean spray.



Water pollution: causes effects and possible solutions.

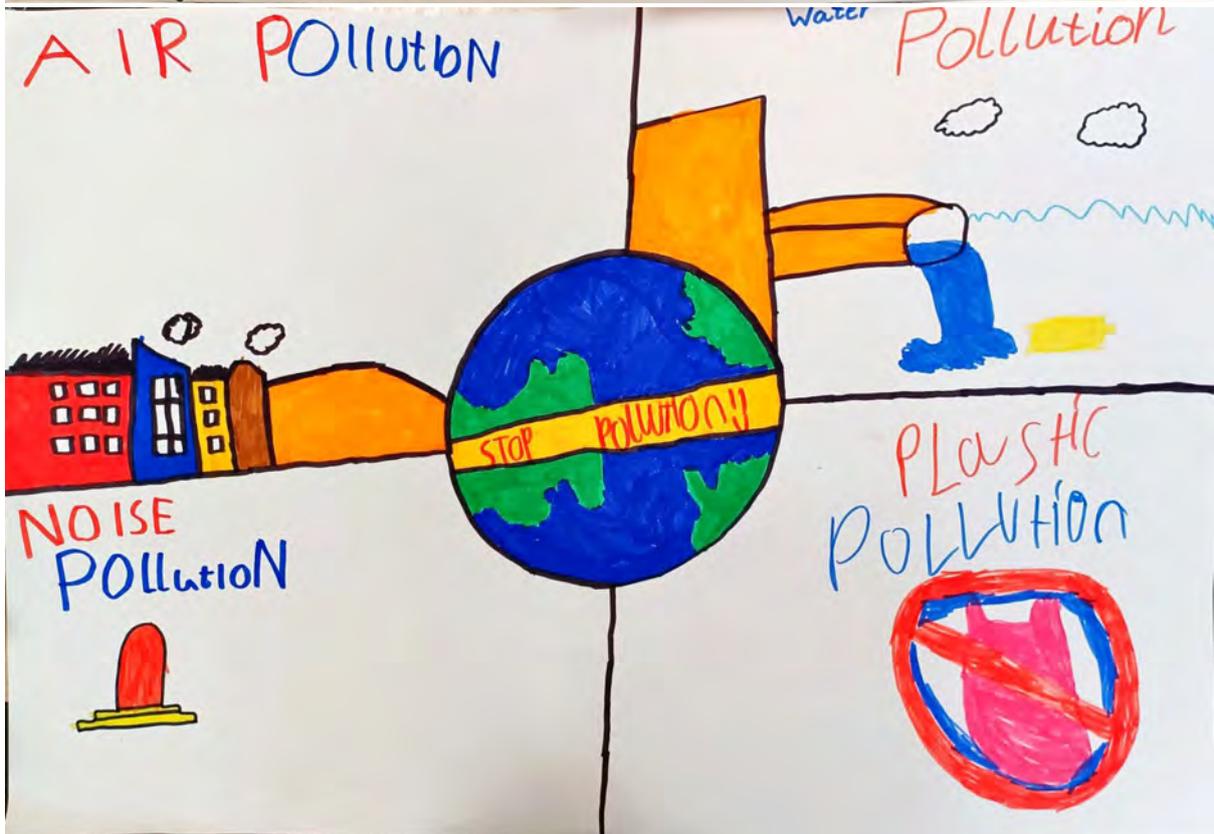
every year the global population generates approximately 1.3 billion tons of waste to the weight of 6.5 million blue whales.

Pollution is one of the deadliest killers affecting more than 10 million people worldwide.

For every 1 pound spent on air pollution control yields in return 30 pounds in economic benefits.

Approximately nine million deaths in 2015 were linked to pollution.





Human activities that generate waste and toxic sewage and waste water treatment

water

Save water

High Amounts of air pollution
Lower its expectancy

High Air

air - plant a tree and get rid of air so use
USE LESS heating
Walk to school more and be active

INSHES
PRIMARY

Stop littering and do more litter picking

Land - plant more trees
Stop cutting so many trees
1.2 - 2kg of waste per day

pick up litter to help the environment

help the environment in giving people a clean deep

Drive your car less
try to walk to school more
Don't burn your garbage
Plant trees

Air pollution is the biggest threat to the environmental world wide

INSHES
PRIMARY
School

LAND

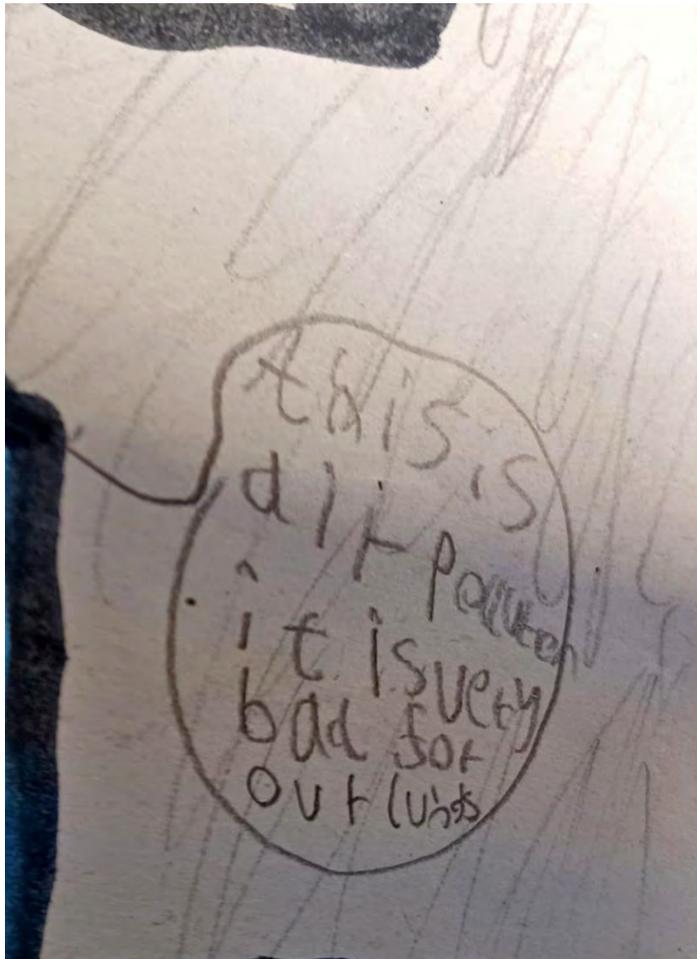
real wish

H₂O

We have lots of water pollution

Water
Help clean beaches and rivers

insure on market try to reduce low pollution as they are a place to do it. people could be saving money but yes to wait way what to be full of rubbish. USE A BIN.



Appendix B.5 – School Engagement Information

Newsletter summary sheet for each school

2022-23

1. Bishop Eden
2. Crown
3. Dalneigh
4. Holm
5. Kirkhill
6. Pennyland

2023-24

7. Bun-Sgoil Ghaidhlig Inbir Nis
8. Central
9. Cradlehall
10. Hilton
11. Inverlochy
12. Lundavra
13. Merkinch
14. Millbank
15. Muirtown
16. Rosebank

2024-25

17. Cauldeen
18. Drakies
19. Duncan Forbes
20. Inshes
21. Kinmylies
22. Lochardil



Bishop Eden's Primary Air Quality Monitoring

The Highland Council carried out an air quality survey in conjunction with Bishop Eden's Primary School during Autumn 2022.

Introduction

Passive diffusion tubes were deployed at the locations in Figure 1 on roads beside the school to collect data on nitrogen dioxide concentrations over a three month cycle – tubes were changed on a monthly basis.

An Earthsense Zephyr unit was deployed at the location in Figure 1 between 14/09/22 – 03/11/22. This collected real-time data on a range of pollutants including nitrogen dioxide and particulates.

Officers from Environmental Health gave a presentation to pupils in Primary 5-7 on Monday 24th October providing an overview of air pollution discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

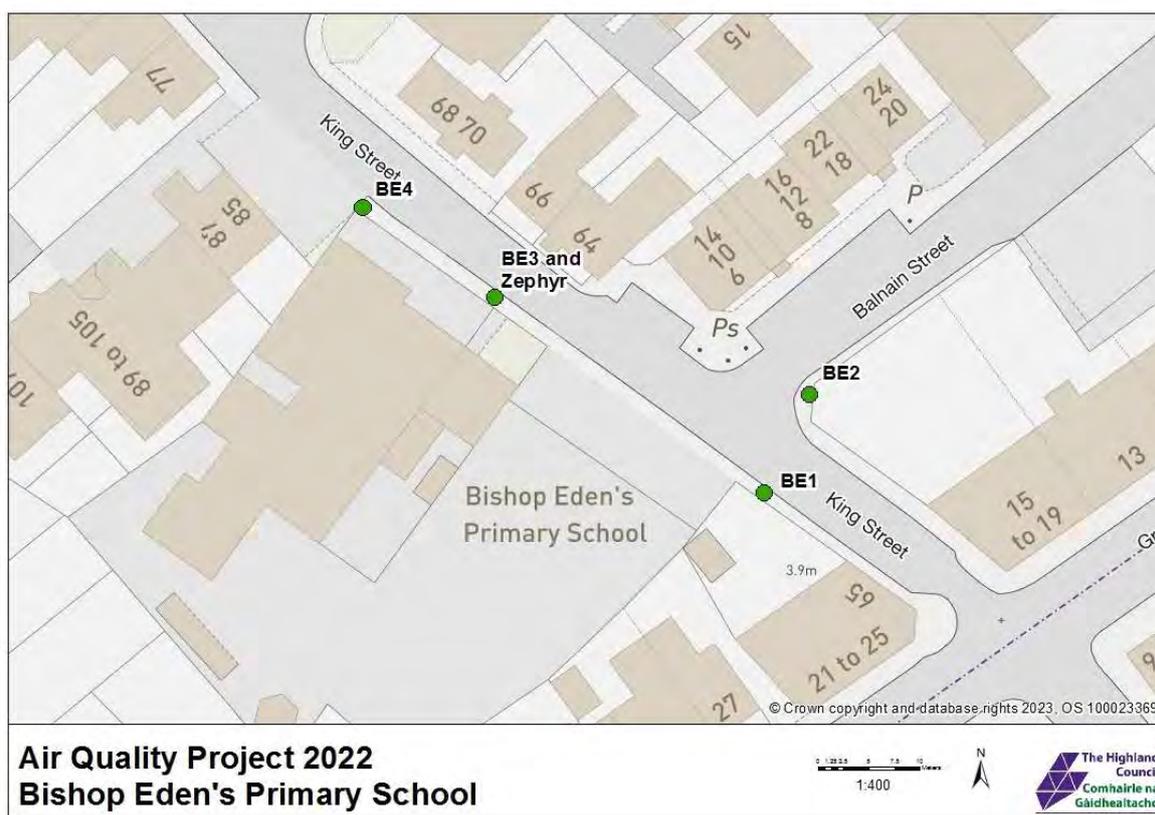


Figure 1 – Location of Diffusion tubes and Zephyr unit

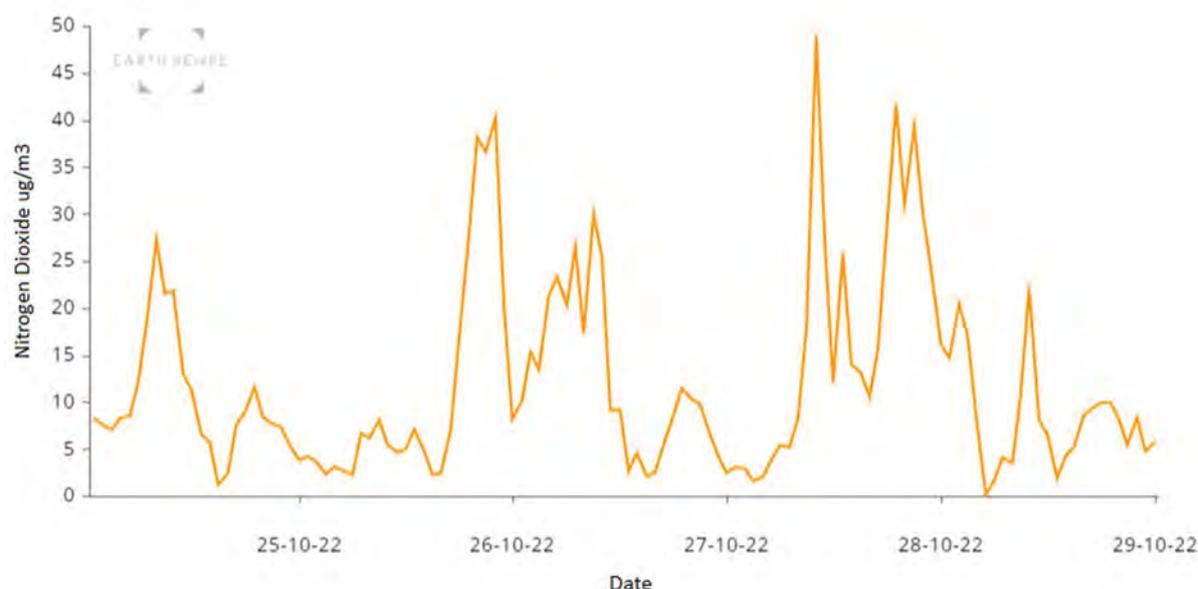
Results

Table 1 provides the results of the monthly passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³. Figure 2 provides a summary of the zephyr real-time data for NO₂ over a selected typical Monday – Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ results for September 2022 in µg/m ³	NO ₂ results for October 2022 in µg/m ³	NO ₂ results for November 2022 in µg/m ³
BE 1	9.98	11.4	14.95
BE 2	9.44	11.54	17.5
BE 3	9.47	10.73	11.99
BE 4	9.12	10.62	15.59

Figure 2 – Graph presenting hourly mean Nitrogen Dioxide concentrations during a typical Monday-Friday using Zephyr data.



Conclusion

Objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being annual mean of 40µg/m³, with a one hour mean of 200µg/m³ not to be exceeded more than 18 times in one year.

The monthly average at Bishop Eden's Primary using the diffusion tube data is 11.9µg/m³, which is one quarter of the annual mean target objective.

Using the zephyr data, the average nitrogen dioxide concentration for all Monday - Friday 9am-4pm periods is 8.5 µg/m³ which is below the passive diffusion tube data, and around one fifth of the annual mean target objective. The one hour mean target objective was not breached onsite during the monitoring period.

It can therefore be concluded that air quality at Bishop Eden's Primary School is not in breach of the Scottish Government's standards on air quality for nitrogen dioxide.

Limitations

The diffusion tube data has been collected for three months, and averaged without adjustments for bias or seasonality, to compare to the annual mean target objective for nitrogen dioxide.

The EarthSense Zephyr monitors are internally calibrated, and have not been recalibrated with known standards, therefore the data is for indicative purposes only. The indicative data demonstrates the range of pollutants over daily cycles, but cannot be relied upon as an absolute dataset.

Crown Primary Air Quality Monitoring

The Highland Council carried out an air quality survey in conjunction with Crown Primary School during Autumn 2022.

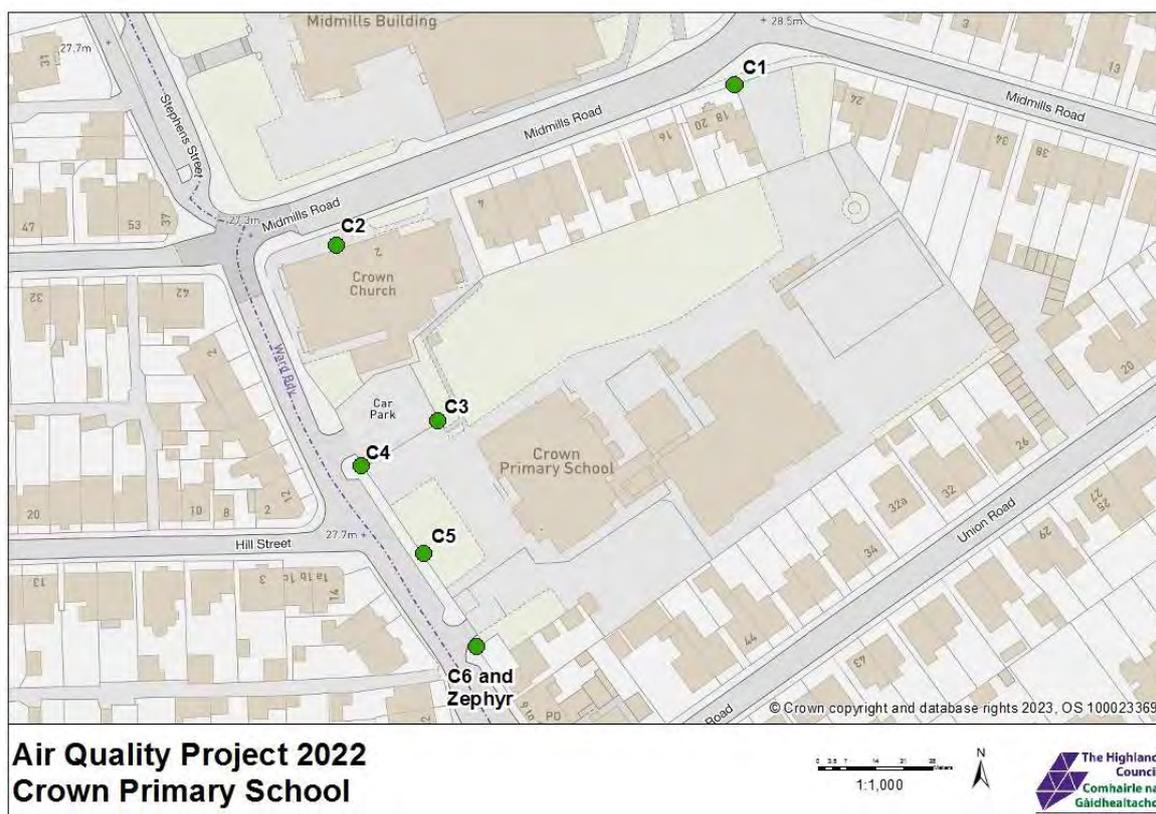
Introduction

Passive diffusion tubes were deployed at the locations in Figure 1 on roads beside the school to collect data on nitrogen dioxide concentrations over a three month cycle – tubes were changed on a monthly basis.

An Earthsense Zephyr unit was deployed at the location in Figure 1 between 03/11/22 – 28/02/23. This collected real-time data on a range of pollutants including nitrogen dioxide and particulates.

Officers from Environmental Health gave a presentation to the school’s Junior Road Safety Officers on Thursday 3rd November providing an overview of air pollution discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Figure 1 – Location of Diffusion tubes and Zephyr unit



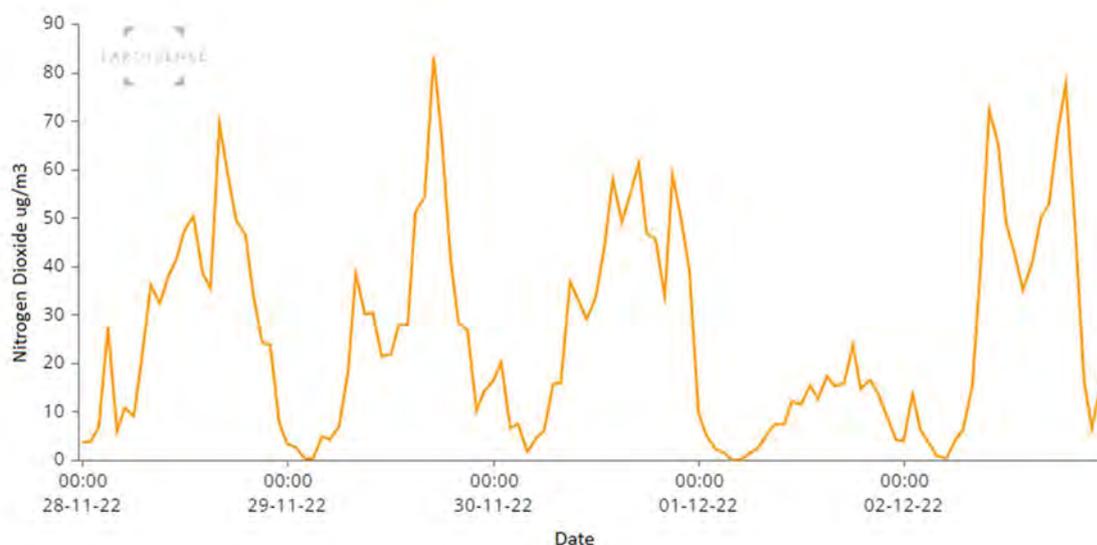
Results

Table 1 provides the results of the monthly passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³. Figure 2 provides a summary of the zephyr real-time data for NO₂ over a selected typical Monday – Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ results for September 2022 in µg/m ³	NO ₂ results for October 2022 in µg/m ³	NO ₂ results for November 2022 in µg/m ³
C1	11.52	12.87	16.61
C2	10.46	11.04	17.91
C3	9.25	10.41	14.35
C4	11.13	12.21	14.35
C5	10.79	12.19	18.08
C6	10.83	12.33	18.37

Figure 2 – Graph presenting hourly mean Nitrogen Dioxide concentrations during a typical Monday-Friday using Zephyr data.



Conclusion

Objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being annual mean of 40 µg/m³, with a one hour mean of 200 µg/m³ not to be exceeded more than 18 times in one year.

The monthly average at Crown Primary using the diffusion tube data is 13 µg/m³, which is around one third of the annual mean target objective.

Using the zephyr data, the average nitrogen dioxide concentration for all Monday - Friday 9am-4pm periods is 22.8 µg/m³ which is above the passive diffusion tube data, but still around half of the annual mean target objective. The one hour mean target objective was not breached onsite during the monitoring period.

It can therefore be concluded that air quality at Crown Primary School is not in breach of the Scottish Government’s standards on air quality for nitrogen dioxide.

Limitations

The diffusion tube data has been collected for three months, and averaged without adjustments for bias or seasonality, to compare to the annual mean target objective for nitrogen dioxide.

The EarthSense Zephyr monitors are internally calibrated, and have not been recalibrated with known standards, therefore the data is for indicative purposes only. The indicative data demonstrates the range of pollutants over daily cycles, but cannot be relied upon as an absolute dataset.

Dalneigh Primary School Air Quality Monitoring

The Highland Council carried out an air quality survey in conjunction with Dalneigh Primary School during Autumn 2022.

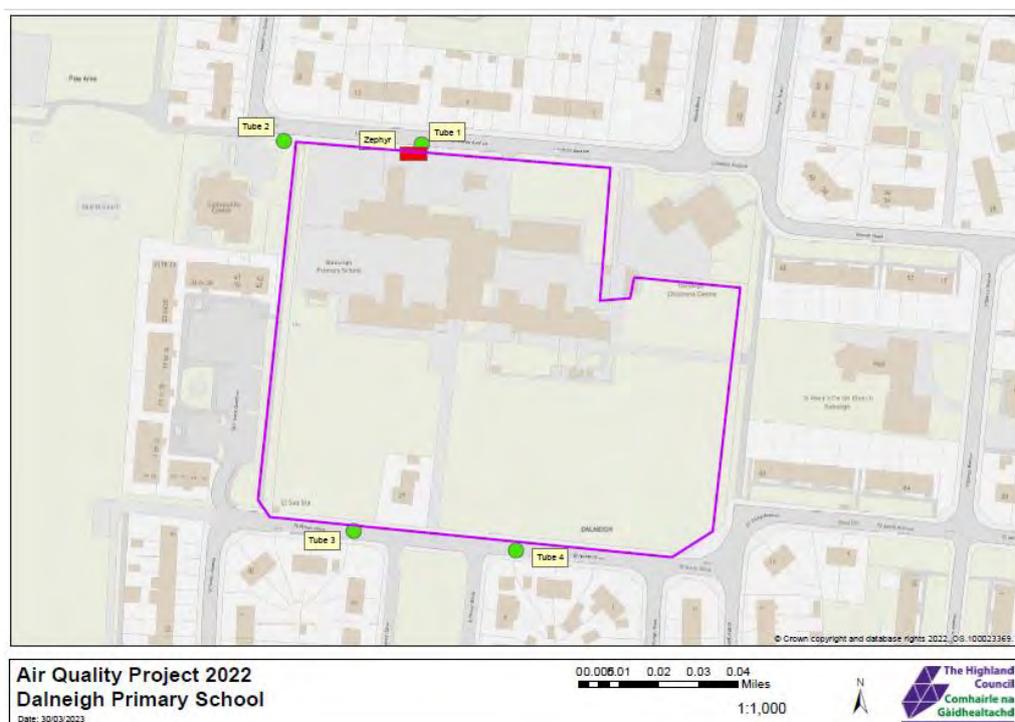
Introduction

Passive diffusion tubes were deployed at the locations in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a three-month cycle; tubes were changed monthly.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 12th August 2022 and 14th November 2022. This collected real-time data on a range of pollutants including nitrogen dioxide and particulates.

Officers from Environmental Health gave a presentation to pupils on 21st September 2022 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Figure 1 – Location of Diffusion tubes and Zephyr unit



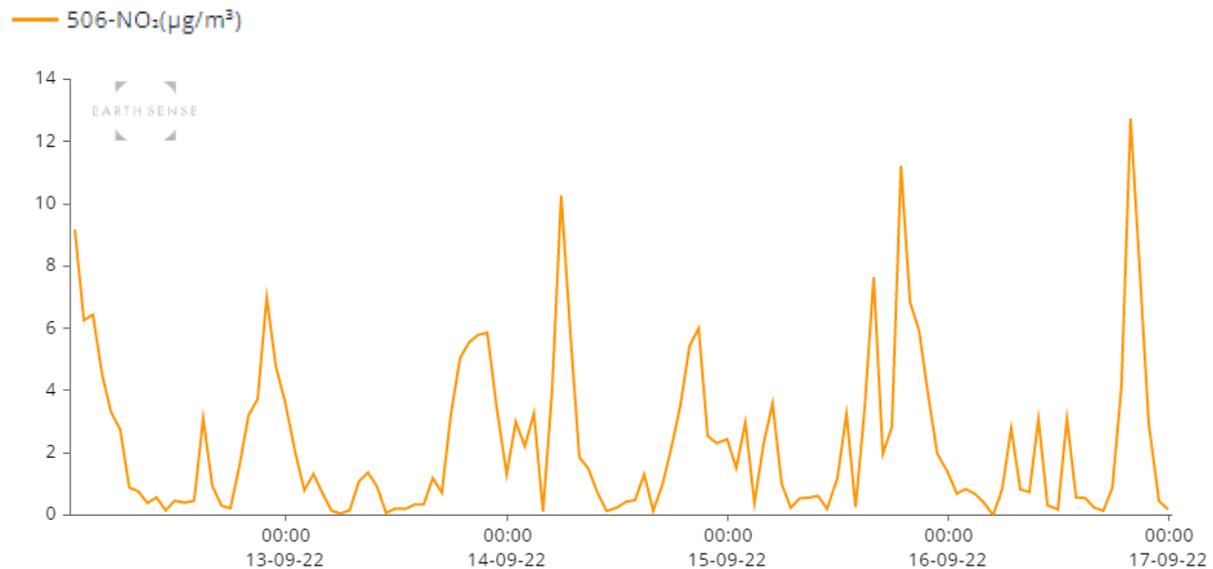
Results

Table 1 below provides the results of the monthly passive diffusion tube nitrogen dioxide concentrations in $\mu\text{g}/\text{m}^3$. Figure 2 provides a summary of the zephyr real-time data for nitrogen dioxide over a selected typical Monday – Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	Results for 12/08/22 – 14/09/22 in $\mu\text{g}/\text{m}^3$	Results for 14/09/22 – 21/10/22 in $\mu\text{g}/\text{m}^3$	Results for 21/10/22 - 21/11/22 in $\mu\text{g}/\text{m}^3$
Location 1	6.16	Missing	10.86
Location 2	Missing	4.79	Missing
Location 3	6.51	Missing	11.9
Location 4	6.58	5.27	11.4

Figure 2 – Graph presenting Nitrogen Dioxide concentrations during a typical Monday-Friday using Zephyr data.



Conclusion

Objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of 40µg/m³, with a one hour mean of 200µg/m³ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is 7.93µg/m³, which is less than a fifth of the annual mean target objective.

Using the zephyr data, the average nitrogen dioxide concentration for all Monday-Friday 9am-4pm periods is 2.45µg/m³ which is below the passive diffusion tube data, and again well below the annual mean target objective. The one hour mean target objective was not breached onsite during the monitoring period.

It can therefore be concluded that air quality at Dalneigh Primary School is not in breach of the Scottish Government's standards on air quality for nitrogen dioxide.

Limitations

The diffusion tube data has been collected for three months, and averaged without adjustments, to compare to the annual mean target objective for nitrogen dioxide.

The EarthSense Zephyr monitors are internally calibrated, and have not been recalibrated with known standards, therefore the data is for indicative purposes only. The indicative data demonstrates the range of pollutants over daily cycles but cannot be relied upon as an absolute dataset.

Holm Primary School - Air Quality Monitoring

The Highland Council carried out an air quality survey in conjunction with Holm Primary School during Autumn-Winter 2022.

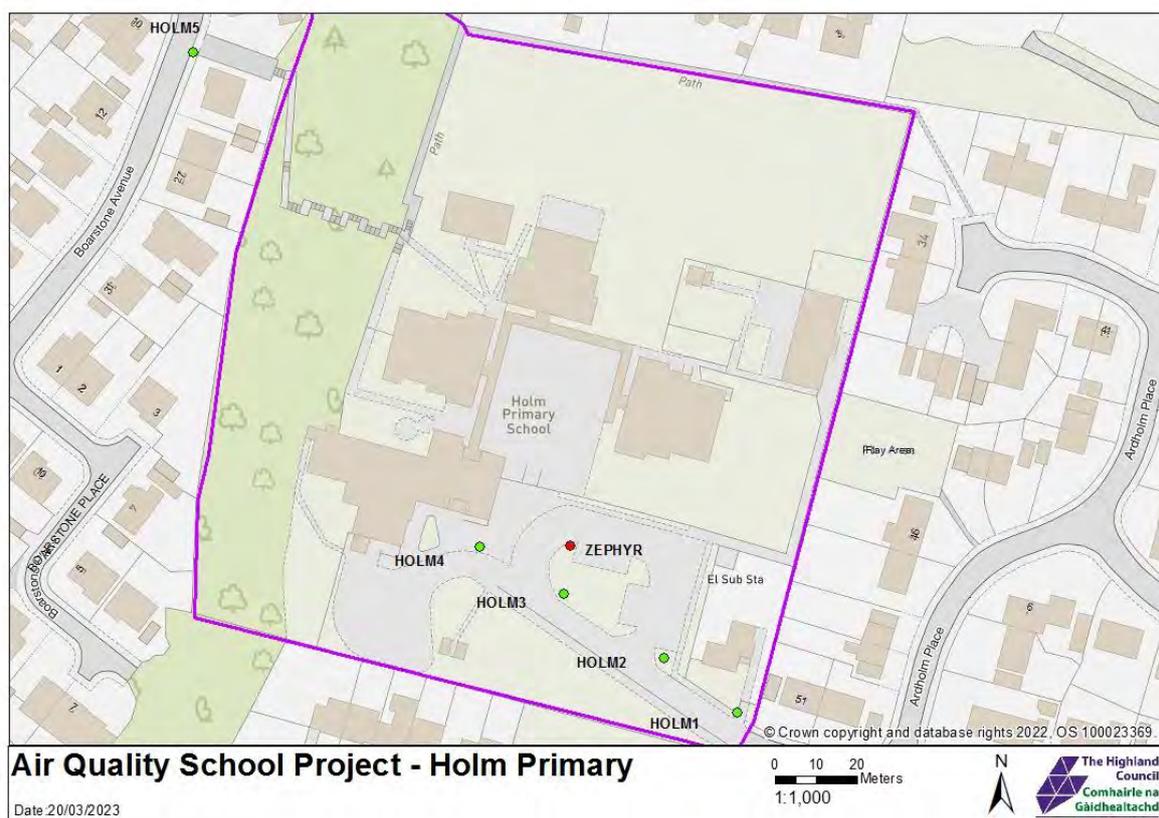
Introduction

Passive diffusion tubes were deployed at the 5 locations in Figure 1 within the drop off area and roads beside the school to collect data on nitrogen dioxide concentrations over a three-month cycle – tubes were changed monthly.

An Earthsense Zephyr Unit (No. 585) was deployed at the red location in Figure 1 between 03/11/22 to 02/02/2023. This collected real-time data on a range of pollutants including nitrogen dioxide and particulates.

Officers from Environmental Health gave a presentation to P7 pupils on 21/11/22 providing an overview of air pollution covering what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Figure 1 – Location of Diffusion tubes and Zephyr unit



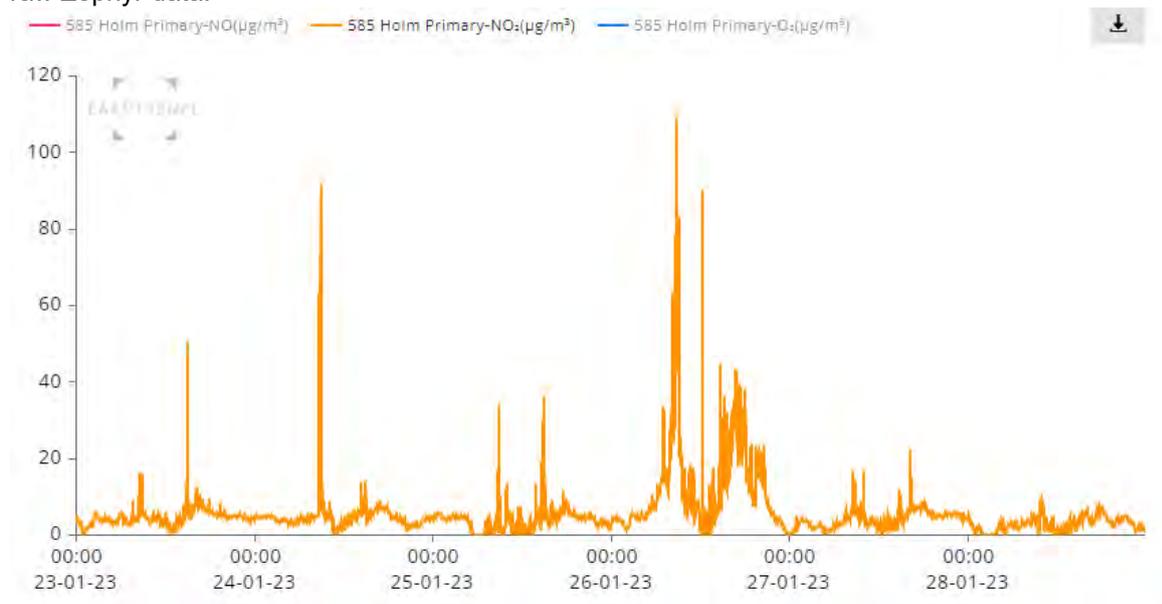
Results

Table 1 below provides the results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³. Figure 2 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday – Friday period.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2022	NO ₂ Results in µg/m ³ October 2022	NO ₂ Results in µg/m ³ November 2022
HOLM 1	4.31	5.68	9.55
HOLM 2	4.17	5.51	9.18
HOLM 3	4.34	5.49	9.16
HOLM 4	4.25	2.97	8.37
HOLM 5	4.13	5.59	8.12

Figure 2 – Graph presenting Nitrogen Dioxide concentrations during a typical Monday-Friday using raw Zephyr data.



Conclusion

Objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being annual mean of 40µg/m³, with a one hour mean of 200µg/m³ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is 6.05 µg/m³, which is low at under one quarter of the annual mean target objective.

Using the Zephyr data, the average nitrogen dioxide concentration for all school day Monday-Friday 9am-4pm periods is 11.77 µg/m³ which is higher than the passive diffusion tube data, but still well below half the annual mean target objective. The one hour mean target objective was not breached onsite during the monitoring period.

It can therefore be concluded that air quality at Holm Primary is not in breach of the Scottish Government’s standards on air quality for nitrogen dioxide.

Limitations

The diffusion tube data has been collected for three months and averaged without any adjustments to compare to the annual mean target objective for nitrogen dioxide.

The EarthSense Zephyr monitors are internally calibrated, and have not been recalibrated with known standards, therefore the data is for indicative purposes only. The indicative data demonstrates the range of pollutants over daily cycles but cannot be relied upon as an absolute dataset.

Kirkhill Primary School - Air Quality Monitoring

The Highland Council carried out an air quality survey in conjunction with Kirkhill Primary School during Autumn 2022.

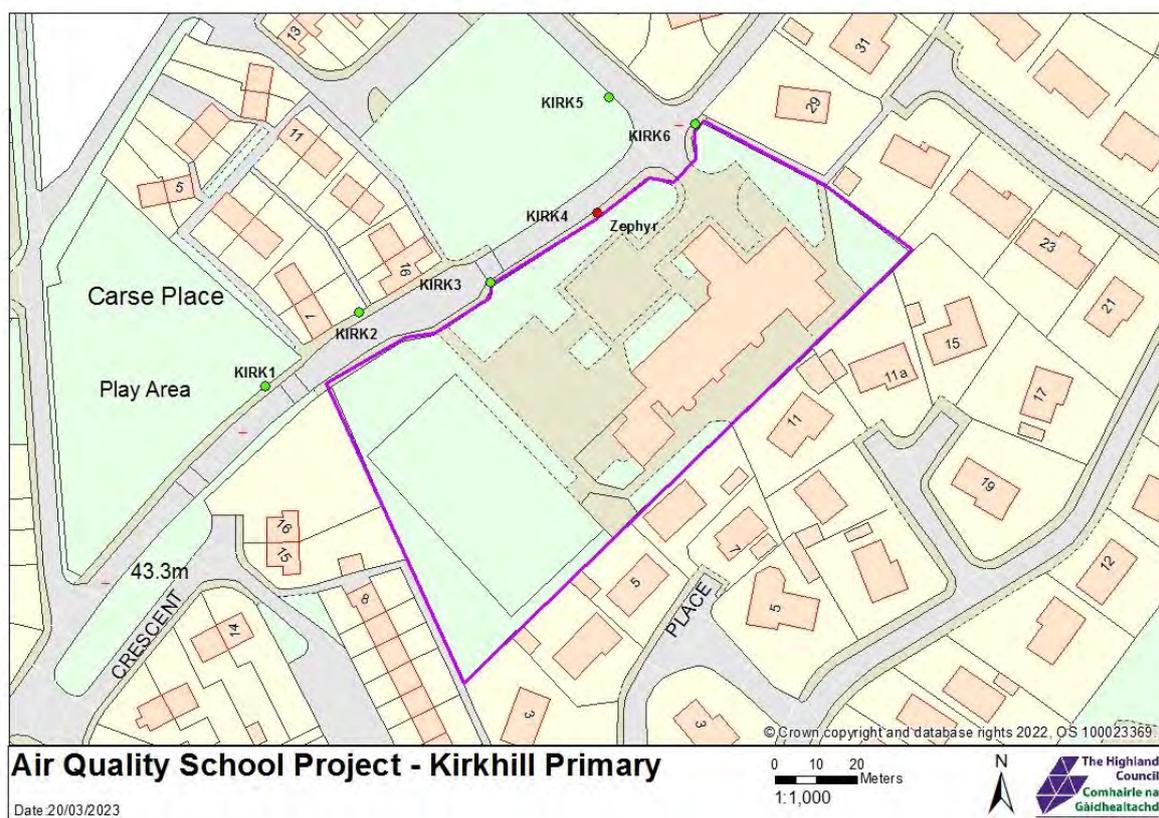
Introduction

Passive diffusion tubes were deployed at all 6 locations in Figure 1 on roads beside the school to collect data on nitrogen dioxide concentrations over a three-month cycle – tubes were changed monthly.

An Earthsense Zephyr Unit (No. 442) was deployed at the red location in Figure 1 between 22/09/22 to 03/11/22. This collected real-time data on a range of pollutants including nitrogen dioxide and particulates.

Officers from Environmental Health gave a presentation to P6 pupils on 22/09/22 providing an overview of air pollution covering what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Figure 1 – Location of Diffusion tubes and Zephyr unit



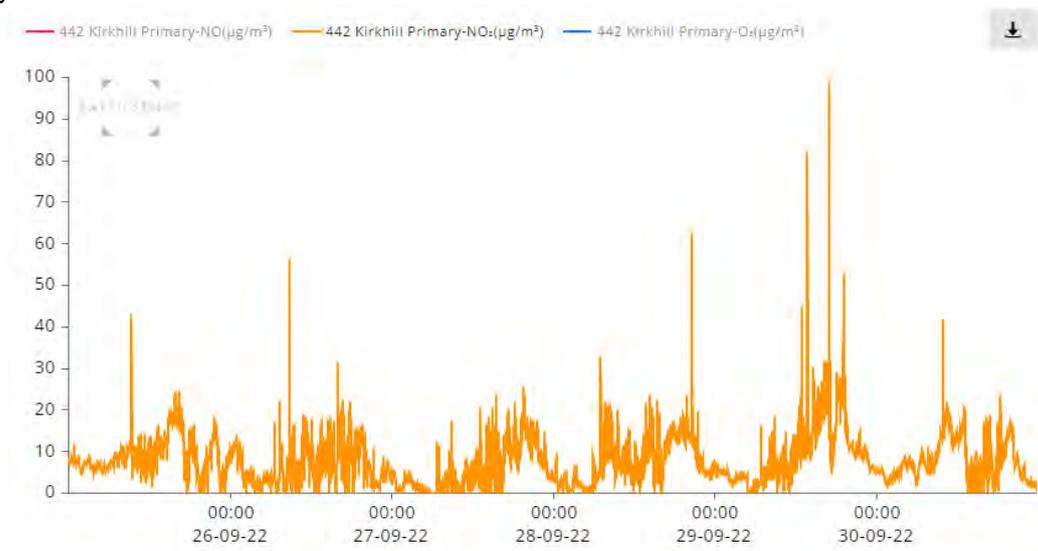
Results

Table 1 below provides the results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³. Figure 2 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday – Friday period.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2022	NO ₂ Results in µg/m ³ October 2022	NO ₂ Results in µg/m ³ November 2022
KIRK 1	3.58	Location removed	n/a
KIRK 2	3.38	4.36	Tube missing
KIRK 3	3.06	Tube missing	6.75
KIRK 4	3.38	3.85	6.71
KIRK 5	2.6	3.25	6.1
KIRK 6	2.94	3.83	6.71

Figure 2 – Graph presenting Nitrogen Dioxide concentrations during a typical Monday-Friday using Zephyr data.



Conclusion

Objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being annual mean of 40ug/m³, with a one hour mean of 200ug/m³ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is 4.32 µg/m³, which is low at just over one tenth of the annual mean target objective.

Using the Zephyr data, the average nitrogen dioxide concentration for all school days Monday-Friday 9am-4pm periods is 4.44 µg/m³ which is very close to the average passive diffusion tube result, also low, at approximately one tenth of the annual mean target objective. The one hour mean target objective was not breached onsite during the monitoring period.

It can therefore be concluded that air quality at Kirkhill Primary is not in breach of the Scottish Government’s standards on air quality for nitrogen dioxide. Officers from Environmental Health attended the school on 03/11/22 to discuss the results of the monitoring with pupils.

Limitations

The diffusion tube data has been collected for three months and averaged without any adjustments to compare to the annual mean target objective for nitrogen dioxide.

The EarthSense Zephyr monitors are internally calibrated, and have not been recalibrated with known standards, therefore the data is for indicative purposes only. The indicative data demonstrates the range of pollutants over daily cycles but cannot be relied upon as an absolute dataset.

PENNYLAND PRIMARY SCHOOL AIR QUALITY MONITORING

The Highland Council carried out an air quality survey in conjunction with Pennyland Primary School during Autumn 2022.

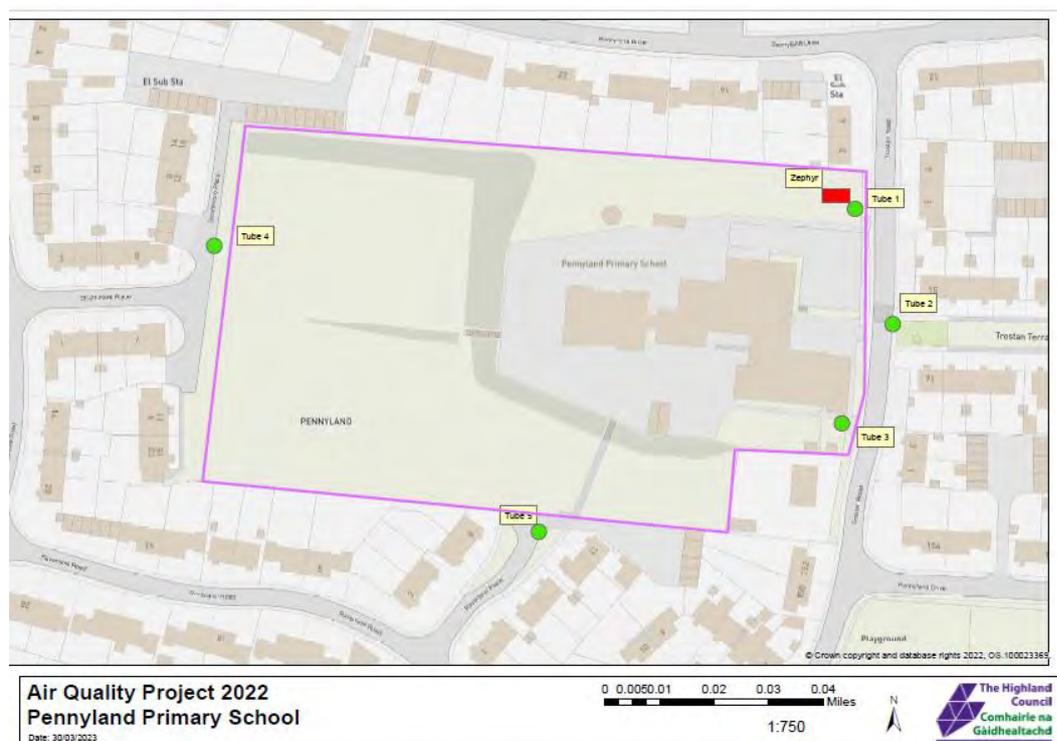
Introduction

Passive diffusion tubes were deployed at the locations in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a three-month cycle; tubes were changed monthly.

An Earthsense Zephyr unit was deployed at the location in Figure 1 between 7th November 2022 and 22nd February 2023. This collected real-time data on a range of pollutants including nitrogen dioxide and particulates.

An officer from Environmental Health gave a presentation to pupils on the 7th November 2022 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Figure 1 – Location of Diffusion tubes and Zephyr unit



Results

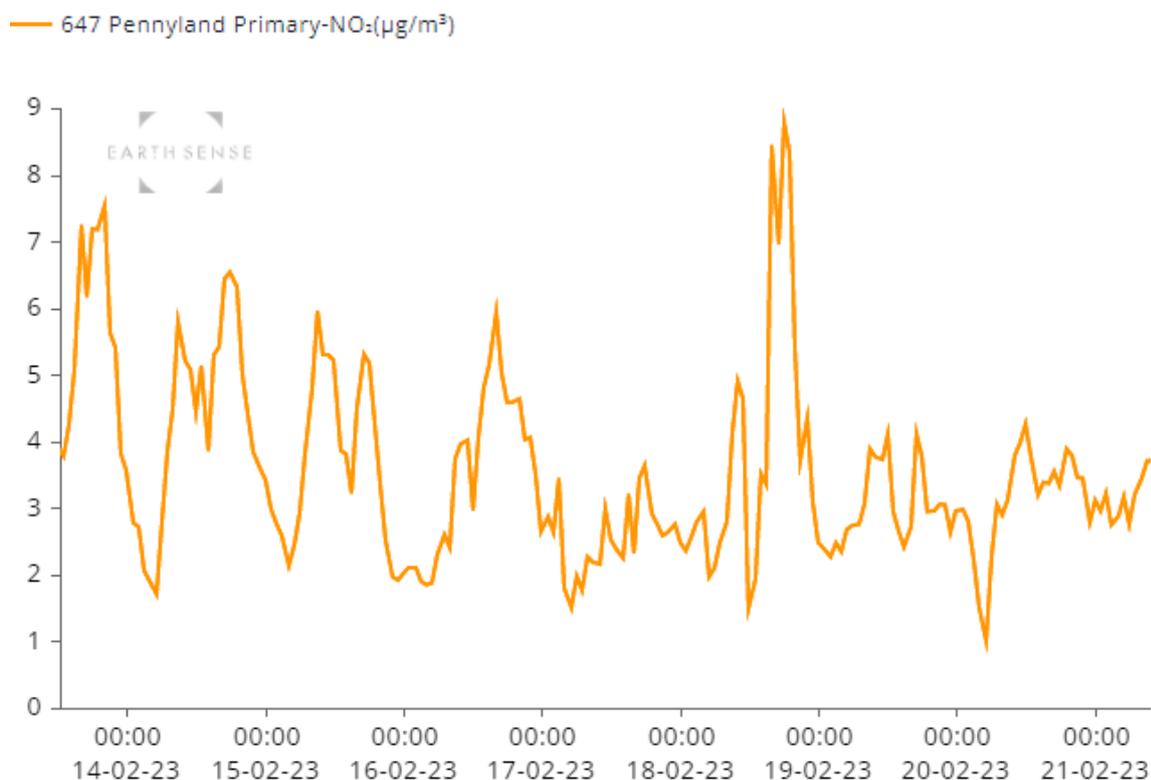
Table 1 below provides the results of the monthly passive diffusion tube nitrogen dioxide concentrations in $\mu\text{g}/\text{m}^3$. Figure 2 provides a summary of the zephyr real-time data for nitrogen dioxide over a selected typical Monday – Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	Results for 11/09/22 – 07/10/22 in $\mu\text{g}/\text{m}^3$	Results for 07/10/22 – 07/11/22 in $\mu\text{g}/\text{m}^3$	Results for 07/11/22 – 06/12/22 in $\mu\text{g}/\text{m}^3$
Location 1	2.53	3.96	5.47
Location 2	2.70	Missing	6.22

Location 3	2.22	3.80	6.37
Location 4	2.13	3.41	5.91
Location 5	2.50	3.35	5.83

Figure 2 – Graph presenting Nitrogen Dioxide concentrations during a typical Monday-Friday using Zephyr data.



Conclusion

Objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of 40µg/m³, with a one hour mean of 200µg/m³ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is 4.03µg/m³, which is a tenth of the annual mean target objective.

Using the zephyr data, the average nitrogen dioxide concentration for all Monday-Friday 9am-4pm periods is 3.7µg/m³ which is below the passive diffusion tube data, and again less than a tenth of the annual mean target objective. The one hour mean target objective was not breached onsite during the monitoring period.

It can therefore be concluded that air quality at Pennyland Primary School is not in breach of the Scottish Government’s standards on air quality for nitrogen dioxide.

Officers from Environmental Health attended school on 6th December 2022 to discuss the results of the monitoring.

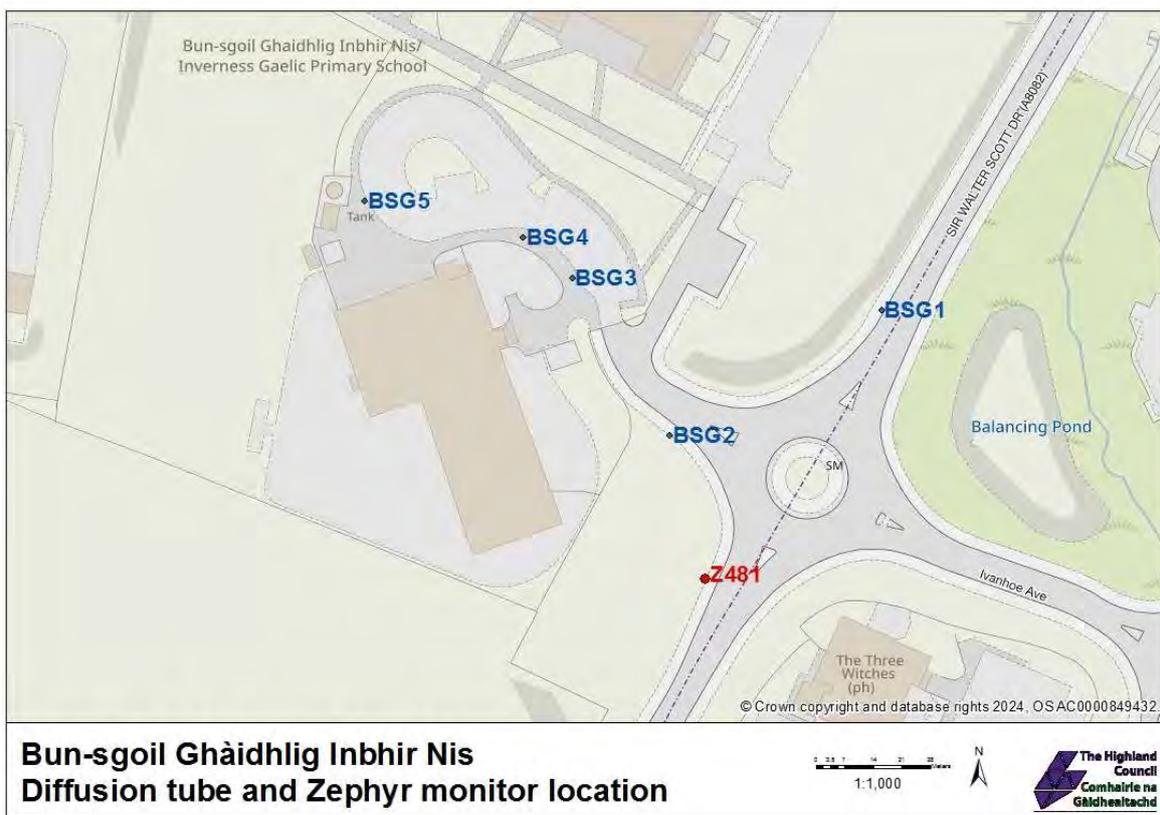
Limitations

The diffusion tube data has been collected for three months, and averaged without adjustments, to compare to the annual mean target objective for nitrogen dioxide. The EarthSense Zephyr monitors are internally calibrated, and have not been recalibrated with known standards, therefore the data is for indicative purposes only. The indicative data demonstrates the range of pollutants over daily cycles but cannot be relied upon as an absolute dataset.

Introduction

The Highland Council carried out an air quality study at Bun-sgoil Ghàidhlig Inbhir Nis during the 2023-2024 school year.

Passive diffusion tubes were deployed at five locations on roads beside the school to measure nitrogen dioxide concentrations over a three-month cycle from September to November 2023. An Earthsense Zephyr Unit (No. 481) was deployed at the red location in the below figure between 08/03/24 to 31/05/24 to collect real-time data on a range of pollutants including nitrogen dioxide and particulate matter.

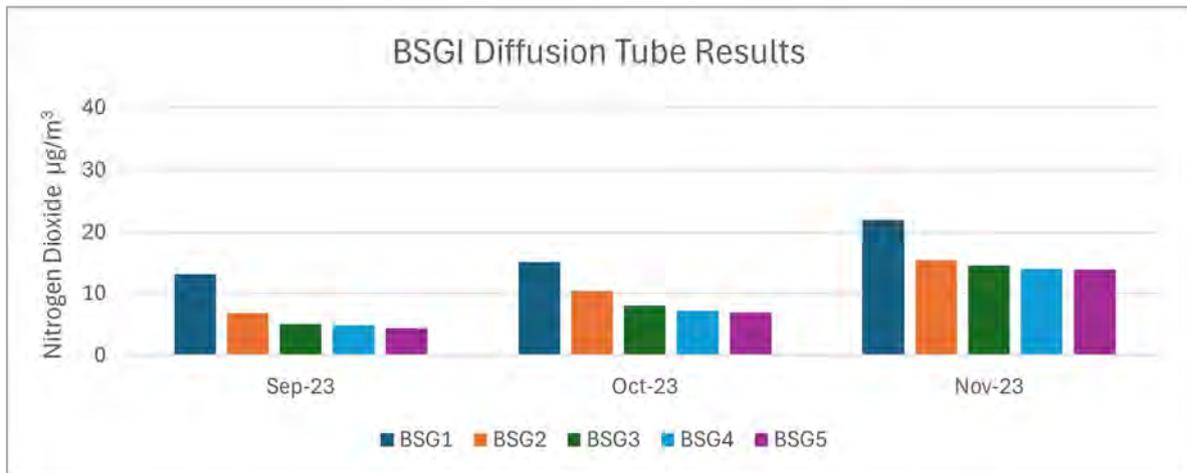


Results

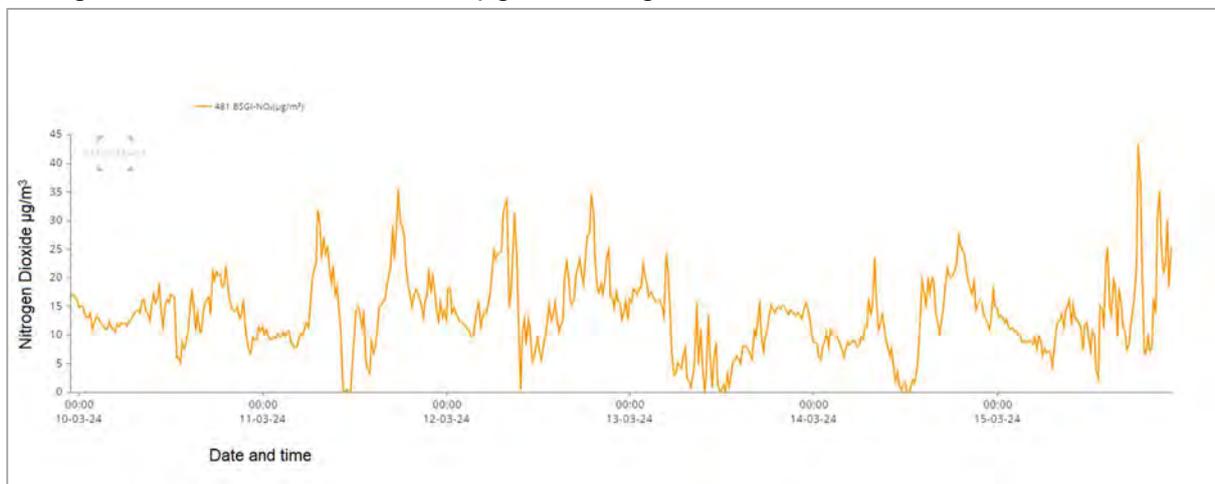
The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in the below table and bar chart. The final chart provides an example of the Zephyr real-time data for nitrogen dioxide over a selected week.

Location	NO ₂ µg/m ³ September 2023	NO ₂ µg/m ³ October 2023	NO ₂ µg/m ³ November 2023
BSG1	13.1	15.1	22.0
BSG2	6.9	10.4	15.3
BSG3	5.1	8.1	14.5
BSG4	4.9	7.2	13.9
BSG5	4.4	6.9	13.9

Passive diffusion tube nitrogen dioxide concentrations in $\mu\text{g}/\text{m}^3$ by month.



Nitrogen dioxide real-time data in $\mu\text{g}/\text{m}^3$ during a selected week 10th – 15th March 2024



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40\mu\text{g}/\text{m}^3$, with a one hour mean of $200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average nitrogen dioxide using the diffusion tube data is $11\mu\text{g}/\text{m}^3$, which is low, at less than a third of the annual mean target objective.

The Zephyr data generally shows peaks of pollutants during the day, with lower concentrations at night. The average nitrogen dioxide concentration for all school days Mon-Fri, 9am-4pm, excluding holidays is $13\mu\text{g}/\text{m}^3$ which is still low in comparison to the annual mean target objective.

The one hour mean target objective was not exceeded onsite during the monitoring period as measured by the Zephyr.

The study has shown the air quality at Bun-sgoil Ghàidhlig Inbhir Nis is GOOD and meets the Scottish Government's standards for nitrogen dioxide.

Introduction

The Highland Council carried out an air quality survey in conjunction with Central Primary School during 2023-2024.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a three-month cycle between September to December 2023.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 8th March and 28th March 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 25th March 2024 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2023	NO ₂ Results in µg/m ³ October 2023	NO ₂ Results in µg/m ³ November 2023
CE1	6.3	10.6	14.8
CE2	7.8	12.9	15.1
CE3	14.7	18.9	22.2
CE4	15.0	21.6	21.8
CE5	16.4	18.9	23.6

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

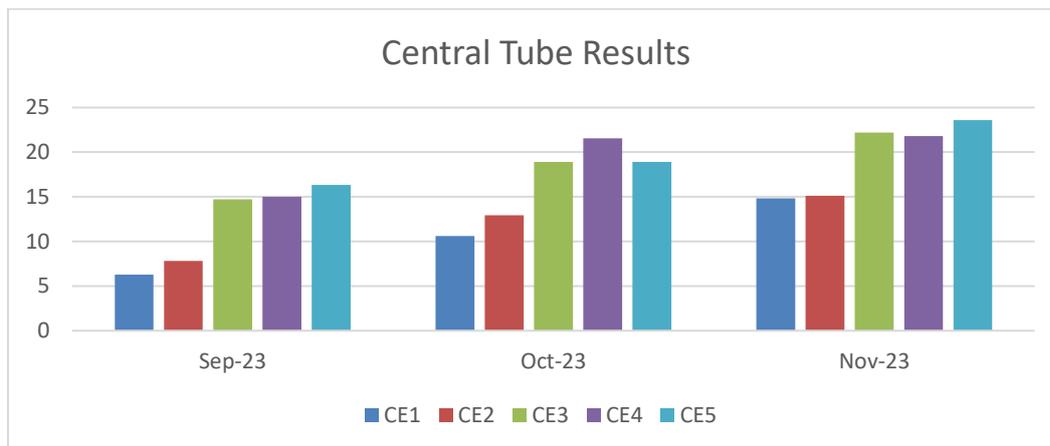
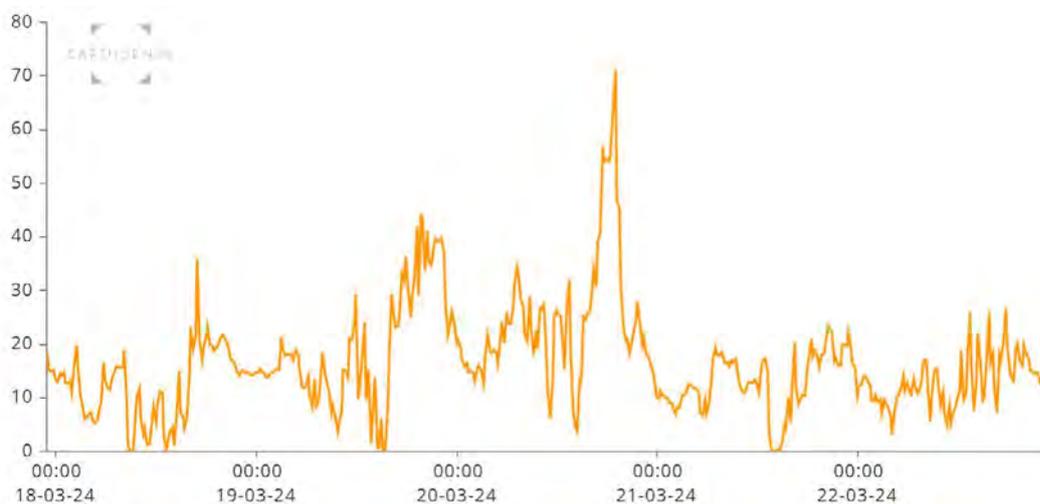


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is $16.04 \mu\text{g}/\text{m}^3$, which is 40 percent of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $17.69 \mu\text{g}/\text{m}^3$ which is again well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Central Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.

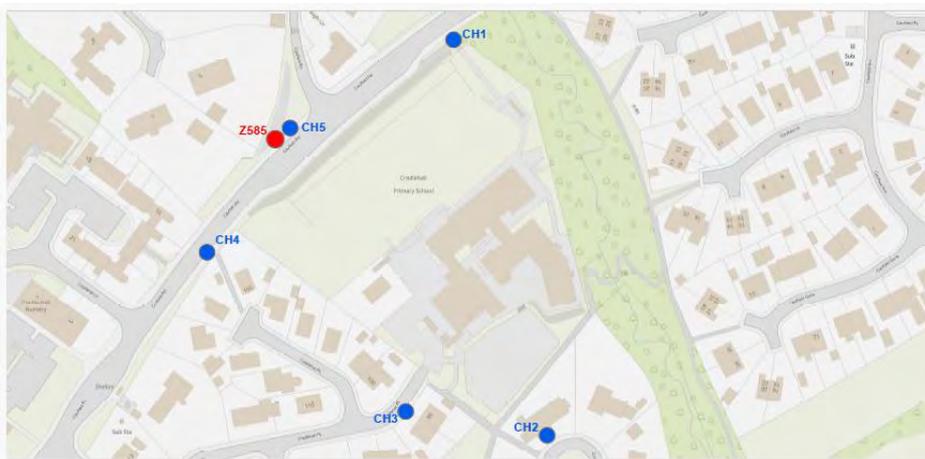
Introduction

The Highland Council carried out an air quality survey in conjunction with Cradlehall Primary School during 2023-2024.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a three-month cycle between September to December 2023.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 28th March and 27th May 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health offered to give a presentation to P6/P7 pupils providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and ask pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2023	NO ₂ Results in µg/m ³ October 2023	NO ₂ Results in µg/m ³ November 2023
CH1	3.7	4.6	10.2
CH2	3.6	4.4	9.3
CH3	4.0	4.7	10.3
CH4	5.5	5.6	12.6
CH5	9.0	6.1	12.1

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

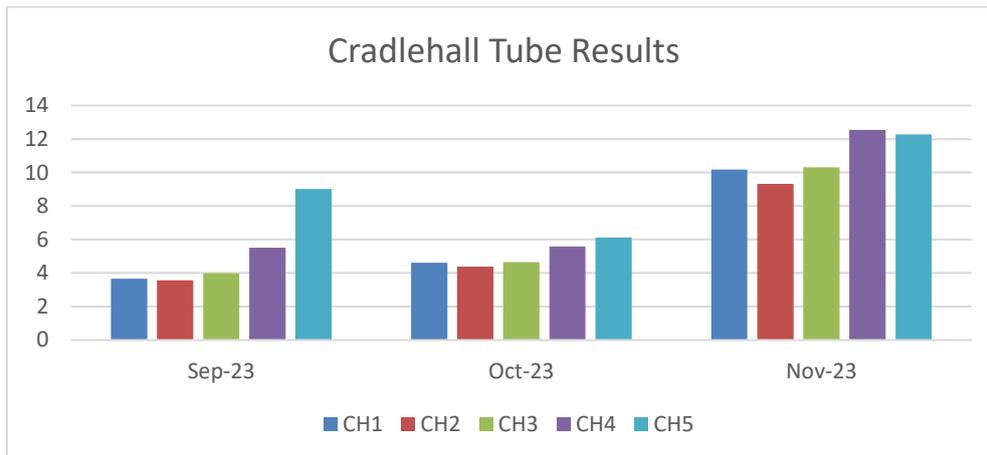
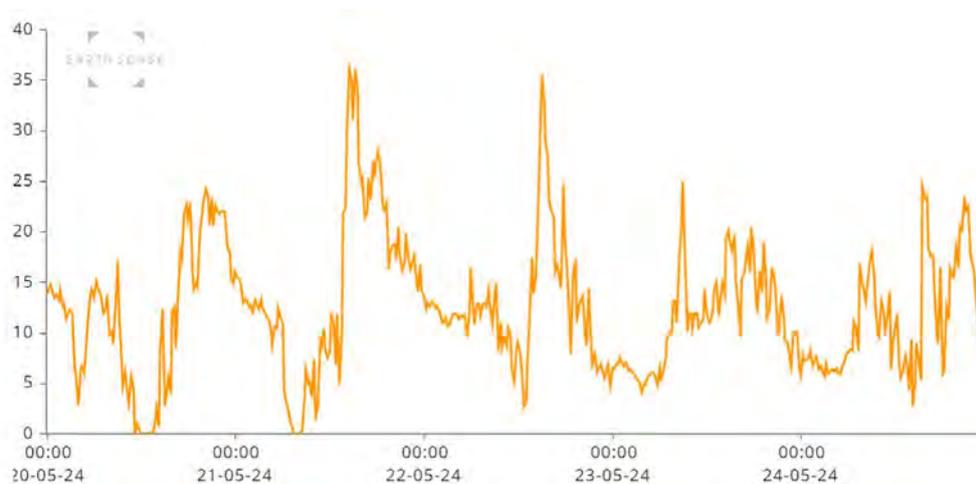


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is $7.05 \mu\text{g}/\text{m}^3$, which is less than a fifth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $11.49 \mu\text{g}/\text{m}^3$ which is again well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Cradlehall Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.

Introduction

The Highland Council carried out an air quality study at Hilton Primary School during the 2023-2024 school year.

Passive diffusion tubes were deployed at 5 locations on roads around the school to collect data on nitrogen dioxide concentrations over a three-month cycle between September to December 2023. While an Earthsense Zephyr Unit (No.442) was deployed at the red location in Figure 1 between 08/03/24 to 27/05/2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulate matter.



Figure 1 – Location of Diffusion tubes and Zephyr unit

An Officer from Environmental Health offered a presentation to P6/7 pupils providing an overview of air pollution covering what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation, however a convenient time was not arranged within the project timescale.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday – Friday period.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2023	NO ₂ Results in µg/m ³ October 2023	NO ₂ Results in µg/m ³ November 2023
HL1	4.95	7.78	14.72
HL2		7.47	15.06
HL3	5.02	7.17	14.75
HL4	5.42	8.43	16.18
HL5	6.38	9.43	16.71

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month.

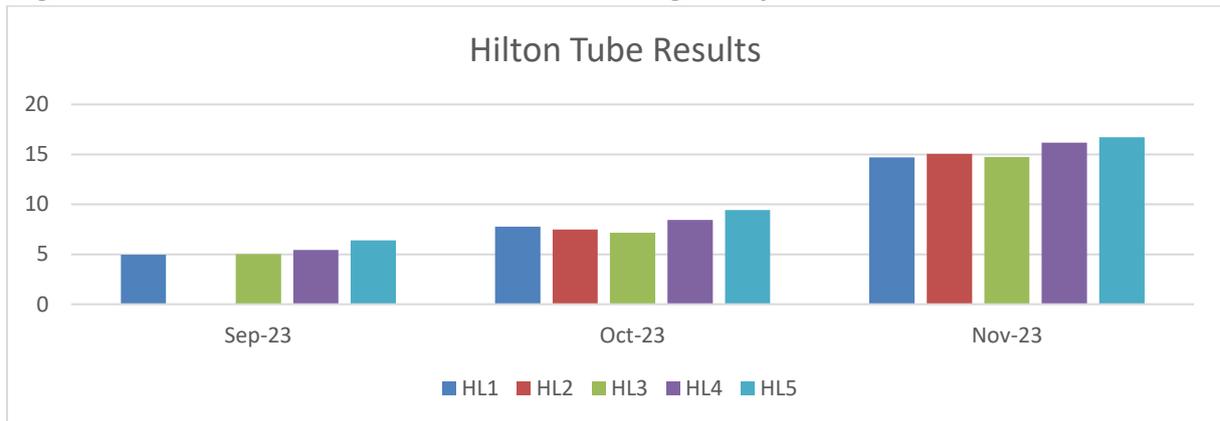
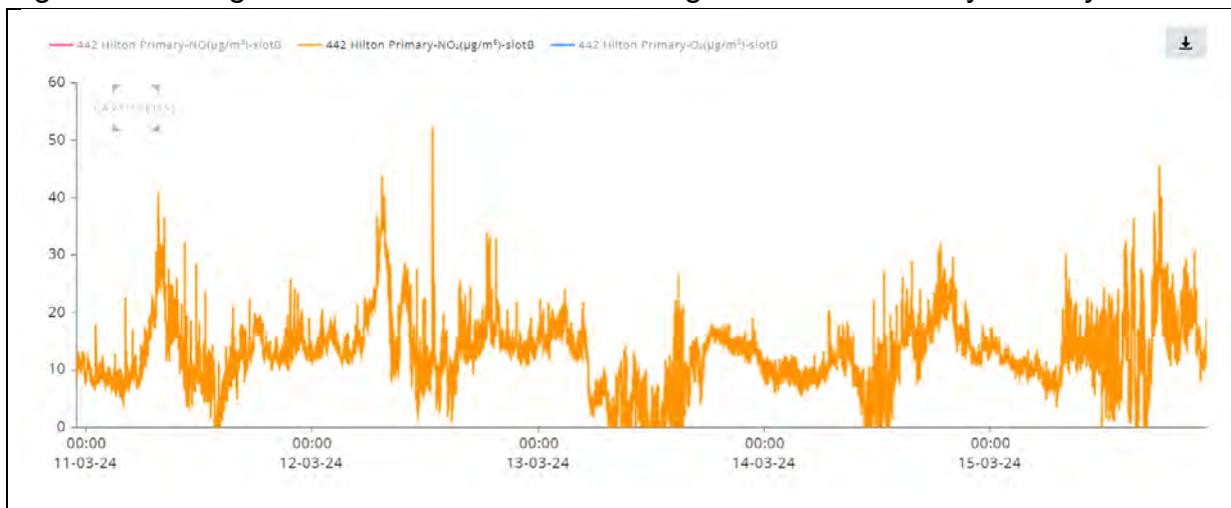


Figure 3 – Nitrogen Dioxide real-time data during a selected Monday - Friday



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being - annual mean of $40\mu\text{g}/\text{m}^3$, with a one hour mean of $200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is $7.025\mu\text{g}/\text{m}^3$, which is low at below a fifth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all school days Mon-Fri, 9am-4pm, excluding holidays is $13.66\mu\text{g}/\text{m}^3$ which although more than the diffusion tube data is still low in comparison to the annual mean target objective.

The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Hilton Primary is GOOD and meets the Scottish Government's standards for nitrogen dioxide.

Limitations – Tube data has been averaged with bias and annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.

Introduction

The Highland Council carried out an air quality study in conjunction with Inverloch Primary School during the 2023-2024 school year.

Passive diffusion tubes were deployed at 5 locations on roads and in the playground area beside the railway line to collect data on nitrogen dioxide concentrations over a three-month cycle between September to December 2023. While an Earthsense Zephyr Unit (No. 647) was deployed at the red location in Figure 1 between 29/02/24 to 27/05/2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulate matter.



Figure 1 – Location of Diffusion tubes and Zephyr unit

An Officer from Environmental Health gave a presentation to P6/7 pupils on 07th May 2024 providing an overview of air pollution covering what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday – Friday period.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2023	NO ₂ Results in µg/m ³ October 2023	NO ₂ Results in µg/m ³ November 2023
NV1	6.9	9.2	17
NV2	8.1	8.9	16.4
NV3	6.6	8.6	16.4
NV4	7.6	8.7	17.1
NV5	5.1	6.8	14.4

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month.

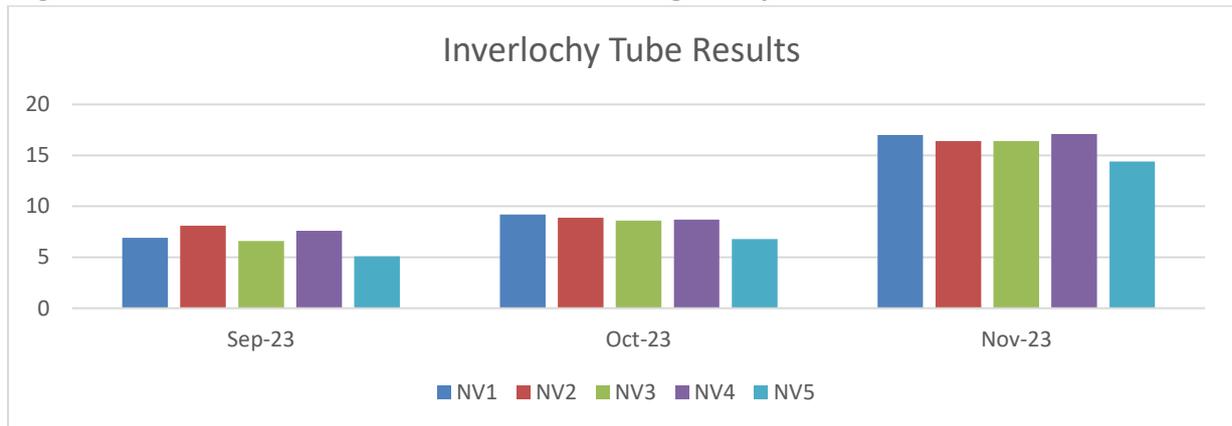
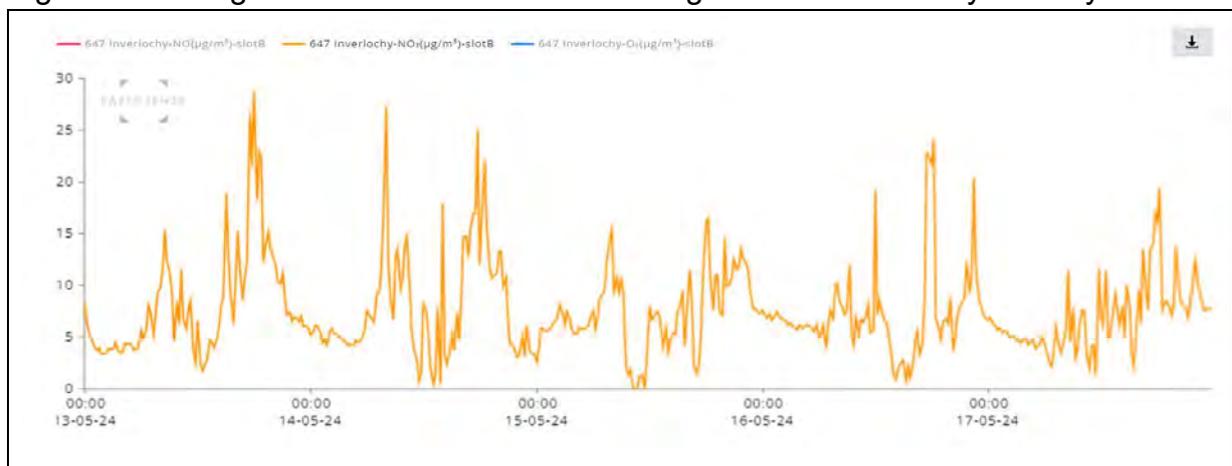


Figure 3 – Nitrogen Dioxide real-time data during a selected Monday - Friday



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being - annual mean of $40\mu\text{g}/\text{m}^3$, with a one hour mean of $200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is $10.52\mu\text{g}/\text{m}^3$, which is low at just over a quarter of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all school days Mon-Fri, 9am-4pm, excluding holidays is $7.35\mu\text{g}/\text{m}^3$ which is even lower in comparison to the annual mean target objective.

The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Inverlochty Primary is GOOD and meets the Scottish Government's standards for nitrogen dioxide.

Limitations – Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.

Introduction

The Highland Council carried out an air quality study in conjunction with Lundavra Primary School during the 2023-2024 school year.

Passive diffusion tubes were deployed at 5 locations on roads and in the parking area beside the school to collect data on nitrogen dioxide concentrations over a three-month cycle between September to December 2023. While an Earthsense Zephyr Unit (No. 647) was deployed at the red location in Figure 1 between 05/10/23 to 29/02/24 to collect real-time data on a range of pollutants including nitrogen dioxide and particulate matter.

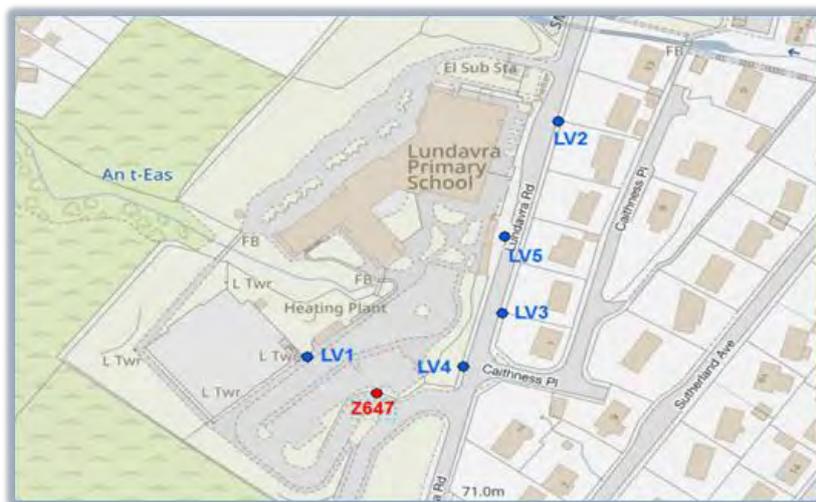


Figure 1 – Location of Diffusion tubes and Zephyr unit

An Officer from Environmental Health gave a presentation to P6 pupils on 09th Nov 2023 providing an overview of air pollution covering what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday – Friday period.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2023	NO ₂ Results in µg/m ³ October 2023	NO ₂ Results in µg/m ³ November 2023
LV1	3.4	5.5	13.3
LV2	5.2	6.9	13.6
LV3	4.8	6.2	12.0
LV4	3.9	5.9	11.8
LV5	4.1	6.1	13.7

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month.

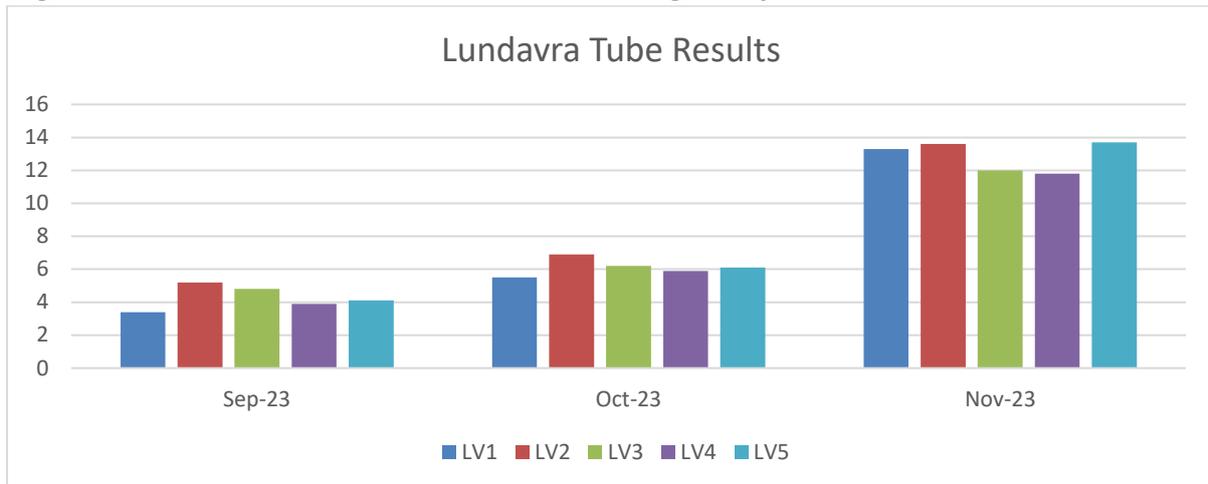
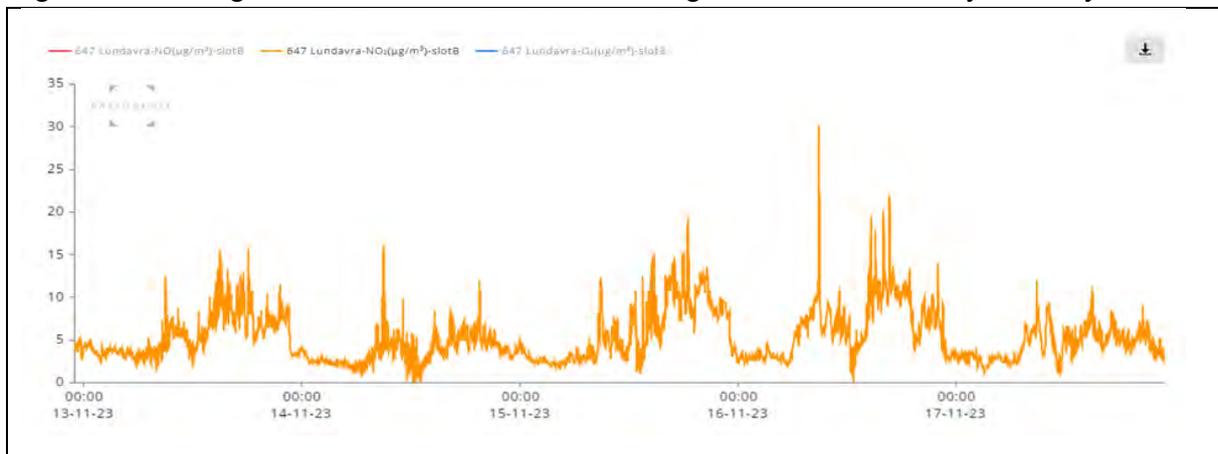


Figure 3 – Nitrogen Dioxide real-time data during a selected Monday - Friday



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being - annual mean of $40\mu\text{g}/\text{m}^3$, with a one hour mean of $200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is $6.44\mu\text{g}/\text{m}^3$, which is low at approximately one sixth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all school days Mon-Fri, 9am-4pm, excluding holidays is $4.54\mu\text{g}/\text{m}^3$ which is even lower in comparison to the annual mean target objective.

The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Lundavra Primary is GOOD and meets the Scottish Government's standards for nitrogen dioxide.

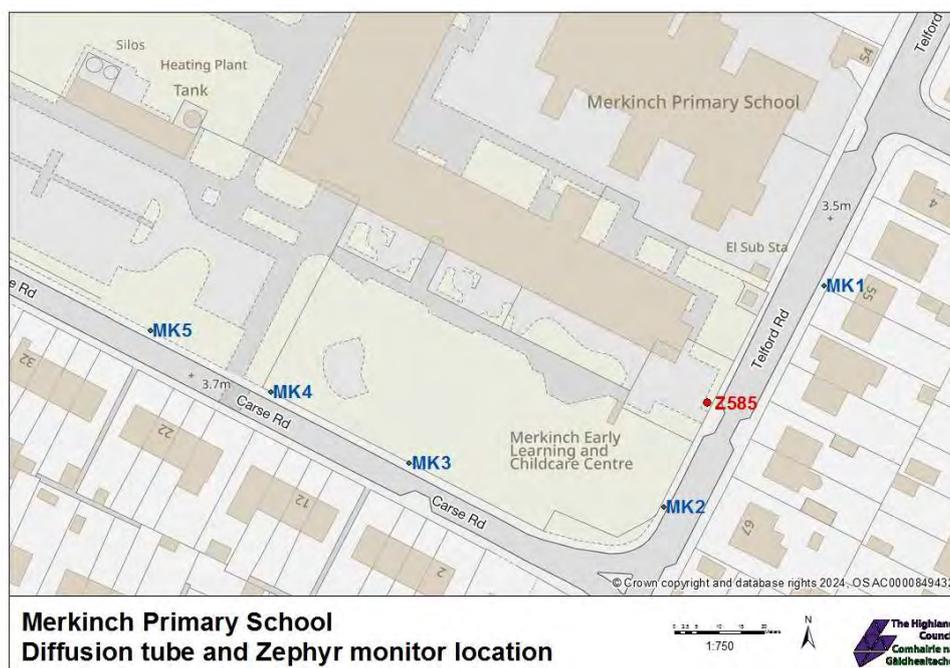
Limitations – Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.

Merkinch Primary School Air Quality Monitoring 2023-2024

Introduction

The Highland Council carried out an air quality study at Merkinch Primary School during the 2023-2024 school year.

Passive diffusion tubes were deployed at five locations on roads beside the school to measure nitrogen dioxide concentrations over a three-month cycle from September to November 2023. An Earthsense Zephyr Unit (No. 585) was deployed at the red location in the below figure between 05/09/23 to 29/02/24 to collect real-time data on a range of pollutants including nitrogen dioxide and particulate matter.



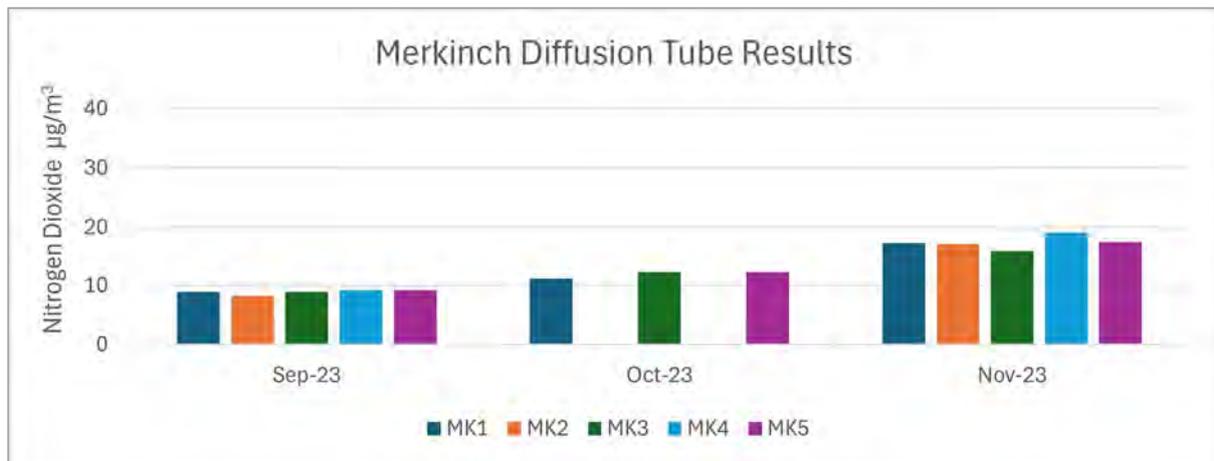
An Officer from Environmental Health gave a presentation to P7 pupils on 3rd October providing an overview of air pollution covering what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

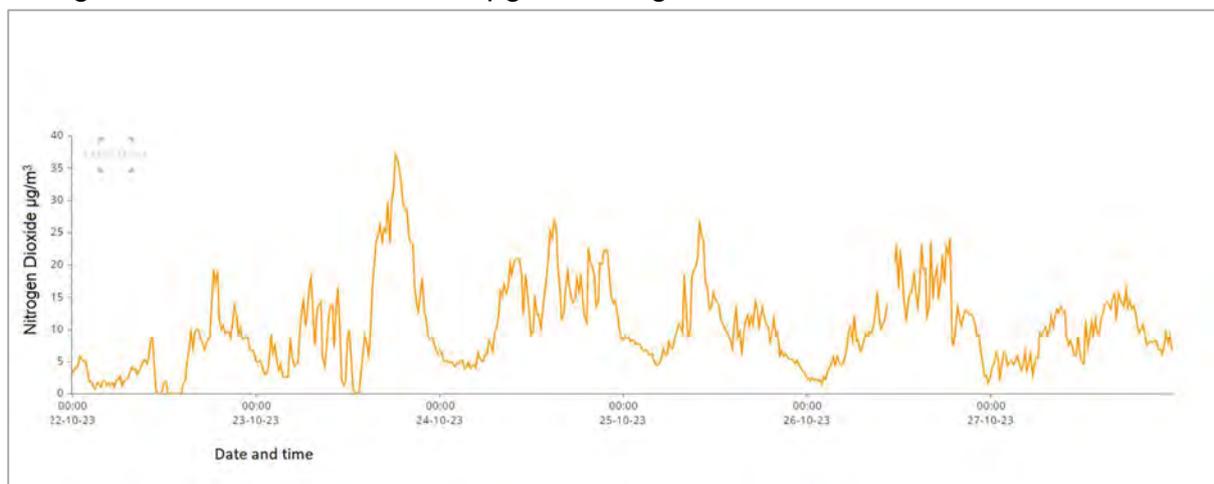
The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in the below table and bar chart. The final chart provides an example of the Zephyr real-time data for nitrogen dioxide over a selected week.

Location	NO ₂ µg/m ³ September 2023	NO ₂ µg/m ³ October 2023	NO ₂ µg/m ³ November 2023
MK1	8.9	11.2	17.2
MK2	8.2	tube missing	17
MK3	8.9	12.3	15.8
MK4	9.2	tube missing	19.2
MK5	9.2	12.3	17.4

Passive diffusion tube nitrogen dioxide concentrations in $\mu\text{g}/\text{m}^3$ by month.



Nitrogen dioxide real-time data in $\mu\text{g}/\text{m}^3$ during a selected week 22-27 October 2023



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of **$40\mu\text{g}/\text{m}^3$** , with a one hour mean of $200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average nitrogen dioxide using the diffusion tube data is **$13\mu\text{g}/\text{m}^3$** , which is low, at less than a third of the annual mean target objective.

The Zephyr data generally shows peaks of pollutants during the day, with lower concentrations at night. The average nitrogen dioxide concentration for all school days Mon-Fri, 9am-4pm, excluding holidays is $12\mu\text{g}/\text{m}^3$.

The one hour mean target objective was not exceeded onsite during the monitoring period as measured by the Zephyr.

The study has shown the air quality at Merkinch Primary is GOOD and meets the Scottish Government's standards for nitrogen dioxide.

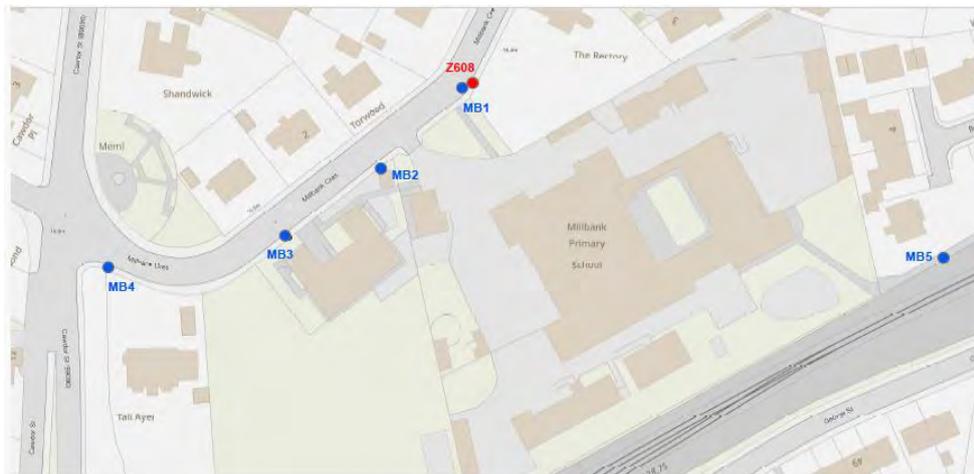
Introduction

The Highland Council carried out an air quality survey in conjunction with Millbank Primary School during 2023-2024.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a three-month cycle between September to December 2023.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 30th April and 27th May 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 4th October 2023 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO2 Results in µg/m ³ September 2023	NO2 Results in µg/m ³ October 2023	NO2 Results in µg/m ³ November 2023
MB1	5.2	6.7	10.7
MB2	5.1	6.6	11.6
MB3	5.2	6.7	12.2
MB4	6.7	8.5	15.9
MB5	4.7	5.7	9.0

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

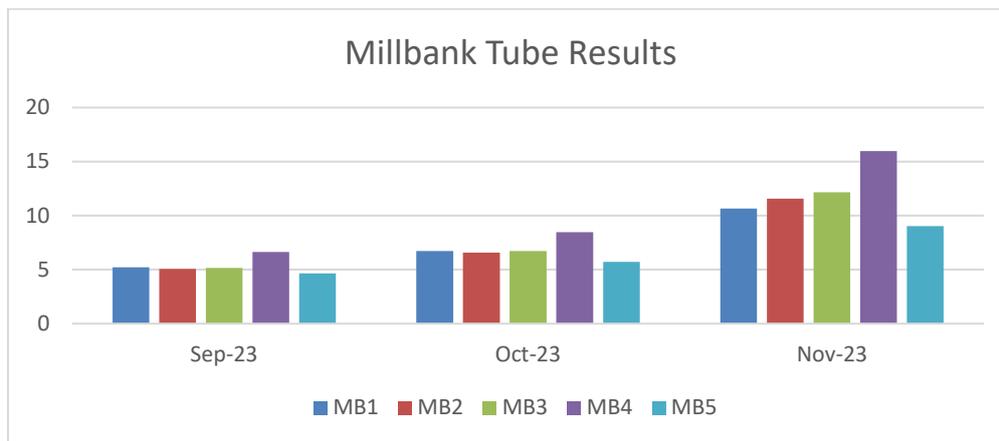
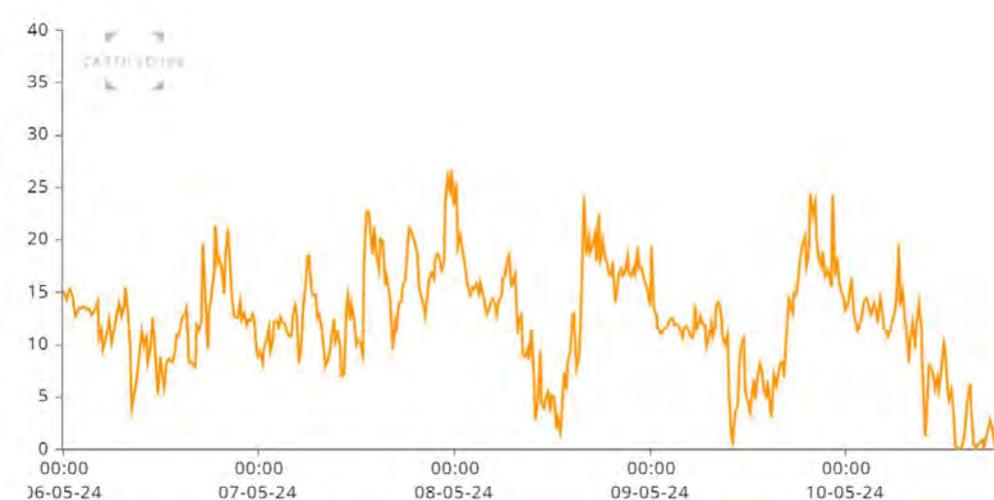


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is $8.02 \mu\text{g}/\text{m}^3$, which is a fifth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $9.98 \mu\text{g}/\text{m}^3$ which is again well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Millbank Primary School meets the Scottish Government's standards for nitrogen dioxide.

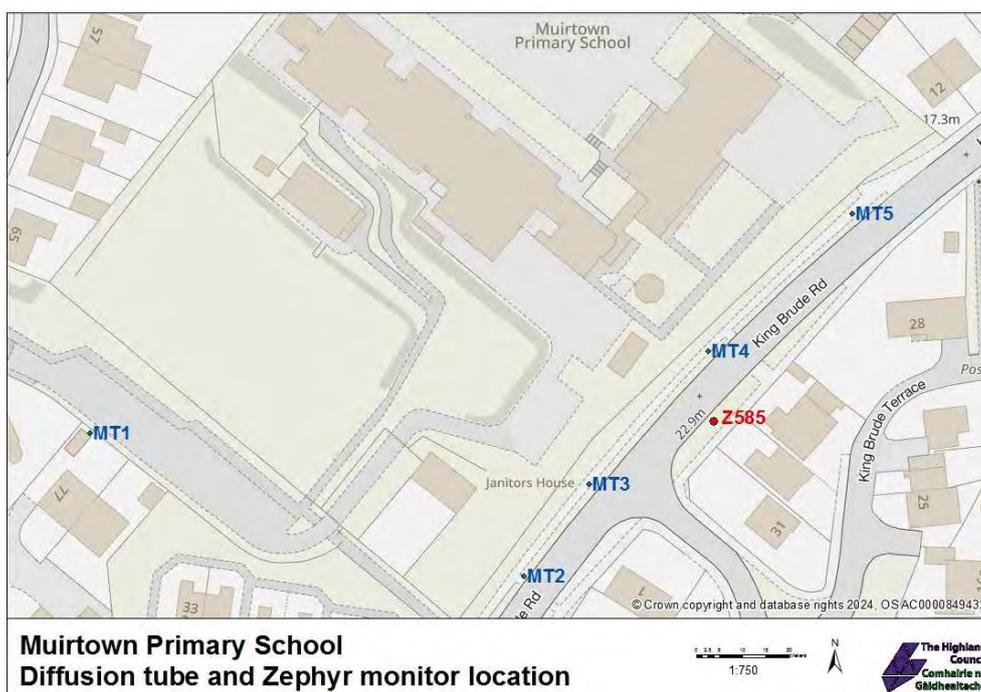
Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.

Introduction

The Highland Council carried out an air quality study at Muirtown Primary School during the 2023-2024 school year.

Passive diffusion tubes were deployed at five locations on roads beside the school to measure nitrogen dioxide concentrations over a three-month cycle from September to November 2023. An Earthsense Zephyr Unit (No. 585) was deployed at the red location in the below figure between 01/02/24 to 08/03/24 to collect real-time data on a range of pollutants including nitrogen dioxide and particulate matter.



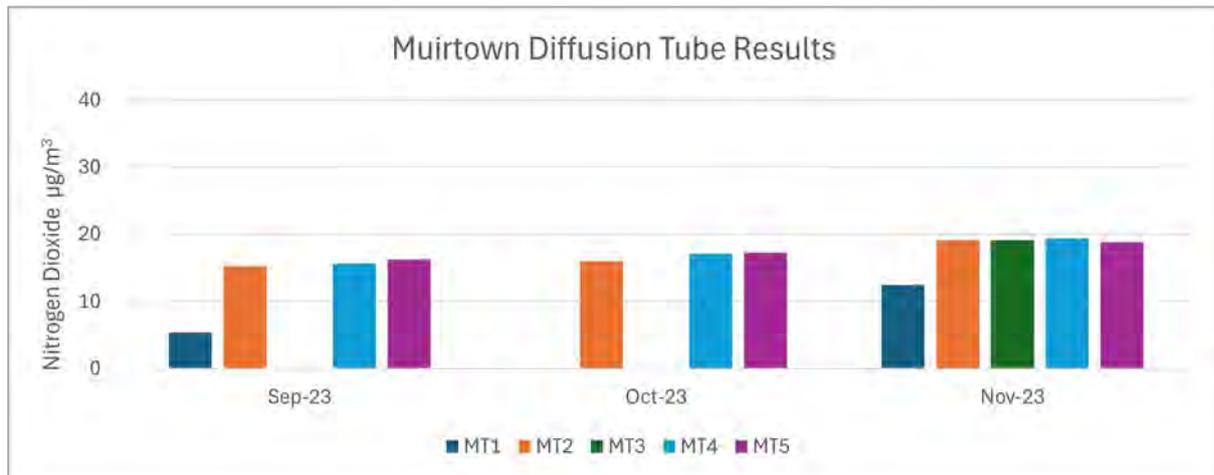
An Officer from Environmental Health gave a presentation to P7 pupils on 13th Feb providing an overview of air pollution covering what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

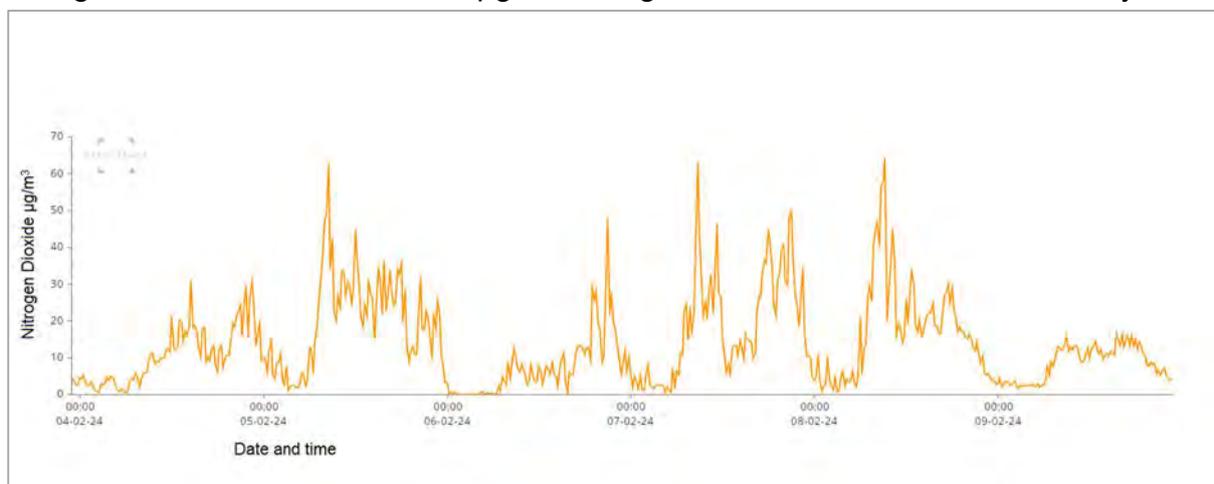
The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in the below table and bar chart. The final chart provides an example of the Zephyr real-time data for nitrogen dioxide over a selected week.

Location	NO ₂ µg/m ³ September 2023	NO ₂ µg/m ³ October 2023	NO ₂ µg/m ³ November 2023
MT1	5.4	tube missing	12.5
MT2	15.3	16.1	19.1
MT3	tube missing	tube missing	19.1
MT4	15.7	17.2	19.3
MT5	16.3	17.3	18.8

Passive diffusion tube nitrogen dioxide concentrations in $\mu\text{g}/\text{m}^3$ by month.



Nitrogen dioxide real-time data in $\mu\text{g}/\text{m}^3$ during a selected week 4th – 9th February 2024



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40\mu\text{g}/\text{m}^3$, with a one hour mean of $200\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average nitrogen dioxide using the diffusion tube data is $16\mu\text{g}/\text{m}^3$, which is low, at less than half of the annual mean target objective.

The Zephyr data generally shows peaks of pollutants during the day, with lower concentrations at night. The average nitrogen dioxide concentration for all school days Mon-Fri, 9am-4pm, excluding holidays is also $16\mu\text{g}/\text{m}^3$.

The one hour mean target objective was not exceeded onsite during the monitoring period as measured by the Zephyr.

The study has shown the air quality at Muirtown Primary is GOOD and meets the Scottish Government's standards for nitrogen dioxide.

Introduction

The Highland Council carried out an air quality survey in conjunction with Rosebank Primary School during the Autumn Term 2023.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a three-month cycle between September to December 2023.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 8th September 2023 and 1st February 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 4th October 2023 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2023	NO ₂ Results in µg/m ³ October 2023	NO ₂ Results in µg/m ³ November 2023
RB1	15.1	16.9	23.6
RB2	14.0	22.7	22.4
RB3	5.6	9.1	16.2
RB4	6.8	9.7	15.4
RB5	7.0	7.9	13.5

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

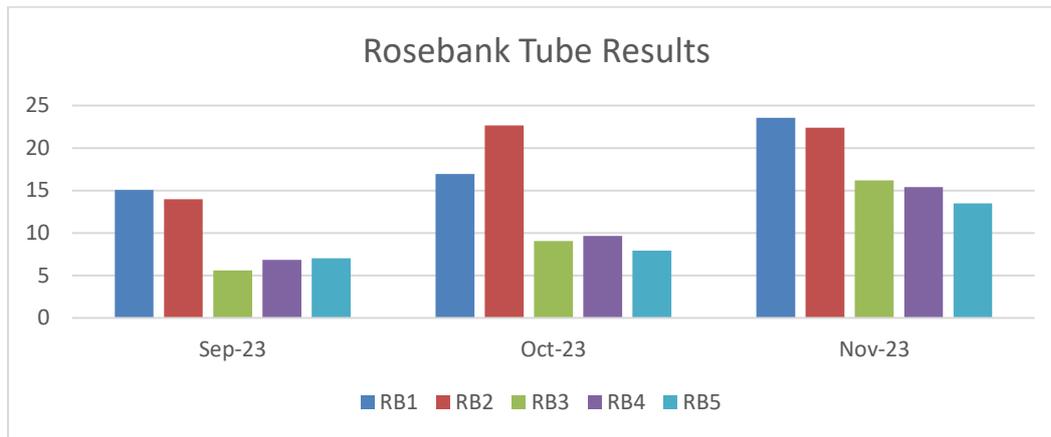
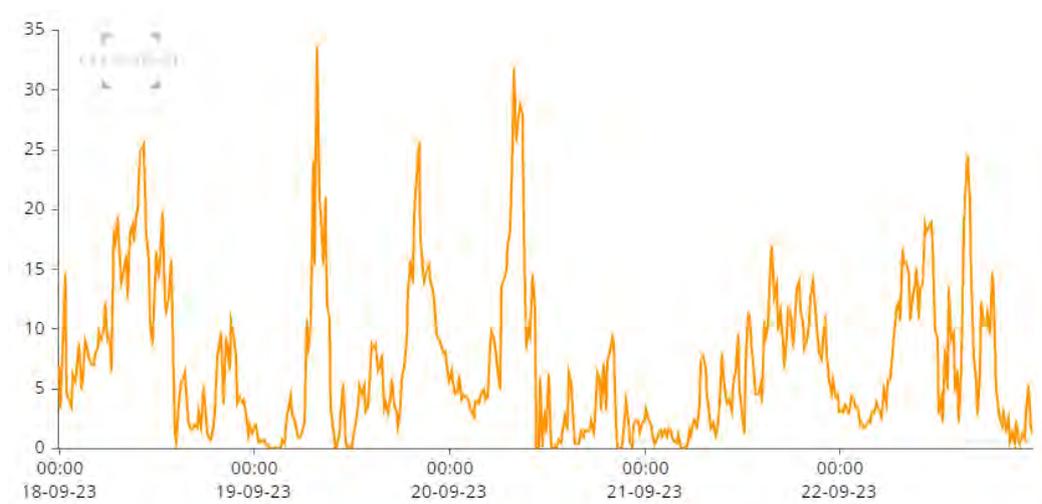


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average using the diffusion tube data is $13.71 \mu\text{g}/\text{m}^3$, which is just over a third of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $10.34 \mu\text{g}/\text{m}^3$ which is below the passive diffusion tube data, and again well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Rosebank Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.

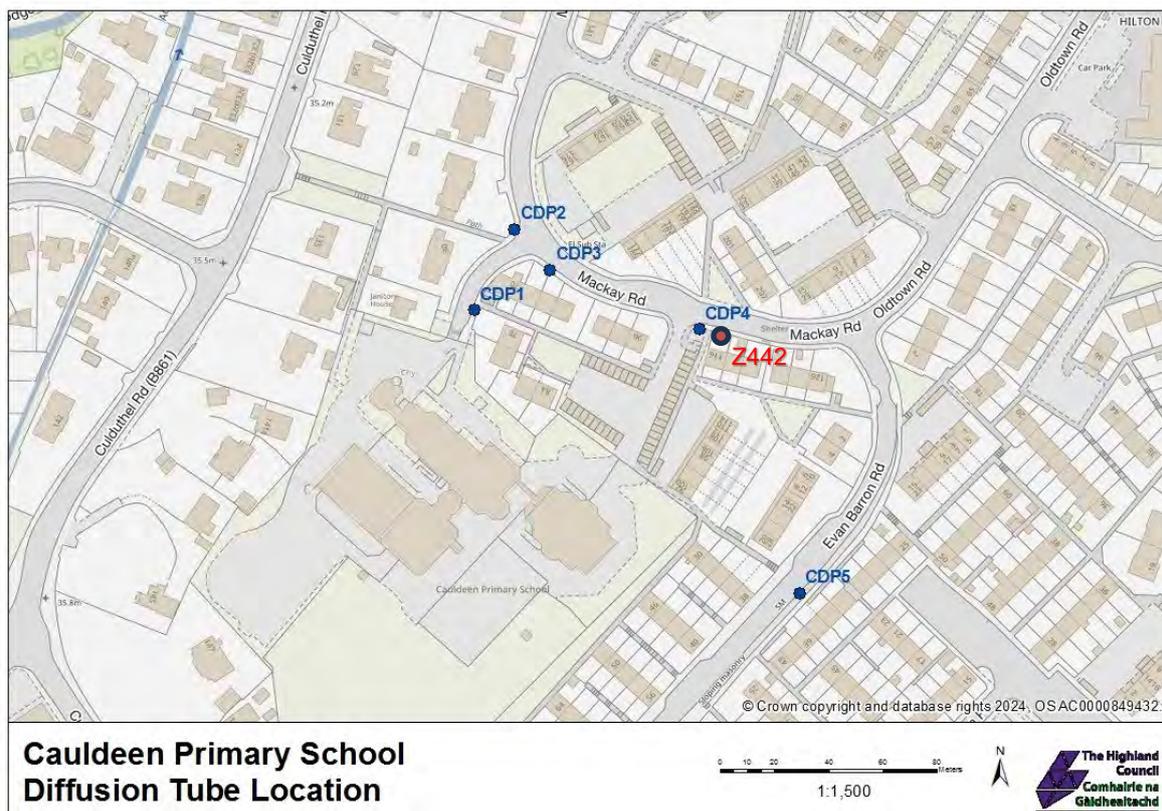
Introduction

The Highland Council carried out an air quality survey in conjunction with Cauldeen Primary School during 2024-2025.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a four-month period between September to December 2024.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 14th November and 5th December 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 23rd January 2025 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO2 Results in $\mu\text{g}/\text{m}^3$ September 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ October 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ November 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ December 2024
CDP1	5.07	5.62	7.60	5.09
CDP2	5.66	6.30	7.11	4.72
CDP3	6.41	7.05	8.61	5.55
CDP4	5.96	5.46	Missing	4.56
CDP5	6.67	6.95	9.19	5.79

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

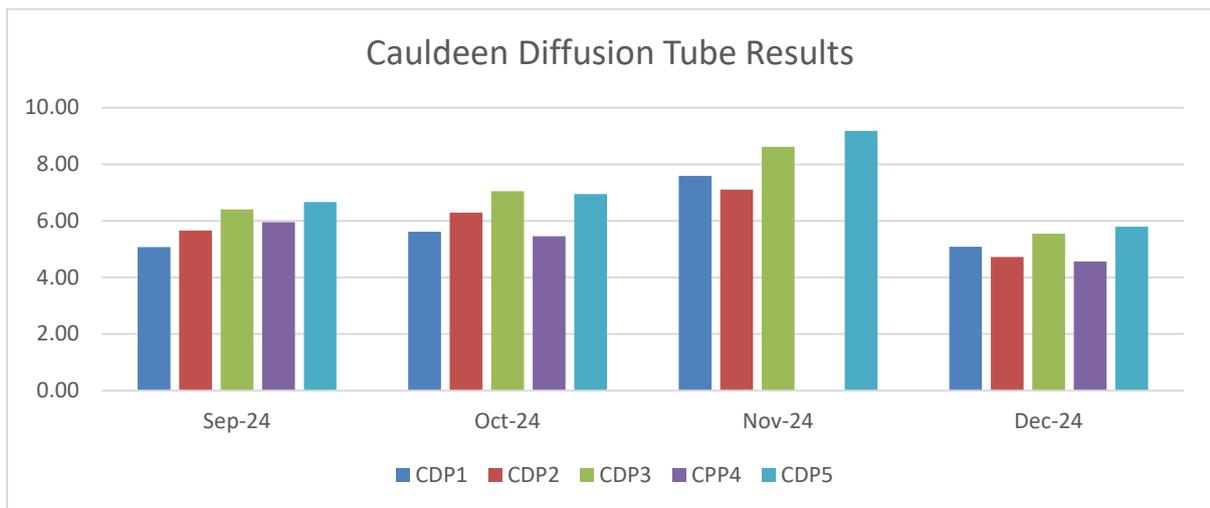


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average for Cauldeen Primary School using the diffusion tube data is $6.28 \mu\text{g}/\text{m}^3$, which is less than a fifth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $18.62 \mu\text{g}/\text{m}^3$ which again is well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Cauldeen Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.



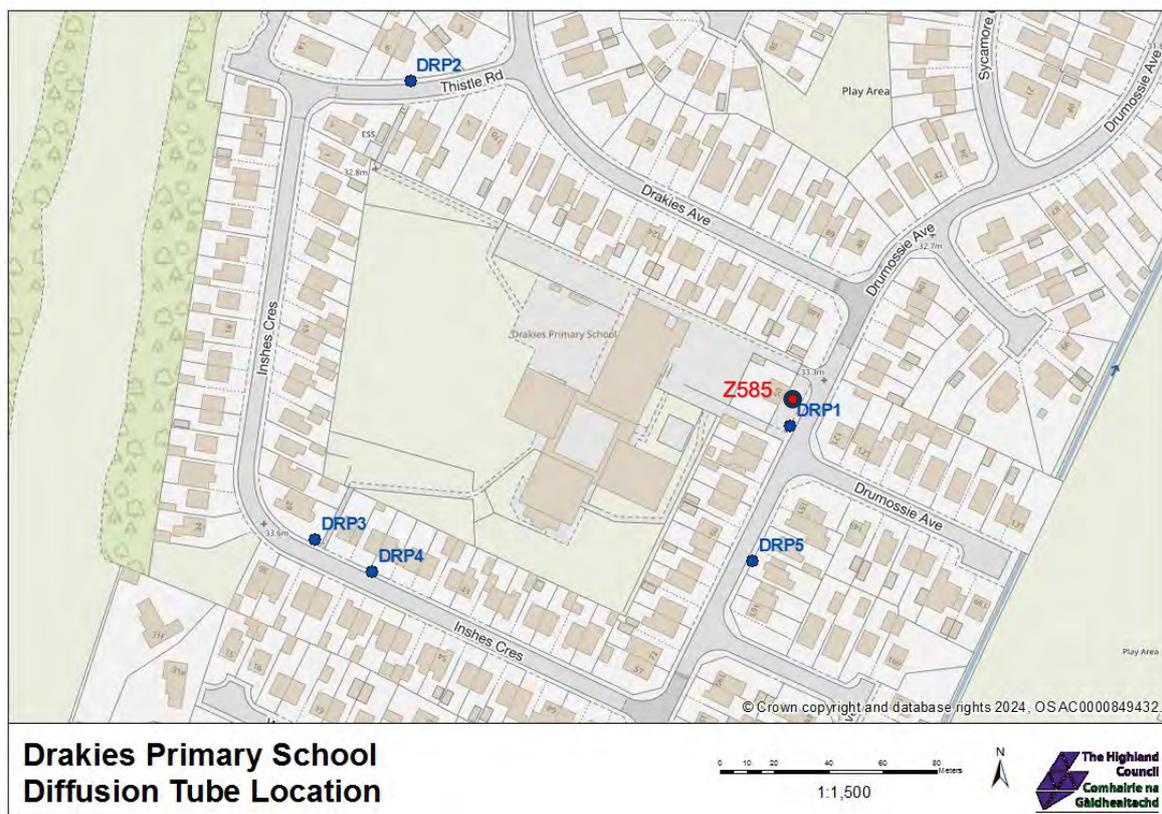
Introduction

The Highland Council carried out an air quality survey in conjunction with Drakies Primary School during 2024-2025.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a four-month cycle between September to December 2024.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 9th September and 12th December 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 14th November 2024 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO2 Results in $\mu\text{g}/\text{m}^3$ September 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ October 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ November 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ November 2024
DRP1	10.91	9.29	12.20	6.68
DRP2	5.91	6.65	8.22	4.99
DRP3	5.55	5.40	8.36	5.59
DRP4	6.18	7.01	8.00	4.81
DRP5	9.06	9.73	11.04	8.48

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

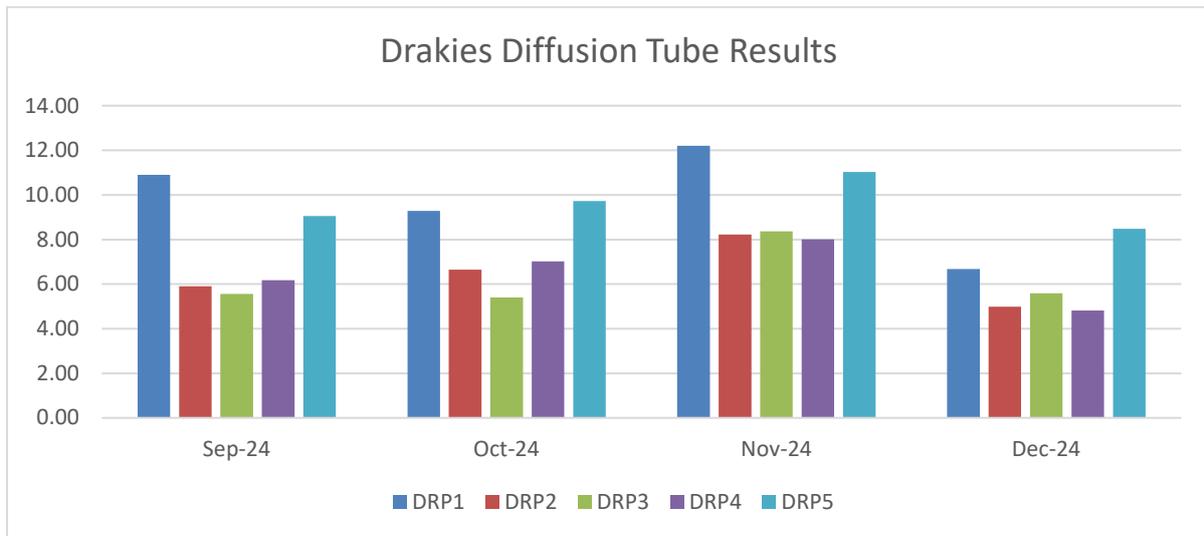
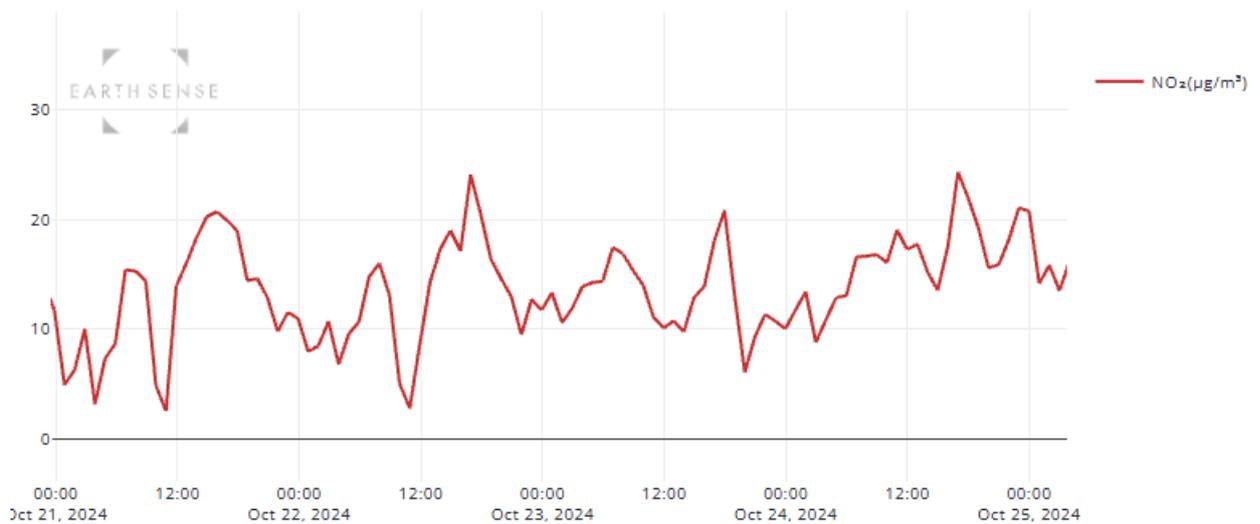


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average at Drakies Primary School using the diffusion tube data is $7.7\mu\text{g}/\text{m}^3$, which is less than a fifth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $17.79\mu\text{g}/\text{m}^3$ which is again well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Drakies Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.



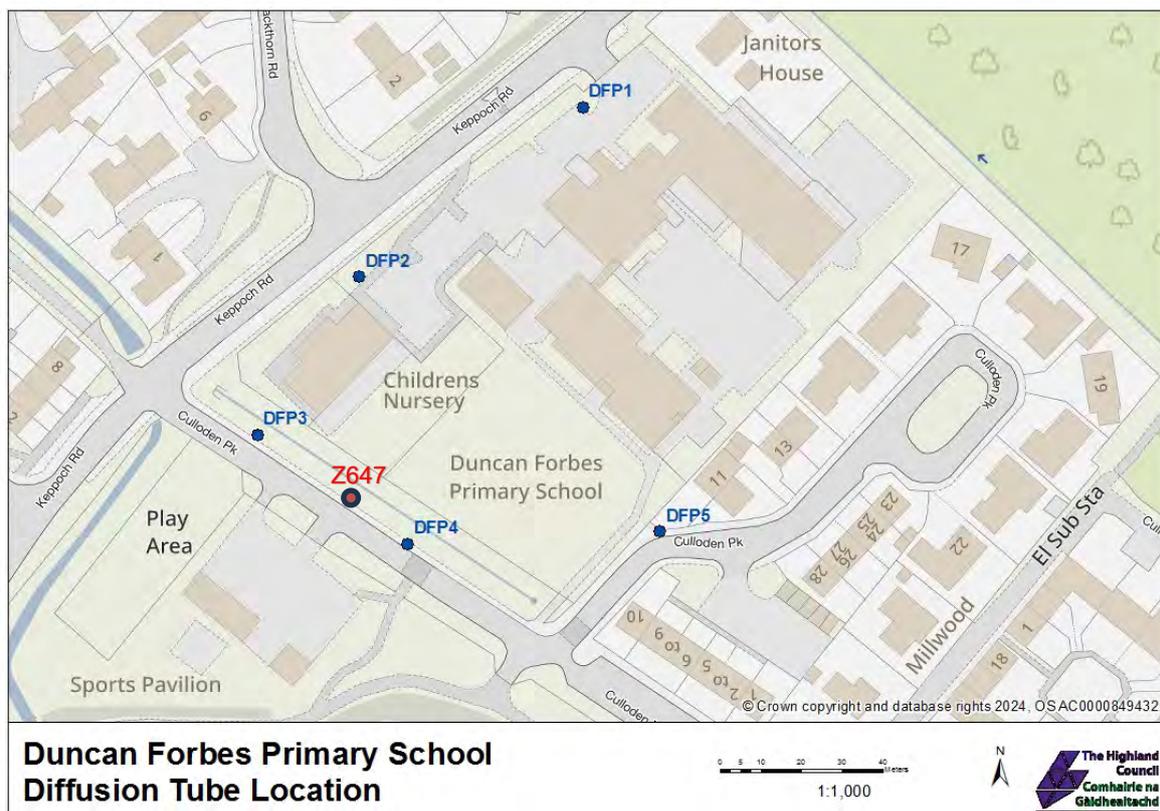
Introduction

The Highland Council carried out an air quality survey in conjunction with Duncan Forbes Primary School during 2024-2025.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a four-month period between September to December 2024.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 04th October 2024 and 12th December 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 18th Nov 2024 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO2 Results in $\mu\text{g}/\text{m}^3$ September 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ October 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ November 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ December 2024
DFP1	4.88	5.61	7.86	6.12
DFP2	4.92	5.38	7.81	6.01
DFP3	4.84	6.44	8.32	6.17
DFP4	4.76	Missing	7.52	6.71
DFP5	4.82	5.89	8.09	5.37

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

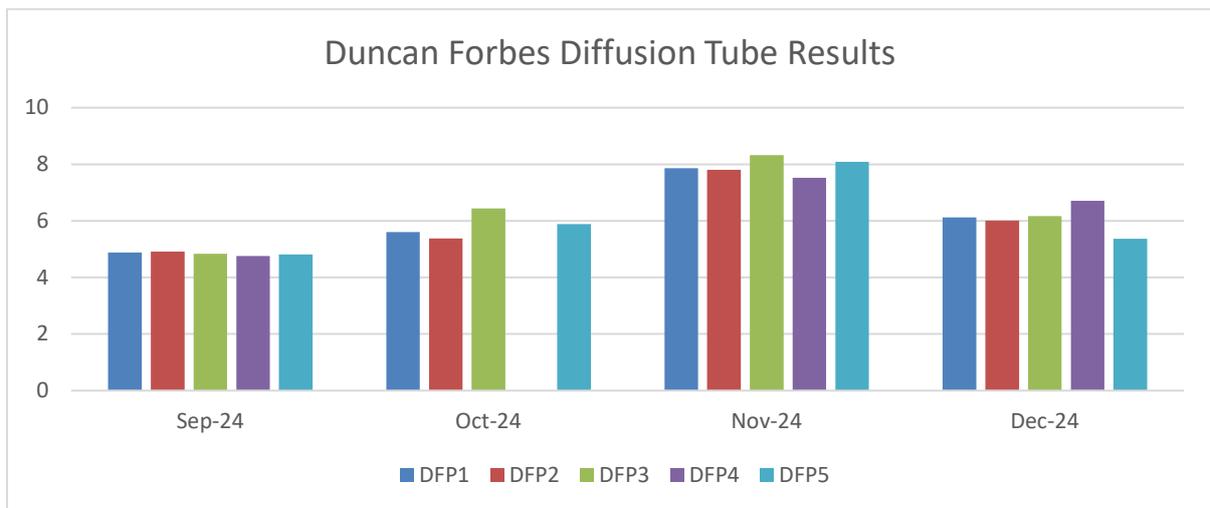


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average for Duncan Forbes Primary School using the diffusion tube data is $6.18 \mu\text{g}/\text{m}^3$, which is less than a sixth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $5.77 \mu\text{g}/\text{m}^3$ which again is well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Duncan Forbes Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.



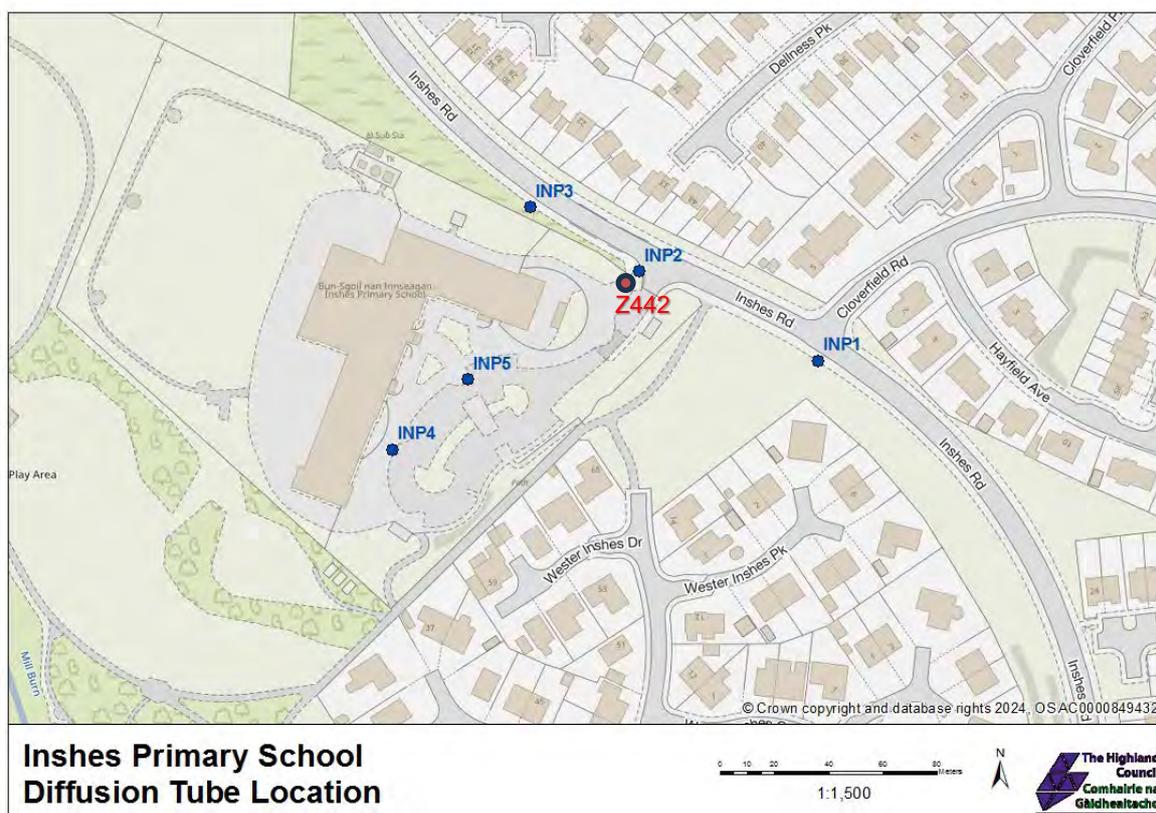
Introduction

The Highland Council carried out an air quality survey in conjunction with Inshes Primary School during 2024-2025.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a four-month period between September to December 2024.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 04th September 2024 and 14th November 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 05th September 2024 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation. Officer revised on 07th October 2024 and discussed the Zephyr monitoring results and pupil research and posters.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO2 Results in µg/m ³ September 2024	NO2 Results in µg/m ³ October 2024	NO2 Results in µg/m ³ November 2024	NO2 Results in µg/m ³ December 2024
INP1	7.03	Missing	Missing	5.99
INP2	7.58	5.92	8.10	5.74
INP3	Missing	6.92	9.77	6.69
INP4	5.93	4.65	6.08	4.55
INP5	5.59	5.03	7.43	4.95

Figure 2 – Passive Diffusion Tube Results in µg/m³ by Month

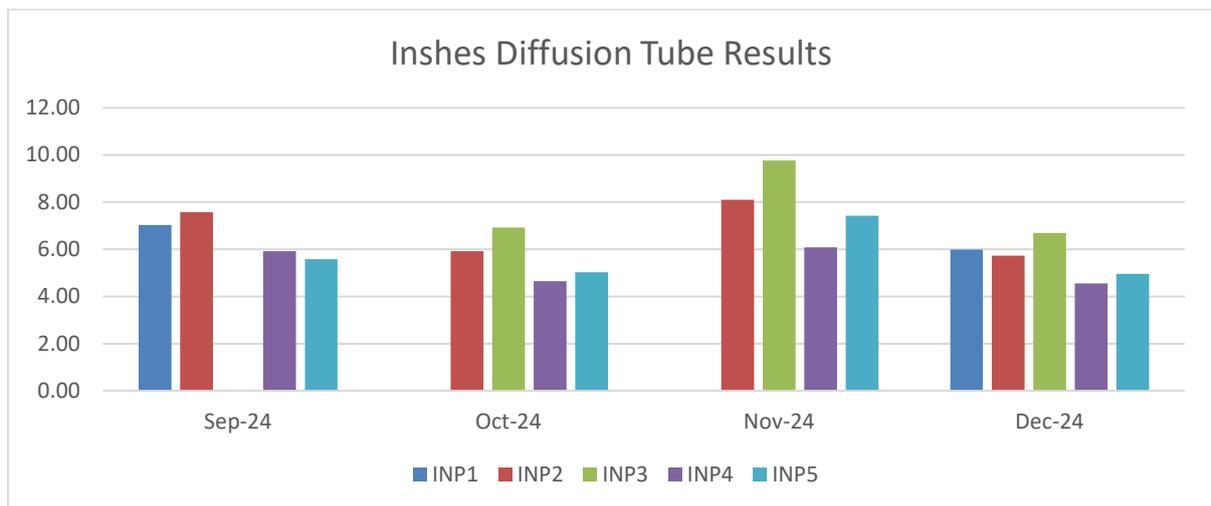
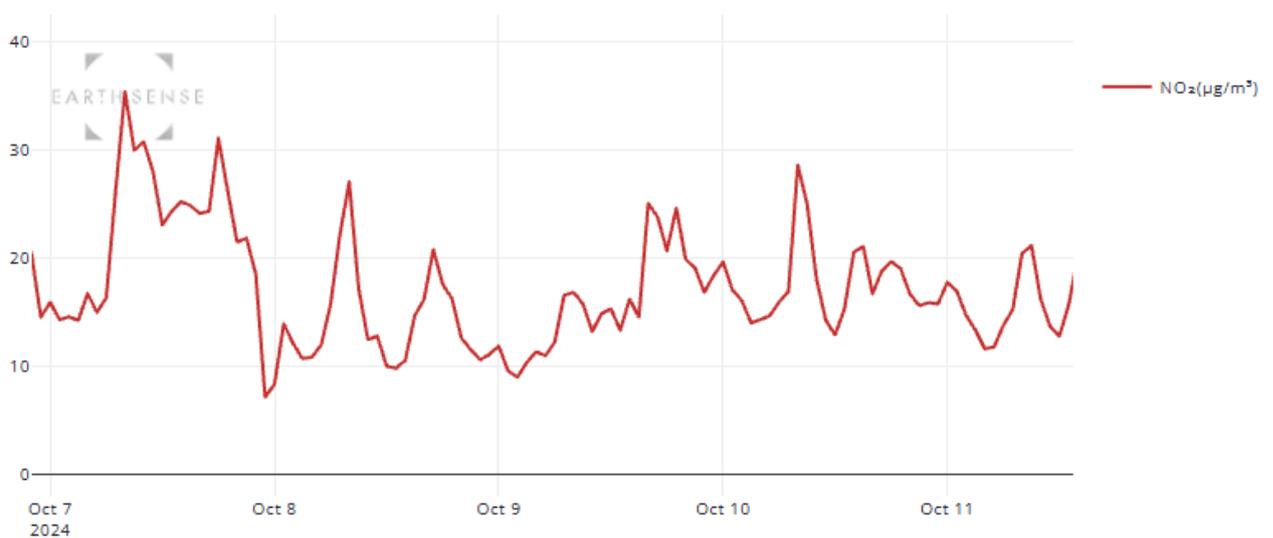


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average for Inshes Primary School using the diffusion tube data is $6.35 \mu\text{g}/\text{m}^3$, which is less than a sixth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $17.55 \mu\text{g}/\text{m}^3$ which again is well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Inshes Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.



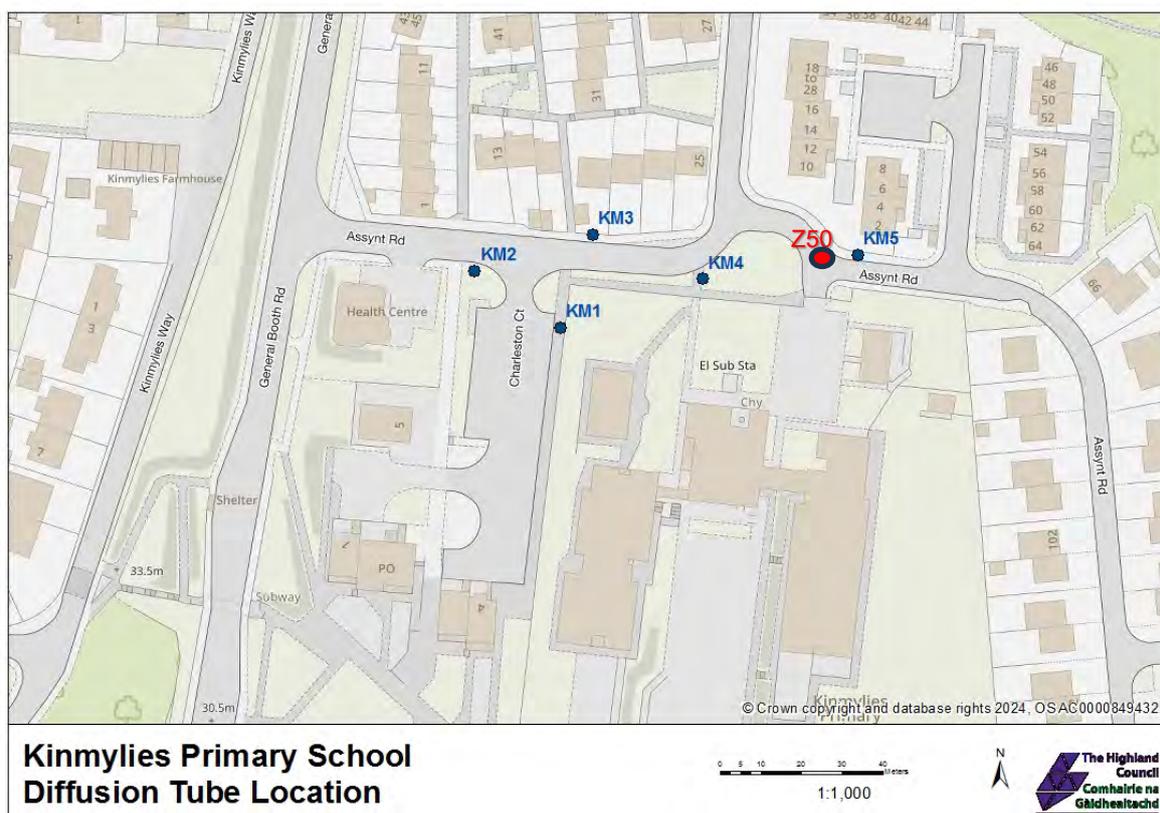
Introduction

The Highland Council carried out an air quality survey in conjunction with Kinmylies Primary School during 2024-2025.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a four-month cycle between September to December 2024.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 4th October and 12th December 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to P6/P7 pupils on 27th November 2024 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO2 Results in $\mu\text{g}/\text{m}^3$ September 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ October 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ November 2024	NO2 Results in $\mu\text{g}/\text{m}^3$ November 2024
KM1	5.83	6.59	9.54	6.18
KM2	7.01	8.85	9.56	6.21
KM3	6.56	8.00	10.55	6.10
KM4	5.68	6.98	8.20	5.29
KM5	5.24	6.05	7.69	5.58

Figure 2 – Passive Diffusion Tube Results in $\mu\text{g}/\text{m}^3$ by Month

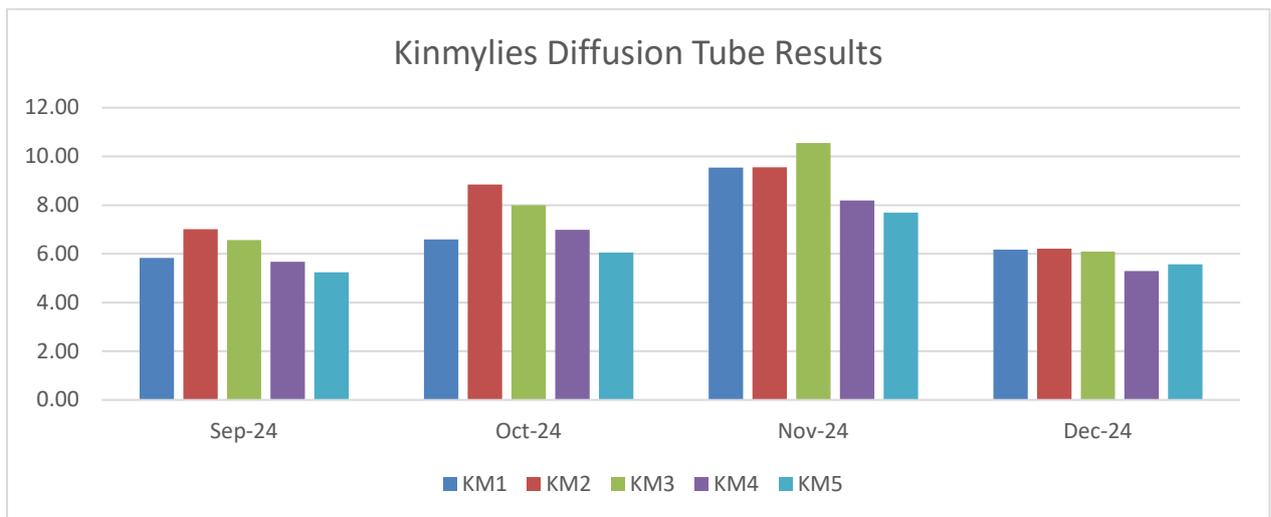
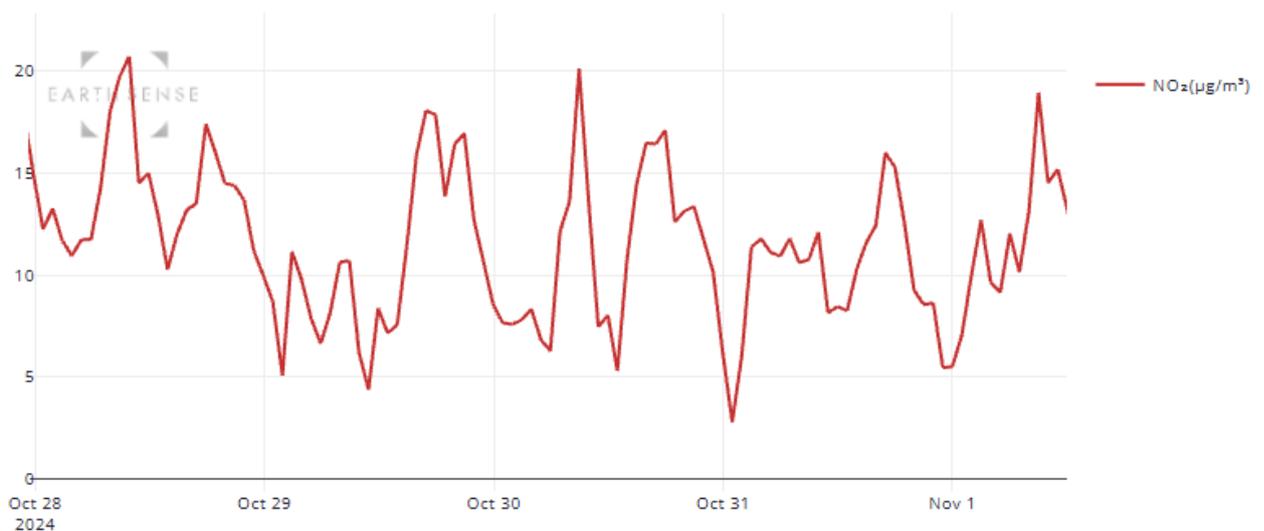


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average for Kinmylies Primary School using the diffusion tube data is $7.08 \mu\text{g}/\text{m}^3$, which is less than a fifth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $16.44 \mu\text{g}/\text{m}^3$ which is again well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Kinmylies Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.



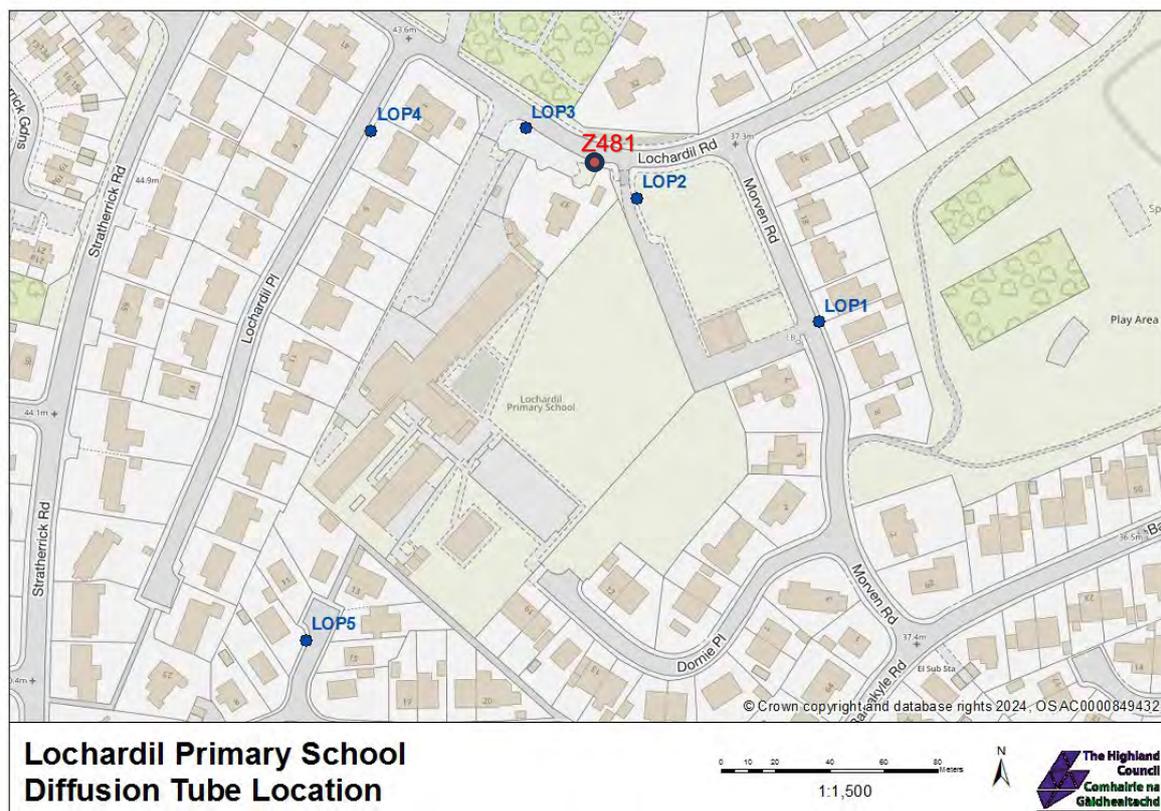
Introduction

The Highland Council carried out an air quality survey in conjunction with Lochardil Primary School during 2024-2025.

Passive diffusion tubes were deployed at 5 locations shown in blue in Figure 1 on roads surrounding the school to collect data on nitrogen dioxide concentrations over a four-month period between September to December 2024.

An Earthsense Zephyr unit was deployed at the location shown in red in Figure 1 between 9th September and 23rd November 2024 to collect real-time data on a range of pollutants including nitrogen dioxide and particulates.

Figure 1 – Location of Diffusion Tubes and Zephyr Unit



An Officer from Environmental Health gave a presentation to Junior Road Safety Officer group on 1st October 2024, and to P3-P7 on 8th November 2024 providing an overview of air pollution, discussing what it is, what causes it, how it impacts us, how we monitor it, and asked pupils to think about how to improve the situation.

Results

The results of the passive diffusion tube nitrogen dioxide (NO₂) concentrations in µg/m³ are shown in Table 1 and Figure 2 below, while Figure 3 provides a summary of the Zephyr real-time data for nitrogen dioxide over a selected Monday-Friday period during term time.

Table 1 – Passive Diffusion Tube Data

Location	NO ₂ Results in µg/m ³ September 2024	NO ₂ Results in µg/m ³ October 2024	NO ₂ Results in µg/m ³ November 2024	NO ₂ Results in µg/m ³ December 2024
LOP1	4.28	5.01	6.68	4.51
LOP2	4.60	5.22	5.81	4.24
LOP3	5.01	4.94	5.92	4.16
LOP4	4.34	5.22	6.72	4.29
LOP5	4.17	5.19	6.06	4.18

Figure 2 – Passive Diffusion Tube Results in µg/m³ by Month

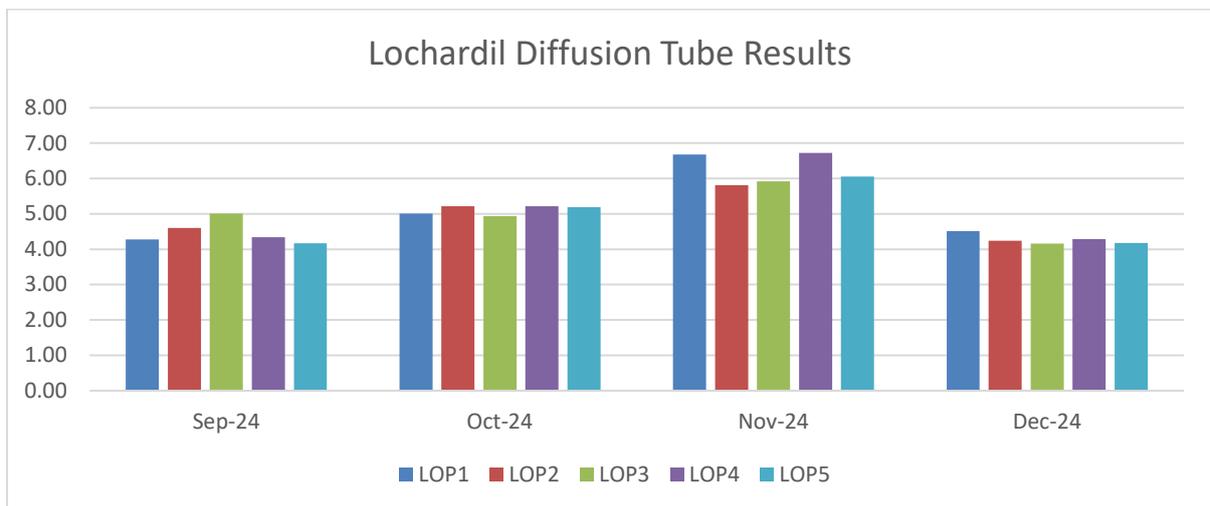
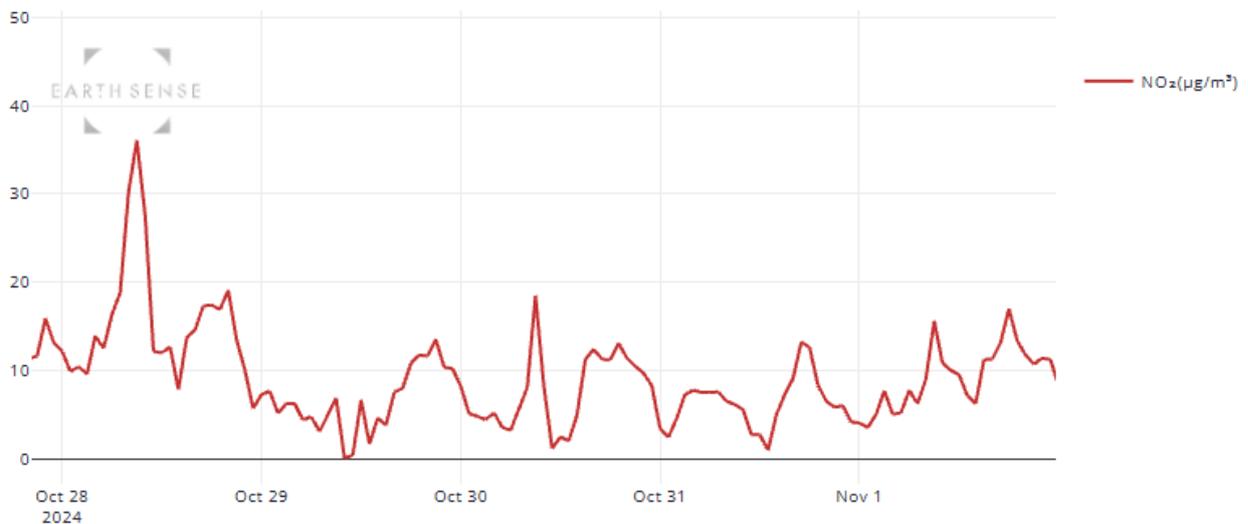


Figure 3 – Nitrogen Dioxide Real-Time Data During a Selected Mon-Fri Term Time



Conclusion

The objectives for nitrogen dioxide are set out in the Air Quality (Scotland) Regulations 2000, with the standard being an annual mean of $40 \mu\text{g}/\text{m}^3$, with a one hour mean of $200 \mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times in one year.

The monthly average for Lochardil Primary School using the diffusion tube data is $5 \mu\text{g}/\text{m}^3$, which is an eighth of the annual mean target objective.

The Zephyr data average nitrogen dioxide concentration for all Mon-Fri school days 9am-4pm, excluding holidays is $10.15 \mu\text{g}/\text{m}^3$ which again is well below the annual mean target objective. The one hour mean target objective was not exceeded onsite during the monitoring period.

The study has shown the air quality at Lochardil Primary School meets the Scottish Government's standards for nitrogen dioxide.

Limitations

Tube data has been averaged without annual adjustments and Zephyr data due to calibration methodology is indicative rather than absolute.



Appendix C – Monitoring Results
Diffusion Tube laboratory Results



LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER Q08400R
BOOKING IN REFERENCE Q08400
DESPATCH NOTE 96025
CUSTOMER Highland Council Attn: John Reid
Environmental Services
Town House
Inverness
IV15 1JJ
DATE SAMPLES RECEIVED 17/10/2022
JOB REFERENCE Highland Schools Round 1

Location	Sample Number	Exposure Data			Time* (hr.)	µg/m ³ *		µg NO ₂ on tube
		Date On*	Date Off*			ppb *		
DAL1 Dalneigh	2040678	12/08/2022	14/09/2022	793.50	6.16	3.21	0.36	
DAL3 Dalneigh	2040680	12/08/2022	14/09/2022	793.17	6.51	3.40	0.38	
DAL4 Dalneigh	2040681	12/08/2022	14/09/2022	793.00	6.58	3.43	0.38	
BE3 Bishop Eden	2040682	29/08/2022	26/09/2022	671.42	9.47	4.94	0.46	
BE4 Bishop Eden	2040683	29/08/2022	26/09/2022	671.43	9.12	4.76	0.45	
BE1 Bishop Eden	2040684	29/08/2022	26/09/2022	671.45	9.98	5.21	0.49	
BE2 Bishop Eden	2040685	29/08/2022	29/09/2022	743.40	9.44	4.93	0.51	
Crown 3	2040686	29/08/2022	26/09/2022	672.28	9.25	4.83	0.45	
Crown 6	2040687	29/08/2022	26/09/2022	672.25	10.83	5.65	0.53	
Crown 5	2040688	29/08/2022	26/09/2022	672.23	10.79	5.63	0.53	
Crown 4	2040689	29/08/2022	26/09/2022	672.20	11.13	5.81	0.54	
Crown 1	2040690	29/08/2022	26/09/2022	672.13	11.52	6.02	0.56	
Crown 2	2040691	29/08/2022	26/09/2022	672.02	10.46	5.46	0.51	
Holm 1	2040692	29/08/2022	26/09/2022	669.82	4.31	2.25	0.21	
Holm 2	2040693	29/08/2022	26/09/2022	669.73	4.17	2.18	0.20	
Holm 3	2040694	29/08/2022	26/09/2022	669.62	4.34	2.26	0.21	
Holm 4	2040695	29/08/2022	26/09/2022	669.58	4.25	2.22	0.21	
Holm 5	2040696	29/08/2022	26/09/2022	668.92	4.13	2.16	0.20	
Kirk 1	2040697	01/09/2022	26/09/2022	603.07	3.58	1.87	0.16	
Pen 3	2040698	11/09/2022	07/10/2022	621.00	2.22	1.16	0.10	
Pen 2	2040699	11/09/2022	07/10/2022	620.92	2.70	1.41	0.12	
Pen 1	2040700	11/09/2022	07/10/2022	621.08	2.53	1.32	0.11	
Kirk 6	2040701	01/09/2022	26/09/2022	602.83	2.94	1.54	0.13	
Kirk 5	2040704	01/09/2022	26/09/2022	602.95	2.60	1.36	0.11	
Kirk 4	2040705	01/09/2022	26/09/2022	602.92	3.38	1.76	0.15	
Kirk 3	2040706	01/09/2022	26/09/2022	602.97	3.06	1.60	0.13	
Kirk 2	2040707	01/09/2022	26/09/2022	603.02	3.38	1.76	0.15	
Pen 5	2040709	11/09/2022	07/10/2022	620.75	2.50	1.31	0.11	
Pen 4	2040710	11/09/2022	07/10/2022	620.53	2.13	1.11	0.10	
Laboratory Blank				793.50	0.21	0.11	0.012	

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

REPORT OFFICIALLY CHECKED

Gradko International Ltd
This signature confirms the authenticity of these results
Signed.....
L. Gates, Laboratory Manager

LABORATORY ANALYSIS REPORT

Comment: Results are not blank subtracted

Customer noted missing tube: 2040679.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

Limit of Detection 0.030µgNO₂

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analysed on UV CARY3

Analyst Name Alison Wright

Report Checked By Adam Robinson

Date of Analysis 27/10/2022

Date of Report 28/10/2022

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

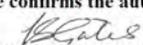
Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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Report Number Q08400R

Page 2 of 2

REPORT OFFICIALLY CHECKED

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This signature confirms the authenticity of these results
Signed.....
L. Gates, Laboratory Manager

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER Q09444R
BOOKING IN REFERENCE Q09444
DESPATCH NOTE 96121
CUSTOMER Highland Council Attn: John Reid
Environmental Services
Town House
Inverness
IV15 1JJ
DATE SAMPLES RECEIVED 23/11/2022
JOB REFERENCE Highland Schools Round 2

Location	Sample Number	Exposure Data		Time* (hr.)	µg/m ³ *	ppb *	µg NO ₂ on tube
		Date On*	Date Off*				
DAL2 Dalneigh	2060455	14/09/2022	21/10/2022	890.38	4.79	2.50	0.31
DAL4 Dalneigh	2060457	14/09/2022	21/10/2022	890.32	5.27	2.75	0.34
BE4 Bishop Eden	2060458	26/09/2022	24/10/2022	675.98	10.62	5.55	0.52
BE3 Bishop Eden	2060459	26/09/2022	24/10/2022	675.95	10.73	5.60	0.53
BE1 Bishop Eden	2060460	26/09/2022	24/10/2022	675.90	11.40	5.95	0.56
BE2 Bishop Eden	2060461	26/09/2022	24/10/2022	675.93	11.54	6.02	0.57
Holm 5	2060462	26/09/2022	24/10/2022	671.90	5.59	2.92	0.27
Holm 1	2060463	26/09/2022	24/10/2022	671.23	5.68	2.96	0.28
Holm 2	2060464	26/09/2022	24/10/2022	671.22	5.51	2.88	0.27
Holm 3	2060465	26/09/2022	24/10/2022	671.20	5.49	2.87	0.27
Holm 4	2060466	26/09/2022	24/10/2022	671.23	2.97	1.55	0.15
Crown 3	2060467	26/09/2022	24/10/2022	671.47	10.41	5.43	0.51
Crown 6	2060468	26/09/2022	24/10/2022	671.60	12.33	6.44	0.60
Crown 5	2060470	26/09/2022	24/10/2022	671.60	12.19	6.36	0.60
Crown 4	2060471	26/09/2022	24/10/2022	671.57	12.21	6.37	0.60
Crown 2	2060472	26/09/2022	24/10/2022	671.57	11.04	5.76	0.54
Crown 1	2060473	26/09/2022	24/10/2022	671.53	12.87	6.72	0.63
Kirk 2	2060475	26/09/2022	24/10/2022	668.75	4.36	2.28	0.21
Kirk 4	2060478	26/09/2022	24/10/2022	668.75	3.85	2.01	0.19
Kirk 6	2060479	26/09/2022	24/10/2022	668.70	3.83	2.00	0.19
Kirk 5	2060480	26/09/2022	24/10/2022	668.70	3.25	1.70	0.16
Pen 4	2079133	07/10/2022	07/11/2022	738.83	3.41	1.78	0.18
Pen1	2079135	07/10/2022	07/11/2022	739.25	3.96	2.07	0.21
Pen 3	2079136	07/10/2022	07/11/2022	738.42	3.80	1.98	0.20
Pen 5	2079137	07/10/2022	07/11/2022	738.68	3.35	1.75	0.18
Laboratory Blank				890.38	0.09	0.05	0.006

Comment: Results are not blank subtracted

Customer noted missing tubes: 2060454,2060456,2060474,2060476 & 2079134.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

Limit of Detection 0.030µgNO₂

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of k=2, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analysed on UV CARY3

Analyst Name Alison Wright

Report Checked By Jon Hall

Date of Analysis 06/12/2022

Date of Report 06/12/2022

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER R00962R
BOOKING IN REFERENCE R00962
DESPATCH NOTE 96122
CUSTOMER Highland Council Attn: John Reid
Environmental Services
Town House
Inverness
IV15 1JJ
DATE SAMPLES RECEIVED 17/01/2023
JOB REFERENCE Highland Schools Round 3

Location	Sample Number	Exposure Data			$\mu\text{g}/\text{m}^3$ *	ppb *	$\mu\text{g NO}_2$ on tube
		Date On*	Date Off*	Time* (hr.)			
Bishop Eden 4	2060469	24/10/2022	21/11/2022	668.90	15.59	8.14	0.76
Pennyland 4	2060481	07/11/2022	06/12/2022	698.32	5.91	3.09	0.30
Pennyland 2	2060483	07/11/2022	06/12/2022	698.57	6.22	3.25	0.32
Kirkhill 3	2079139	24/10/2022	21/11/2022	672.67	6.75	3.52	0.33
Dalneigh 3	2079141	21/10/2022	21/11/2022	741.15	11.90	6.21	0.64
Dalneigh 4	2079142	21/10/2022	21/11/2022	742.68	11.41	5.96	0.62
Dalneigh 1	2079143	21/10/2022	21/11/2022	741.12	10.86	5.67	0.59
Bishop Eden 3	2079144	24/10/2022	21/11/2022	668.97	11.99	6.26	0.58
Holm 2	2079145	24/10/2022	21/11/2022	675.82	9.18	4.79	0.45
Holm 1	2079146	24/10/2022	21/11/2022	675.90	9.55	4.98	0.47
Kirkhill 5	2079147	24/10/2022	21/11/2022	672.47	6.10	3.18	0.30
Kirkhill 6	2079148	24/10/2022	21/11/2022	672.52	6.71	3.50	0.33
Kirkhill 4	2079149	24/10/2022	21/11/2022	672.60	6.71	3.50	0.33
Bishop Eden 1	2079150	24/10/2022	21/11/2022	668.97	14.95	7.80	0.73
Crown 3	2079151	24/10/2022	21/11/2022	672.10	14.35	7.49	0.70
Holm 5	2079152	24/10/2022	21/11/2022	675.72	8.12	4.24	0.40
Holm 4	2079153	24/10/2022	21/11/2022	675.73	8.37	4.37	0.41
Holm 3	2079154	24/10/2022	21/11/2022	675.78	9.16	4.78	0.45
Bishop Eden 2	2079156	24/10/2022	21/11/2022	668.97	17.50	9.14	0.85
Crown 1	2079157	24/10/2022	21/11/2022	671.92	16.61	8.67	0.81
Crown 2	2079158	24/10/2022	21/11/2022	672.08	17.91	9.35	0.88
Crown 4	2079159	24/10/2022	21/11/2022	671.90	14.35	7.49	0.70
Crown 5	2079160	24/10/2022	21/11/2022	671.88	18.08	9.44	0.88
Crown 6	2079161	24/10/2022	21/11/2022	671.82	18.37	9.59	0.90
Pennyland 5	2079162	07/11/2022	06/12/2022	698.30	5.83	3.04	0.30
Pennyland 1	2079163	07/11/2022	06/12/2022	698.87	5.47	2.86	0.28
Pennyland 3	2079164	07/11/2022	06/12/2022	697.85	6.37	3.32	0.32
Laboratory Blank				742.68	0.04	0.02	0.002

Comment: Results are not blank subtracted

Customer noted missing tubes: 2079138 & 2079140.

Tube 2079151 contained a spider. Result may be compromised.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. $\pm 9.7\%$

Limit of Detection 0.028 μgNO_2

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analysed on UV CARY1

Analyst Name Sania Choudhury

Report Checked By Adam Robinson

Date of Analysis 13/02/2023

Date of Report 13/02/2023

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER R08699R
BOOKING IN REFERENCE R08699
DESPATCH NOTE 103399
CUSTOMER Highland Council Attn: John Reid
 Environmental Services
 Town House
 Inverness
 IV15 1JJ

DATE SAMPLES RECEIVED 08/12/2023
JOB REFERENCE Highland Schools September 2023

Location	Sample Number	Exposure Data			µg/m ³ *	ppb *	µg NO ₂ on tube
		Date On*	Date Off*	Time* (hr.)			
MK1	2290325	04/09/2023	04/10/2023	723.48	8.86	4.63	0.47
MK2	2290326	04/09/2023	04/10/2023	723.47	8.18	4.27	0.43
MK3	2290327	04/09/2023	04/10/2023	723.42	8.90	4.65	0.47
MK4	2290328	04/09/2023	04/10/2023	723.38	9.15	4.77	0.48
MK5	2290329	04/09/2023	04/10/2023	723.17	9.19	4.80	0.48
MT1	2290330	04/09/2023	04/10/2023	722.03	5.39	2.81	0.28
MT4	2290332	04/09/2023	04/10/2023	722.08	15.68	8.18	0.82
MT5	2290333	04/09/2023	04/10/2023	724.05	16.32	8.52	0.86
CE1	2290334	04/09/2023	04/10/2023	722.53	6.30	3.29	0.33
CE2	2290335	04/09/2023	04/10/2023	722.52	7.83	4.08	0.41
CE3	2290336	04/09/2023	04/10/2023	722.37	14.72	7.68	0.77
CE4	2290337	04/09/2023	04/10/2023	722.38	15.01	7.83	0.79
CE5	2290338	04/09/2023	04/10/2023	722.25	16.35	8.53	0.86
BSG1	2290339	04/09/2023	03/10/2023	697.55	13.08	6.83	0.66
BSG2	2290340	04/09/2023	03/10/2023	697.53	6.86	3.58	0.35
MT2	2290341	04/09/2023	04/10/2023	722.07	15.34	8.01	0.81
BSG3	2290342	04/09/2023	03/10/2023	697.50	5.07	2.65	0.26
BSG4	2290343	04/09/2023	03/10/2023	697.48	4.85	2.53	0.25
BSG5	2290344	04/09/2023	03/10/2023	697.48	4.38	2.29	0.22
HL1	2290345	04/09/2023	04/10/2023	720.45	4.95	2.58	0.26
HL3	2290347	04/09/2023	04/10/2023	720.48	5.02	2.62	0.26
HL4	2290348	04/09/2023	04/10/2023	720.48	5.42	2.83	0.28
HL5	2290349	04/09/2023	04/10/2023	720.50	6.38	3.33	0.33
CH1	2290350	04/09/2023	04/10/2023	718.38	3.66	1.91	0.19
CH2	2290351	04/09/2023	04/10/2023	718.47	3.56	1.86	0.19
CH3	2290352	04/09/2023	04/10/2023	718.47	3.98	2.08	0.21
CH4	2290353	04/09/2023	04/10/2023	718.43	5.52	2.88	0.29
CH5	2290354	04/09/2023	04/10/2023	718.45	9.02	4.71	0.47
RB1	2290355	07/09/2023	06/10/2023	698.50	15.05	7.85	0.76
RB2	2290356	07/09/2023	06/10/2023	698.47	13.99	7.30	0.71
RB3	2290357	07/09/2023	06/10/2023	698.42	5.58	2.91	0.28
RB4	2290358	07/09/2023	06/10/2023	698.42	6.82	3.56	0.35
RB5	2290359	07/09/2023	06/10/2023	698.37	7.03	3.67	0.36
MB1	2290360	07/09/2023	06/10/2023	697.50	5.23	2.73	0.27
MB2	2290361	07/09/2023	06/10/2023	697.50	5.07	2.65	0.26

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MB3	2290362	07/09/2023	06/10/2023	697.45	5.17	2.70	0.26
MB4	2290363	07/09/2023	06/10/2023	697.47	6.65	3.47	0.34
MB5	2290364	07/09/2023	06/10/2023	698.00	4.65	2.43	0.24
LD1	2290365	13/09/2023	05/10/2023	525.50	3.40	1.78	0.13
LD2	2290366	13/09/2023	05/10/2023	525.75	5.18	2.70	0.20
LD3	2290367	13/09/2023	05/10/2023	525.75	4.76	2.49	0.18
LD4	2290368	13/09/2023	05/10/2023	525.72	3.90	2.04	0.15
LD5	2290369	13/09/2023	05/10/2023	525.65	4.06	2.12	0.16
NV1	2290370	13/09/2023	05/10/2023	525.75	8.51	4.44	0.33
NV2	2290371	13/09/2023	05/10/2023	525.78	10.05	5.24	0.38
NV3	2290372	13/09/2023	05/10/2023	525.82	8.11	4.23	0.31
NV4	2290373	13/09/2023	05/10/2023	525.78	9.42	4.92	0.36
NV5	2290374	27/09/2023	05/10/2023	197.75	6.26	3.27	0.09
Laboratory Blank				724.05	0.11	0.06	0.006

Comment: Results are not blank subtracted

Customer noted missing tubes: 2290331 & 2290346

Tube 2290338 contained a web. Result may be compromised.

Tube 2290374 was exposed for shorter than the recommended 2-4 weeks.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

Limit of Detection 0.030µgNO₂

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analysed on UV CARY3

Analyst Name Alison Wright

Report Checked By Andy Poole

Date of Analysis 13/12/2023

Date of Report 13/12/2023

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

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Report Number R08699R

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER S00890R
BOOKING IN REFERENCE S00890
DESPATCH NOTE 103400
CUSTOMER Highland Council Attn: John Reid
 Environmental Services,
 Town House, Inverness, IV15 1JJ
DATE SAMPLES RECEIVED 24/01/2024
JOB REFERENCE Highland Schools October 2023

Location	Sample Number	Exposure Data		Time* (hr.)	µg/m ³ *	ppb *	µg NO ₂ on tube
		Date On*	Date Off*				
LV1	1431129	05/10/2023	08/11/2023	816.75	5.47	2.86	0.33
LV2	1431130	05/10/2023	08/11/2023	816.67	6.94	3.62	0.41
LV3	1431131	05/10/2023	08/11/2023	816.58	6.17	3.22	0.37
LV4	1431132	05/10/2023	08/11/2023	816.58	5.93	3.10	0.35
LV5	1431133	05/10/2023	08/11/2023	816.58	6.07	3.17	0.36
NV1	1431134	05/10/2023	08/11/2023	817.75	11.41	5.95	0.68
NV2	2290375	05/10/2023	08/11/2023	817.75	10.94	5.71	0.65
NV3	2290376	05/10/2023	08/11/2023	817.75	10.58	5.52	0.63
NV4	2290377	05/10/2023	08/11/2023	817.75	10.75	5.61	0.64
NV5	2290378	05/10/2023	08/11/2023	817.75	8.33	4.35	0.50
BSG2	2310643	03/10/2023	02/11/2023	718.07	10.40	5.43	0.54
BSG1	2310644	03/10/2023	02/11/2023	718.12	15.06	7.86	0.79
HL5	2310645	03/10/2023	02/11/2023	718.17	9.43	4.92	0.49
HL4	2310646	03/10/2023	02/11/2023	718.23	8.43	4.40	0.44
HL3	2310647	03/10/2023	02/11/2023	718.17	7.17	3.74	0.37
HL2	2310648	05/10/2023	02/11/2023	670.55	7.47	3.90	0.36
HL1	2310649	03/10/2023	02/11/2023	718.22	7.78	4.06	0.41
CH4	2310650	04/10/2023	31/10/2023	647.20	5.59	2.92	0.26
CH3	2310651	04/10/2023	31/10/2023	647.20	4.66	2.43	0.22
CH2	2310652	04/10/2023	31/10/2023	647.22	4.38	2.29	0.21
CH1	2310653	04/10/2023	31/10/2023	647.28	4.61	2.41	0.22
BSG5	2310654	03/10/2023	02/11/2023	718.10	6.94	3.62	0.36
BSG4	2310655	03/10/2023	02/11/2023	718.10	7.15	3.73	0.37
BSG3	2310656	03/10/2023	02/11/2023	718.07	8.05	4.20	0.42
CH5	2310657	04/10/2023	31/10/2023	647.17	6.12	3.20	0.29
MT2	2310659	04/10/2023	31/10/2023	647.07	16.05	8.38	0.76
MT4	2310661	04/10/2023	31/10/2023	647.05	17.16	8.96	0.81
MT5	2310662	04/10/2023	31/10/2023	647.03	17.33	9.05	0.82
MK1	2310663	04/10/2023	31/10/2023	647.05	11.16	5.83	0.53
MK3	2310665	04/10/2023	31/10/2023	647.02	12.25	6.39	0.58
MK5	2310667	04/10/2023	31/10/2023	647.00	12.29	6.42	0.58
CE1	2310668	04/10/2023	02/11/2023	695.00	10.61	5.54	0.54
CE2	2310669	04/10/2023	02/11/2023	694.98	12.95	6.76	0.65
CE3	2310670	04/10/2023	02/11/2023	695.00	18.89	9.86	0.95
CE5	2310671	04/10/2023	02/11/2023	695.03	18.91	9.87	0.96
CE4	2310672	04/10/2023	02/11/2023	694.93	21.56	11.25	1.09

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LABORATORY ANALYSIS REPORT

MB1	2310673	06/10/2023	03/11/2023	668.62	6.71	3.50	0.33
MB2	2310674	06/10/2023	03/11/2023	668.53	6.57	3.43	0.32
MB3	2310675	06/10/2023	03/11/2023	668.47	6.71	3.50	0.33
MB4	2310676	06/10/2023	03/11/2023	668.33	8.48	4.43	0.41
RB1	2310677	06/10/2023	03/11/2023	667.58	16.94	8.84	0.82
RB2	2310678	06/10/2023	03/11/2023	667.62	22.65	11.82	1.10
RB3	2310679	06/10/2023	03/11/2023	667.25	9.07	4.74	0.44
RB4	2310680	06/10/2023	03/11/2023	667.25	9.67	5.05	0.47
RB5	2310681	06/10/2023	03/11/2023	667.25	7.94	4.14	0.39
MB5	2310682	06/10/2023	03/11/2023	667.92	5.71	2.98	0.28
Laboratory Blank				817.75	0.13	0.07	0.008

Comment: Results are not blank subtracted

Customer noted missing tubes: 2310658, 2310660, 2310664, 2310666.

Tube 2310655 was indicated by customer as missing but was received & analysed.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

Limit of Detection 0.031 µgNO₂

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analysed on UV CARY2

Analyst Name Jennie Green

Report Checked By Marek Bianga

Date of Analysis 06/02/2024

Date of Report 06/02/2024

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

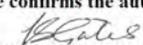
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Report Number S00890R

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER S00893R
BOOKING IN REFERENCE S00893
DESPATCH NOTE 103401
CUSTOMER Highland Council Attn: John Reid
 Environmental Services,
 Town House, Inverness, IV15 1JJ
DATE SAMPLES RECEIVED 24/01/2024
JOB REFERENCE Highland Schools November 2023

Location	Sample Number	Exposure Data		Time* (hr.)	µg/m ³ *	ppb *	µg NO ₂ on tube
		Date On*	Date Off*				
CH1	2330505	31/10/2023	07/12/2023	885.55	10.19	5.32	0.66
CH2	2330506	31/10/2023	07/12/2023	885.55	9.32	4.87	0.60
CH3	2330507	31/10/2023	07/12/2023	885.53	10.32	5.38	0.66
CH4	2330508	31/10/2023	07/12/2023	885.52	12.55	6.55	0.81
CH5	2330509	31/10/2023	07/12/2023	885.53	12.27	6.41	0.79
MT1	2330510	31/10/2023	06/12/2023	864.28	12.47	6.51	0.78
MT2	2330511	31/10/2023	06/12/2023	864.22	19.09	9.96	1.20
MT3	2330512	31/10/2023	06/12/2023	864.15	19.09	9.96	1.20
MT4	2330514	31/10/2023	06/12/2023	864.12	19.31	10.08	1.21
MT5	2330515	31/10/2023	06/12/2023	867.10	18.77	9.80	1.18
MK1	2330516	31/10/2023	06/12/2023	864.13	17.20	8.97	1.08
MK2	2330517	31/10/2023	06/12/2023	864.12	17.01	8.88	1.07
MK3	2330518	31/10/2023	06/12/2023	864.10	15.83	8.26	0.99
MK4	2330519	31/10/2023	06/12/2023	864.08	19.20	10.02	1.21
MK5	2330520	31/10/2023	06/12/2023	864.07	17.37	9.07	1.09
HL1	2330521	02/11/2023	07/12/2023	837.58	14.72	7.68	0.90
HL2	2330522	02/11/2023	07/12/2023	837.55	15.06	7.86	0.92
HL3	2330523	02/11/2023	07/12/2023	837.53	14.75	7.70	0.90
HL4	2330524	02/11/2023	07/12/2023	837.43	16.18	8.45	0.99
HL5	2330525	02/11/2023	07/12/2023	837.43	16.71	8.72	1.02
BSG1	2330526	02/11/2023	07/12/2023	837.42	21.95	11.46	1.34
BSG2	2330527	02/11/2023	07/12/2023	837.42	15.30	7.98	0.93
BSG3	2330528	02/11/2023	07/12/2023	837.38	14.52	7.58	0.88
BSG4	2330529	02/11/2023	07/12/2023	837.33	13.90	7.26	0.85
BSG5	2330530	02/11/2023	07/12/2023	837.30	13.85	7.23	0.84
CE1	2330531	02/11/2023	06/12/2023	814.63	14.83	7.74	0.88
CE2	2330532	02/11/2023	06/12/2023	814.60	15.12	7.89	0.90
CE3	2330533	02/11/2023	06/12/2023	814.52	22.20	11.58	1.31
CE4	2330534	02/11/2023	06/12/2023	814.48	21.81	11.38	1.29
CE5	2330535	02/11/2023	06/12/2023	814.45	23.58	12.31	1.40
RB1	2330536	03/11/2023	08/12/2023	841.42	23.56	12.30	1.44
MB4	2330537	03/11/2023	08/12/2023	840.50	15.96	8.33	0.98
MB3	2330538	03/11/2023	08/12/2023	840.48	12.15	6.34	0.74
MB2	2330539	03/11/2023	08/12/2023	840.48	11.57	6.04	0.71
MB1	2330540	03/11/2023	08/12/2023	840.48	10.66	5.56	0.65
RB5	2330541	03/11/2023	08/12/2023	841.47	13.47	7.03	0.82
RB4	2330542	03/11/2023	08/12/2023	841.52	15.42	8.05	0.94

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RB3	2330543	03/11/2023	08/12/2023	841.62	16.20	8.46	0.99
RB2	2330544	03/11/2023	08/12/2023	841.37	22.39	11.68	1.37
MB5	2330545	03/11/2023	08/12/2023	840.53	9.04	4.72	0.55
LV1	2330546	08/11/2023	06/12/2023	672.33	13.30	6.94	0.65
LV2	2330547	08/11/2023	06/12/2023	672.50	13.56	7.08	0.66
LV3	2330548	08/11/2023	06/12/2023	672.50	11.95	6.24	0.58
LV4	2330549	08/11/2023	06/12/2023	672.50	11.81	6.16	0.58
LV5	2330550	08/11/2023	06/12/2023	672.50	13.67	7.13	0.67
NV1	2330551	08/11/2023	06/12/2023	670.92	20.92	10.92	1.02
NV2	2330552	08/11/2023	06/12/2023	670.92	20.24	10.56	0.99
NV3	2330553	08/11/2023	06/12/2023	670.92	20.22	10.55	0.99
NV4	2330554	08/11/2023	06/12/2023	670.92	21.12	11.02	1.03
NV5	2330555	08/11/2023	06/12/2023	670.83	17.76	9.27	0.87

Laboratory Blank				885.55	0.06	0.03	0.004
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Comment: Results are not blank subtracted

Tube 2330519 was indicated by customer as missing but was received & analysed.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

Limit of Detection 0.030µgNO₂

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analysed on UV CARY3

Analyst Name Alison Wright

Report Checked By Marek Bianga

Date of Analysis 06/02/2024

Date of Report 06/02/2024

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

Form LQF32b Issue 10 – November 2021

Report Number S00893R

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L. Gates, Laboratory Manager

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER S07721R
BOOKING IN REFERENCE S07721
DESPATCH NOTE 107984
CUSTOMER Highland Council Attn: John Reid
 Environmental Services, Town House, Inverness, IV15 1JJ
DATE SAMPLES RECEIVED 12/11/2024
JOB REFERENCE Schools Sept 2024

Location	Sample Number	Exposure Data			Time* (hr.)	µg/m ³ *		µg NO ₂ on tube
		Date On*	Date Off*			ppb *		
INP1	2524103	04/09/2024	04/10/2024	724.42	7.03	3.67	0.37	
INP2	2524104	04/09/2024	04/10/2024	724.38	7.58	3.96	0.40	
INP4	2524106	04/09/2024	04/10/2024	724.32	5.93	3.09	0.31	
INP5	2524107	04/09/2024	04/10/2024	724.28	5.59	2.91	0.29	
KM1	2524108	05/09/2024	04/10/2024	700.68	5.83	3.04	0.30	
KM2	2524109	05/09/2024	04/10/2024	700.68	7.01	3.66	0.36	
KM3	2524110	05/09/2024	04/10/2024	700.63	6.56	3.42	0.33	
KM4	2524111	05/09/2024	04/10/2024	700.65	5.68	2.96	0.29	
KM5	2524112	05/09/2024	04/10/2024	700.67	5.24	2.74	0.27	
LOP1	2524113	05/09/2024	04/10/2024	700.00	4.28	2.24	0.22	
LOP2	2524114	05/09/2024	04/10/2024	700.02	4.60	2.40	0.23	
LOP3	2524115	05/09/2024	04/10/2024	699.97	5.01	2.62	0.26	
LOP4	2524116	05/09/2024	04/10/2024	699.90	4.34	2.27	0.22	
LOP5	2524117	05/09/2024	04/10/2024	699.82	4.17	2.18	0.21	
CDP1	2524118	05/09/2024	04/10/2024	699.90	5.07	2.65	0.26	
CDP2	2524119	05/09/2024	04/10/2024	699.83	5.66	2.96	0.29	
CDP3	2524120	05/09/2024	04/10/2024	699.83	6.41	3.35	0.33	
CDP4	2524121	05/09/2024	04/10/2024	699.77	5.96	3.11	0.30	
CDP5	2524122	05/09/2024	04/10/2024	699.78	6.67	3.48	0.34	
DRP1	2524123	05/09/2024	04/10/2024	698.93	10.91	5.69	0.55	
DRP2	2524124	05/09/2024	04/10/2024	698.87	5.91	3.08	0.30	
DRP3	2524125	05/09/2024	04/10/2024	698.80	5.55	2.90	0.28	
DRP4	2524126	05/09/2024	04/10/2024	698.82	6.18	3.23	0.31	
DRP5	2524127	05/09/2024	04/10/2024	698.78	9.06	4.73	0.46	
DFP1	2524128	05/09/2024	04/10/2024	699.27	4.88	2.55	0.25	
DFP2	2524129	05/09/2024	04/10/2024	699.25	4.92	2.57	0.25	
DFP3	2524130	05/09/2024	04/10/2024	699.17	4.84	2.53	0.25	
DFP4	2524131	05/09/2024	04/10/2024	699.12	4.76	2.49	0.24	
DFP5	2524132	05/09/2024	04/10/2024	699.03	4.82	2.52	0.25	
Laboratory Blank				724.42	0.09	0.05	0.005	

Comment: Results are not blank subtracted

Customer noted missing tube: 2524105.

Tube 2524126 contained a spider. Result may be compromised.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analyst Name Alison Wright

Date of Analysis 26/11/2024

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Limit of Detection 0.013µgNO₂

Analysed on UV CARY4

Report Checked By Marek Bianga

Date of Report 26/11/2024

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LABORATORY ANALYSIS REPORT

NIROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER S07722R
BOOKING IN REFERENCE S07722
DESPATCH NOTE 110300
CUSTOMER Highland Council Attn: John Reid
 Environmental Services, Town House, Inverness, IV15 1JJ
DATE SAMPLES RECEIVED 12/11/2024
JOB REFERENCE Schools Oct 2024

Location	Sample Number	Exposure Data			µg/m ³ *	ppb *	µg NO ₂ on tube
		Date On*	Date Off*	Time* (hr.)			
INP2	2547057	04/10/2024	08/11/2024	834.85	5.92	3.09	0.36
INP3	2547058	04/10/2024	08/11/2024	834.80	6.92	3.61	0.42
INP4	2547059	04/10/2024	08/11/2024	834.72	4.65	2.43	0.28
INP5	2547060	04/10/2024	08/11/2024	834.68	5.03	2.62	0.31
KM1	2547036	04/10/2024	08/11/2024	839.33	6.59	3.44	0.40
KM2	2547037	04/10/2024	08/11/2024	839.32	8.85	4.62	0.54
KM3	2547038	04/10/2024	08/11/2024	839.28	8.00	4.18	0.49
KM4	2547039	04/10/2024	08/11/2024	839.23	6.98	3.65	0.43
KM5	2547040	04/10/2024	08/11/2024	839.23	6.05	3.16	0.37
LOP1	2547041	04/10/2024	08/11/2024	838.05	5.01	2.61	0.31
LOP2	2547042	04/10/2024	08/11/2024	838.07	5.22	2.72	0.32
LOP3	2547043	04/10/2024	08/11/2024	838.10	4.94	2.58	0.30
LOP4	2547044	04/10/2024	08/11/2024	838.08	5.22	2.72	0.32
LOP5	2547045	04/10/2024	08/11/2024	838.08	5.19	2.71	0.32
CDP1	2547046	04/10/2024	08/11/2024	837.17	5.62	2.93	0.34
CDP2	2547047	04/10/2024	08/11/2024	837.12	6.30	3.29	0.38
CDP3	2547048	04/10/2024	08/11/2024	837.12	7.05	3.68	0.43
CDP4	2547049	04/10/2024	08/11/2024	837.12	5.46	2.85	0.33
CDP5	2547050	04/10/2024	08/11/2024	837.10	6.95	3.63	0.42
DRP1	2547051	04/10/2024	08/11/2024	835.75	9.29	4.85	0.56
DRP2	2547052	04/10/2024	08/11/2024	835.87	6.65	3.47	0.40
DRP3	2547053	04/10/2024	08/11/2024	835.75	5.40	2.82	0.33
DRP4	2547054	04/10/2024	08/11/2024	835.72	7.01	3.66	0.43
DRP5	2547055	04/10/2024	08/11/2024	835.62	9.73	5.08	0.59
DFP1	2547061	04/10/2024	08/11/2024	833.68	5.61	2.93	0.34
DFP2	2547062	04/10/2024	08/11/2024	833.68	5.38	2.81	0.33
DFP3	2547063	04/10/2024	08/11/2024	833.58	6.44	3.36	0.39
DFP5	2547065	04/10/2024	08/11/2024	833.45	5.89	3.08	0.36
Laboratory Blank				839.33	0.08	0.04	0.005

Comment: Results are not blank subtracted
Customer noted missing tubes: 2547056 & 2547064.
 Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analyst Name Alison Wright

Date of Analysis 26/11/2024

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Limit of Detection 0.013µgNO₂

Analysed on UV CARY4

Report Checked By

Date of Report

Marek Bianga

26/11/2024

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

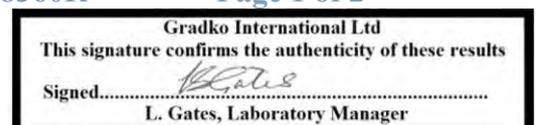
REPORT NUMBER S08360R
BOOKING IN REFERENCE S08360
DESPATCH NOTE 110301
CUSTOMER Highland Council Attn: John Reid
 Environmental Services
 Town House
 Inverness
 IV15 1JJ
DATE SAMPLES RECEIVED 09/12/2024

Location	Sample Number	Exposure Data			µg/m ³ *	ppb *	µg NO ₂ on tube
		Date On*	Date Off*	Time* (hr.)			
KM1	2564776	08/11/2024	05/12/2024	647.83	9.54	4.98	0.45
KM2	2564777	08/11/2024	05/12/2024	647.85	9.56	4.99	0.45
KM3	2564778	08/11/2024	05/12/2024	647.88	10.55	5.51	0.50
KM4	2564779	08/11/2024	05/12/2024	647.90	8.20	4.28	0.39
KM5	2564780	08/11/2024	05/12/2024	647.92	7.69	4.01	0.36
LO1	2564781	08/11/2024	05/12/2024	649.03	6.68	3.49	0.32
LO2	2564782	08/11/2024	05/12/2024	649.00	5.81	3.03	0.27
LO3	2564783	08/11/2024	05/12/2024	648.98	5.92	3.09	0.28
LO4	2564784	08/11/2024	05/12/2024	648.97	6.72	3.51	0.32
LO5	2564785	08/11/2024	05/12/2024	648.92	6.06	3.16	0.29
CDP1	2564786	08/11/2024	05/12/2024	650.28	7.60	3.96	0.36
CDP2	2564787	08/11/2024	05/12/2024	650.28	7.11	3.71	0.34
CDP3	2564788	08/11/2024	05/12/2024	650.23	8.61	4.49	0.41
CDP5	2564790	08/11/2024	05/12/2024	650.07	9.19	4.79	0.43
DRP1	2564791	08/11/2024	05/12/2024	648.38	12.20	6.37	0.58
DRP2	2564792	08/11/2024	05/12/2024	647.97	8.22	4.29	0.39
DRP3	2564793	08/11/2024	05/12/2024	648.17	8.36	4.37	0.39
DRP4	2564794	08/11/2024	05/12/2024	648.18	8.00	4.18	0.38
DRP5	2564795	08/11/2024	05/12/2024	648.30	11.04	5.76	0.52
INP2	2564797	08/11/2024	05/12/2024	651.88	8.10	4.23	0.38
INP3	2564798	08/11/2024	05/12/2024	651.88	9.77	5.10	0.46
INP4	2564799	08/11/2024	05/12/2024	651.85	6.08	3.17	0.29
INP5	2564800	08/11/2024	05/12/2024	651.87	7.43	3.88	0.35
DFF1	2564801	08/11/2024	05/12/2024	649.85	7.86	4.10	0.37
DFF2	2564802	08/11/2024	05/12/2024	649.77	7.81	4.08	0.37
DFF3	2564803	08/11/2024	05/12/2024	649.82	8.32	4.34	0.39
DFF4	2564804	08/11/2024	05/12/2024	649.82	7.52	3.92	0.36
DFF5	2564805	08/11/2024	05/12/2024	649.83	8.09	4.22	0.38
Laboratory Blank				651.88	0.11	0.06	0.005

Comment: Results are not blank subtracted

Customer noted missing tubes: 2564789 & 2564796.

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.



LABORATORY ANALYSIS REPORT

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7% **Limit of Detection** 0.028µgNO₂
The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analyst Name Ivelina Paldamova **Report Checked By** Jon Hall

Analysed on UV CARY1

Date of Analysis 03/01/2025 **Date of Report** 03/01/2025

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

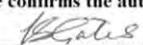
Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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LABORATORY ANALYSIS REPORT

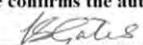
NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER T00601R
BOOKING IN REFERENCE T00601
DESPATCH NOTE 110302
CUSTOMER Highland Council Attn: John Reid
Environmental Services
Town House
Inverness
IV15 1JJ
DATE SAMPLES RECEIVED 20/01/2025
JOB REFERENCE Schools Jan 25

Location	Sample Number	Exposure Data		Time* (hr.)	µg/m ³ *	ppb *	µg NO ₂ on tube
		Date On*	Date Off*				
DFP1	2583464	05/12/2024	10/01/2025	863.33	6.12	3.19	0.38
DFP2	2583465	05/12/2024	10/01/2025	863.42	6.01	3.14	0.38
DFP3	2583466	05/12/2024	10/01/2025	863.50	6.17	3.22	0.39
DFP4	2583467	05/12/2024	10/01/2025	863.57	6.71	3.50	0.42
DFP5	2583468	05/12/2024	10/01/2025	863.63	5.37	2.80	0.34
DRP1	2583469	05/12/2024	10/01/2025	863.45	6.68	3.48	0.42
DRP2	2583470	05/12/2024	10/01/2025	863.50	4.99	2.60	0.31
DRP3	2583471	05/12/2024	10/01/2025	863.50	5.59	2.92	0.35
DRP4	2583472	05/12/2024	10/01/2025	863.43	4.81	2.51	0.30
DRP5	2583473	05/12/2024	10/01/2025	863.47	8.48	4.42	0.53
INP1	2583474	05/12/2024	10/01/2025	861.17	5.99	3.13	0.38
INP2	2583475	05/12/2024	10/01/2025	861.17	5.74	2.99	0.36
INP3	2583476	05/12/2024	10/01/2025	861.18	6.69	3.49	0.42
INP4	2583477	05/12/2024	10/01/2025	861.20	4.55	2.38	0.29
INP5	2583478	05/12/2024	10/01/2025	861.13	4.95	2.59	0.31
LOP1	2583479	05/12/2024	10/01/2025	862.93	4.51	2.36	0.28
LOP2	2583480	05/12/2024	10/01/2025	862.88	4.24	2.21	0.27
LOP3	2583481	05/12/2024	10/01/2025	862.78	4.16	2.17	0.26
LOP4	2583482	05/12/2024	10/01/2025	862.73	4.29	2.24	0.27
LOP5	2583483	05/12/2024	10/01/2025	862.83	4.18	2.18	0.26
CDP1	2583484	05/12/2024	10/01/2025	862.25	5.09	2.66	0.32
CDP2	2583485	05/12/2024	10/01/2025	862.30	4.72	2.47	0.30
CDP3	2583486	05/12/2024	10/01/2025	862.35	5.55	2.90	0.35
CDP4	2583487	05/12/2024	10/01/2025	862.22	4.56	2.38	0.29
CDP5	2583488	05/12/2024	10/01/2025	862.33	5.79	3.02	0.36
KM1	2583489	05/12/2024	10/01/2025	866.25	6.18	3.22	0.39
KM2	2583490	05/12/2024	10/01/2025	866.25	6.21	3.24	0.39
KM3	2583491	05/12/2024	10/01/2025	866.25	6.10	3.18	0.38
KM4	2583492	05/12/2024	10/01/2025	866.23	5.29	2.76	0.33
KM5	2583493	05/12/2024	10/01/2025	866.22	5.58	2.91	0.35
Laboratory Blank				866.25	0.10	0.05	0.006

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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LABORATORY ANALYSIS REPORT

Comment: Results are not blank subtracted

Exposure times were calculated from start and finish times given on the exposure sheet.

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7% **Limit of Detection** 0.028µgNO₂
The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 20% TEA / Water

Analyst Name Ivelina Paldamova **Analysed on** UV CARY1 **Report Checked By** Jon Hall

Date of Analysis 07/02/2025 **Date of Report** 10/02/2025

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

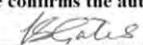
Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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Report Number T00601R

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Appendix C – Monitoring Results
Diffusion Tube Data Processing Tool Outputs



2022-23

Bishop Eden & Crown Tube Data – Extract from BV Processing Tool DTDES Inputs sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
BE1266255845330	BE1	Bishop Eden's Primary	New	Single	Urban Background	266255	845330		1.5	23.1	National	0.83									10.0	11.4	15.0			12.1	10.3	
BE2266261845339	BE2	Bishop Eden's Primary	New	Single	Urban Background	266261	845339		1.5	23.1	National	0.83									9.4	11.5	17.5			12.8	10.9	
BE3266230845348	BE3	Bishop Eden's Primary	New	Single	Urban Background	266230	845348		1.5	23.1	National	0.83									9.5	10.7	12.0			10.7	9.1	
BE4266217845357	BE4	Bishop Eden's Primary	New	Single	Urban Background	266217	845357		1.5	23.1	National	0.83									9.1	10.6	15.6			11.8	10.0	
C1267179845224	C1	Crown Primary	New	Single	Urban Background	267179	845224		1.5	23.1	National	0.83									11.5	12.9	16.6			13.7	11.6	
C2267080845188	C2	Crown Primary	New	Single	Urban Background	267080	845188		1.5	23.1	National	0.83									10.5	11.0	17.9			13.1	11.2	
C3267107845141	C3	Crown Primary	New	Single	Urban Background	267107	845141		1.5	23.1	National	0.83									9.3	10.4	14.4			11.3	9.7	
C4267088845129	C4	Crown Primary	New	Single	Urban Background	267088	845129		1.5	23.1	National	0.83									11.1	12.2	14.4			12.6	10.7	
C5267103845108	C5	Crown Primary	New	Single	Urban Background	267103	845108		1.5	23.1	National	0.83									10.8	12.2	18.1			13.7	11.7	
C6267116845085	C6	Crown Primary	New	Single	Urban Background	267116	845085		1.5	23.1	National	0.83									10.8	12.3	18.4			13.8	11.8	

Dalneigh Tube Data – Extract from BV Processing Tool DTDES Inputs sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
DAL1 Dalneigh265299845056	DAL1 Dalneigh	Dalneigh Primary School	New	Single	Urban Background	265299	845056		1.5	17.6	National	0.83									6.2		10.9			-	-	
DAL2 Dalneigh265237845063	DAL2 Dalneigh	Dalneigh Primary School	New	Single	Urban Background	265237	845063		1.5	10.2	National	0.83														-	-	
DAL3 Dalneigh265261844909	DAL3 Dalneigh	Dalneigh Primary School	New	Single	Urban Background	265261	844909		1.5	17.6	National	0.83									6.5		11.9			-	-	
DAL4 Dalneigh26533844901	DAL4 Dalneigh	Dalneigh Primary School	New	Single	Urban Background	265333	844901		1.5	27.7	National	0.83									6.6	5.3	11.4			7.6	7.1	

Holm Diffusion Tube Data – Extract from BV Processing Tool DTDES Input sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
H1265644842313	H1	Holm Primary	New	Single	Suburban	265644	842313		1.5	23.1	National	0.83									4.3	5.7	9.6			6.5	5.4	
H2265626842326	H2	Holm Primary	New	Single	Suburban	265626	842326		1.5	23.1	National	0.83									4.2	5.5	9.2			6.3	5.2	
H3265601842342	H3	Holm Primary	New	Single	Suburban	265601	842342		1.5	23.1	National	0.83									4.3	5.5	9.2			6.3	5.2	
H4265577842354	H4	Holm Primary	New	Single	Suburban	265577	842354		1.5	23.1	National	0.83									4.3	3.0	8.4			5.2	4.3	
H5265511842475	H5	Holm Primary	New	Single	Suburban	265511	842475		1.5	23.1	National	0.83									4.1	5.6	8.1			5.9	4.9	

Kirkhill Diffusion Tube Data – Extract from BV Processing Tool DTDES Input sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
KIRK1255488845586	KIRK1	Kirkhill Primary	New	Single	Suburban	255488	845586		1.5	6.9	National	0.83									3.6					-	-	
KIRK2255512845606	KIRK2	Kirkhill Primary	New	Single	Suburban	255512	845606		1.5	14.6	National	0.83									3.4	4.4				-	-	
KIRK3255544845612	KIRK3	Kirkhill Primary	New	Single	Suburban	255544	845612		1.5	14.6	National	0.83									3.1		6.8			-	-	
KIRK4255570845630	KIRK4	Kirkhill Primary	New	Single	Suburban	255570	845630		1.5	22.3	National	0.83									3.4	3.9	6.7			-	-	
KIRK5255573845453	KIRK5	Kirkhill Primary	New	Single	Suburban	255573	845453		1.5	22.3	National	0.83									2.6	3.3	6.1			-	-	
KIRK6255594845652	KIRK6	Kirkhill Primary	New	Single	Suburban	255594	845652		1.5	22.3	National	0.83									2.9	3.8	6.7			-	-	

Pennyland Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
Pen 1310859968464	Pen 1	Pennyland Primary School	New	Single	Suburban	310859	968464		1.5	23.6	National	0.83									2.5	4.0	5.5			4.0	3.1	
Pen 2310871968430	Pen 2	Pennyland Primary School	New	Single	Suburban	310871	968430		1.5	15.1	National	0.83									2.7		6.2			-	-	
Pen 3310854968403	Pen 3	Pennyland Primary School	New	Single	Suburban	310854	968403		1.5	23.6	National	0.83									2.2	3.8	6.4			4.2	3.2	
Pen 4310763968362	Pen 4	Pennyland Primary School	New	Single	Suburban	310763	968362		1.5	23.6	National	0.83									2.1	3.4	5.9			3.9	3.0	
Pen 5310671968452	Pen 5	Pennyland Primary School	New	Single	Suburban	310671	968452		1.5	23.6	National	0.83									2.5	3.4	5.8			3.9	3.0	

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BSGI Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)	
BSG1266992842211	BSG1	Bun-Sgoil Ghàidhlig Inbhir Nis	New	Single	Kerbside	266992	842211	2.5	0.5	25.0	National	0.81										13.1	15.1	22.0			17.1	11.8	
BSG2266940842180	BSG2	Bun-Sgoil Ghàidhlig Inbhir Nis	New	Single	Roadside	266940	842180	2.5	2.7	25.0	National	0.81										6.9	10.4	15.3			11.2	7.7	
BSG3266916842219	BSG3	Bun-Sgoil Ghàidhlig Inbhir Nis	New	Single	Urban Background	266916	842219	2.5	1.0	25.0	National	0.81										5.1	8.1	14.5			9.6	6.6	
BSG4266904842229	BSG4	Bun-Sgoil Ghàidhlig Inbhir Nis	New	Single	Urban Background	266904	842229	2.5	1.0	25.0	National	0.81										4.9	7.2	13.9			9.0	6.2	
BSG5266865842238	BSG5	Bun-Sgoil Ghàidhlig Inbhir Nis	New	Single	Urban Background	266865	842238	2.5	1.0	25.0	National	0.81										4.4	6.9	13.9			8.8	6.1	

Central Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)	
CE1266170845092	CE1	Central Primary School	New	Single	Roadside	266170	845092	2.5	1.7	25.0	National	0.81										6.3	10.6	14.8			10.9	7.5	
CE2266184845067	CE2	Central Primary School	New	Single	Roadside	266184	845067	2.5	1.7	25.0	National	0.81										7.8	13.0	15.1			12.2	8.4	
CE3266308845088	CE3	Central Primary School	New	Single	Roadside	266308	845088	2.5	1.8	25.0	National	0.81										14.7	18.9	22.2			18.9	13.0	
CE4266286845116	CE4	Central Primary School	New	Single	Roadside	266286	845116	2.5	1.8	25.0	National	0.81										15.0	21.6	21.8			19.6	13.5	
CE5266263845144	CE5	Central Primary School	New	Single	Roadside	266263	845144	2.5	1.8	25.0	National	0.81										16.4	18.9	23.6			19.9	13.7	

Cradlehall Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)	
CH1270528844675	CH1	Cradlehall Primary School	New	Single	Roadside	270528	844675	5.5	7.5	25.0	National	0.81										3.7	4.6	10.2			6.5	4.5	
CH227057184488	CH2	Cradlehall Primary School	New	Single	Suburban	270571	84488	2.5	2.0	25.0	National	0.81										3.6	4.4	9.3			6.0	4.2	
CH3270505844500	CH3	Cradlehall Primary School	New	Single	Roadside	270505	844500	2.5	2.0	25.0	National	0.81										4.0	4.7	10.3			6.6	4.6	
CH4270411844575	CH4	Cradlehall Primary School	New	Single	Kerbside	270411	844575	2.5	0.5	25.0	National	0.81										5.5	5.6	12.6			8.2	5.7	
CH5270449844634	CH5	Cradlehall Primary School	New	Single	Roadside	270449	844634	2.5	3.0	25.0	National	0.81										9.0	6.1	12.3			9.4	6.5	

Hilton Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)	
HL1267507843764	HL1	Hilton Primary School	New	Single	Roadside	267507	843764	2.5	2.0	25.0	National	0.81										5.0	7.8	14.7		9.6	6.6		
HL2267476843699	HL2	Hilton Primary School	New	Single	Roadside	267476	843699	2.5	2.0	17.3	National	0.81											7.5	15.1		-	-		
HL3267497843671	HL3	Hilton Primary School	New	Single	Roadside	267497	843671	2.5	2.0	25.0	National	0.81											5.0	7.2	14.8		9.4	6.5	
HL4267567843591	HL4	Hilton Primary School	New	Single	Roadside	267567	843591	2.5	2.0	25.0	National	0.81														10.5	7.2		
HL5267650843680	HL5	Hilton Primary School	New	Single	Kerbside	267650	843680	2.5	0.5	25.0	National	0.81														11.3	7.8		

Inverloch Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)	
NV1211258774547	NV1	Inverloch 1	New	Single	Roadside	211258	774547	2.5	1.6	23.6	National	0.81										8.5	11.4	20.9		14.0	11.3		
NV2211263774514	NV2	Inverloch 2	New	Single	Roadside	211263	774514	2.5	1.6	23.6	National	0.81											10.1	10.9	20.2		14.0	11.3	
NV3211268774487	NV3	Inverloch 3	New	Single	Roadside	211268	774487	2.5	1.6	23.6	National	0.81											8.1	10.6	20.2		13.3	10.8	
NV4211278774459	NV4	Inverloch 4	New	Single	Roadside	211278	774459	2.5	1.4	23.6	National	0.81											9.4	10.8	21.1		14.0	11.4	
NV5211230774434	NV5	Inverloch 4	New	Single	Urban Background	211230	774434	2.5	53.0	19.8	National	0.81											6.3	8.3	17.8		-	-	

Lundavra Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)			
LV1209624772863	LV1	Lundavra 1	New	Single	Urban Background	209624	772863	2.5	60.0	23.6	National	0.81										3.4	5.5	13.3		7.7	6.2				
LV2209720772965	LV2	Lundavra 2	New	Single	Roadside	209720	772965	2.5	1.6	23.6	National	0.81											5.2	6.9	13.6		8.8	7.1			
LV3209700772882	LV3	Lundavra 3	New	Single	Roadside	209700	772882	2.5	1.6	23.6	National	0.81												4.8	6.2	12.0		7.8	6.3		
LV4209682772856	LV4	Lundavra 4	New	Single	Roadside	209682	772856	2.5	1.6	23.6	National	0.81												3.9	5.9	11.8		7.5	6.0		
LV5209699772912	LV5	Lundavra 5	New	Single	Roadside	209699	772912	2.5	1.6	23.6	National	0.81														4.1	6.1	13.7		8.2	6.6

Merkinch Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)			
MK1265902845870	MK1	Merkinch Primary School	New	Single	Roadside	265902	845870	2.5	1.5	25.0	National	0.81											8.9	11.2	17.2		12.8	8.8			
MK2265866845820	MK2	Merkinch Primary School	New	Single	Roadside	265866	845820	2.5	1.5	17.3	National	0.81														8.2		17.0		-	-
MK3265809845830	MK3	Merkinch Primary School	New	Single	Roadside	265809	845830	2.5	1.8	25.0	National	0.81														8.9	12.3	15.8		12.6	8.7
MK4265778845846	MK4	Merkinch Primary School	New	Single	Roadside	265778	845846	2.5	1.8	17.3	National	0.81														9.2		19.2		-	-
MK5265751845860	MK5	Merkinch Primary School	New	Single	Roadside	265751	845860	2.5	2.0	25.0	National	0.81														9.2	12.3	17.4		13.3	9.2

Millbank Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)				
MB1288308856218	MB1	Millbank Primary School	New	Single	Roadside	288308	856218	2.5	1.8	25.0	National	0.81														5.2	6.7	10.7		7.8	5.4	
MB228828285856196	MB2	Millbank Primary School	New	Single	Roadside	288285	856196	2.5	1.8	25.0	National	0.81															5.1	6.6	11.6		8.0	5.5
MB3288260856177	MB3	Millbank Primary School	New	Single	Roadside	288260	856177	2.5	1.7	25.0	National	0.81															5.2	6.7	12.2		8.3	5.7
MB4288210856169	MB4	Millbank Primary School	New	Single	Roadside	288210	856169	2.5	1.8	25.0	National	0.81															6.7	8.5	16.0		10.8	7.4
MB5288439856171	MB5	Millbank Primary School	New	Single	Urban Background	288439	856171	2.5	50.0	25.0	National	0.81														4.7	5.7	9.0		6.7	4.6	

Muirtown Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)	
MT1264947845773	MT1	Muirtown Primary School	New	Single	Urban Background	264947	845773	2.5	1.5	17.3	National	0.81										5.4		12.5			-	-	
MT2265041845742	MT2	Muirtown Primary School	New	Single	Kerbside	265041	845742	2.5	0.5	25.0	National	0.81										15.3	16.1	19.1			17.0	11.7	
MT3265055845762	MT3	Muirtown Primary School	New	Single	Kerbside	265055	845762	2.5	0.5	9.6	National	0.81												19.1			-	-	
MT4265081845791	MT4	Muirtown Primary School	New	Single	Kerbside	265081	845791	2.5	0.5	25.0	National	0.81										15.7	17.2	19.3			17.5	12.1	
MT5265112845821	MT5	Muirtown Primary School	New	Single	Kerbside	265112	845821	2.5	0.5	25.0	National	0.81										16.3	17.3	18.8			17.6	12.1	

Rosebank Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)	
RB1288039856423	RB1	Rosebank Primary School	New	Single	Roadside	288039	856423	2.5	1.5	25.0	National	0.81										15.1	16.9	23.6			18.9	13.0	
RB2288120856441	RB2	Rosebank Primary School	New	Single	Roadside	288120	856441	2.5	2.8	25.0	National	0.81										14.0	22.7	22.4			19.9	13.7	
RB3288223856334	RB3	Rosebank Primary School	New	Single	Roadside	288223	856334	2.5	3.0	25.0	National	0.81										5.6	9.1	16.2			10.7	7.4	
RB4288230856333	RB4	Rosebank Primary School	New	Single	Kerbside	288230	856333	2.5	0.5	25.0	National	0.81										6.8	9.7	15.4			11.0	7.6	
RB5288203856326	RB5	Rosebank Primary School	New	Single	Roadside	288203	856326	2.5	2.5	25.0	National	0.81										7.0	7.9	13.5			9.8	6.8	

2024-25

Cauldeen Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
CDP1267020843127	CDP1	Cauldeen Primary	New	Single	Urban Background	267020	843127	2.2	0.6	34.0	National	0.81									5.1	5.6	7.6	5.1		5.8	3.9	
CDP2267035843157	CDP2	Cauldeen Primary	New	Single	Urban Background	267035	843157	2.2	1.4	34.0	National	0.81									5.7	6.3	7.1	4.7		5.9	3.9	
CDP3267048843142	CDP3	Cauldeen Primary	New	Single	Urban Background	267048	843142	2.2	1.5	34.0	National	0.81									6.4	7.1	8.6	5.6		6.9	4.6	
CDP4267103843120	CDP4	Cauldeen Primary	New	Single	Urban Background	267103	843120	2.2	1.6	25.0	National	0.81									6.0	5.5		4.6		5.3	4.0	
CDP5267140843022	CDP5	Cauldeen Primary	New	Single	Urban Background	267140	843022	2.2	0.3	34.0	National	0.81									6.7	7.0	9.2	5.8		7.2	4.8	

Drakies Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
DRP1268320844097	DRP1	Drakies Primary	New	Single	Suburban	268320	844097	2.2	1.9	34.0	National	0.81									10.9	9.3	12.2	6.7		9.8	6.5	
DRP2268180844225	DRP2	Drakies Primary	New	Single	Suburban	268180	844225	2.2	1.4	34.0	National	0.81									5.9	6.7	8.2	5.0		6.4	4.3	
DRP3268145844055	DRP3	Drakies Primary	New	Single	Suburban	268145	844055	2.2	1.9	34.0	National	0.81									5.6	5.4	8.4	5.6		6.2	4.1	
DRP4268166844043	DRP4	Drakies Primary	New	Single	Suburban	268166	844043	2.2	1.6	34.0	National	0.81									6.2	7.0	8.0	4.8		6.5	4.3	
DRP5268306844047	DRP5	Drakies Primary	New	Single	Suburban	268306	844047	2.2	1.9	34.0	National	0.81									9.1	9.7	11.0	8.5		9.6	6.4	

Duncan Forbes Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
DFF1271757846609	DFF1	Duncan Forbes Primary	New	Single	Suburban	271757	846609	2.2	11.0	34.0	National	0.81									4.9	5.6	7.9	6.1		6.1	4.1	
DFF2271702846567	DFF2	Duncan Forbes Primary	New	Single	Suburban	271702	846567	2.2	8.0	34.0	National	0.81									4.9	5.4	7.8	6.0		6.0	4.0	
DFF3271662846536	DFF3	Duncan Forbes Primary	New	Single	Suburban	271662	846536	2.2	2.4	34.0	National	0.81									4.8	6.4	8.3	6.2		6.4	4.3	
DFF4271714846501	DFF4	Duncan Forbes Primary	New	Single	Suburban	271714	846501	2.2	1.5	25.0	National	0.81									4.8		7.5	6.7		6.3	4.0	
DFF5271776846504	DFF5	Duncan Forbes Primary	New	Single	Suburban	271776	846504	2.0	1.6	34.0	National	0.81									4.8	5.9	8.1	5.4		6.0	4.0	

Inshes Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
INP1268864843665	INP1	Inshes Primary	New	Single	Suburban	268864	843665	2.2	3.0	17.0	National	0.81									7.0			6.0		6.5	5.3	
INP2268780843698	INP2	Inshes Primary	New	Single	Suburban	268780	843698	2.0	0.5	34.0	National	0.81									7.6	5.9	8.1	5.7		6.8	4.5	
INP3268740843722	INP3	Inshes Primary	New	Single	Suburban	268740	843722	2.2	2.5	25.0	National	0.81										6.9	9.8	6.7		7.8	4.7	
INP4268689843632	INP4	Inshes Primary	New	Single	Suburban	268689	843632	1.8	3.4	34.0	National	0.81									5.9	4.6	6.1	4.6		5.3	3.5	
INP5268717843658	INP5	Inshes Primary	New	Single	Suburban	268717	843658	1.8	0.5	34.0	National	0.81									5.6	5.0	7.4	5.0		5.8	3.8	

Kinmylies Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
KM1264813844738	KM1	Kinmylies Primary	New	Single	Suburban	264813	844738	2.2	8.0	34.0	National	0.81									5.8	6.6	9.5	6.2		7.0	4.7	
KM2264792844752	KM2	Kinmylies Primary	New	Single	Suburban	264792	844752	2.2	2.0	34.0	National	0.81									7.0	8.9	9.6	6.2		7.9	5.3	
KM3264821844761	KM3	Kinmylies Primary	New	Single	Suburban	264821	844761	2.2	1.6	34.0	National	0.81									6.6	8.0	10.6	6.1		7.8	5.2	
KM4264848844750	KM4	Kinmylies Primary	New	Single	Suburban	264848	844750	2.2	3.0	34.0	National	0.81									5.7	7.0	8.2	5.3		6.5	4.3	
KM5264886844756	KM5	Kinmylies Primary	New	Single	Suburban	264886	844756	2.2	2.0	34.0	National	0.81									5.2	6.0	7.7	5.6		6.1	4.1	

Lochardil Diffusion Tube Data – Extract from BV Processing Tool DTDES Input Sheet

Unique ID	Site ID	Site Name	New / Existing	Single / Duplicate / Triplicate	Site Type	X OS Grid Reference	Y OS Grid Reference	Height (m)	Distance to Kerb of Nearest Road (m)	Data Capture (%)	National or Local Bias Adjustment	Bias Adjustment Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	Raw Annual Mean (µg/m3)	Bias Adjusted and Annualised Annual Mean (µg/m3)	Distance Corrected Annual Mean (µg/m3)
LOP1266180842683	LOP1	Lochardil Primary	New	Single	Suburban	266180	842683	2.2	1.8	34.0	National	0.81									4.3	5.0	6.7	4.5		5.1	3.4	
LOP2266113842739	LOP2	Lochardil Primary	New	Single	Suburban	266113	842739	2.2	2.6	34.0	National	0.81									4.6	5.2	5.8	4.2		5.0	3.3	
LOP3266072842755	LOP3	Lochardil Primary	New	Single	Suburban	266072	842755	2.2	1.4	34.0	National	0.81									5.0	4.9	5.9	4.2		5.0	3.3	
LOP4266015842754	LOP4	Lochardil Primary	New	Single	Suburban	266015	842754	2.2	1.4	34.0	National	0.81									4.3	5.2	6.7	4.3		5.1	3.4	
LOP5265991842565	LOP5	Lochardil Primary	New	Single	Suburban	265991	842565	2.2	1.4	34.0	National	0.81									4.2	5.2	6.1	4.2		4.9	3.3	

Appendix D – Zephyr® Calibration Certificates

Unit 442 - BIC 2783

Unit 481 - BIC 2742

Unit 506 - BIC 2778

Unit 585 - BIC 2785

Unit 608 - BIC 2765

Unit 647 - BIC 2166

Unit 473 - BIC 2766



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Gas Sensor Cartridge Calibration Certificate

Sensor Cartridge BIC2783

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	Accuracy Specification ($\mu\text{g}/\text{m}^3$)	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Slope of regression	Offset of regression ($\mu\text{g}/\text{m}^3$)	Maximum Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Average Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Status
NO ₂	8.0			0.77	≥ 0.69	1.00	0.0	84.7	29.6	Pass
NO	8.0			0.97	≥ 0.69	1.00	0.1	155.6	15.3	Pass
O ₃	15.0	4.18	≤ 7.5			0.98	0.3	70.4	36.0	Pass

All EarthSense cartridges are progressed through a strict quality and calibration assessment prior to shipping.

All tests are performed in real-world conditions.

In conditions with relatively low concentrations of the target gas, the RMS error must be less than half the specified accuracy.

For higher ambient conditions, a strict R² criteria is applied. In all cases, the slope must be 1 ± 0.1 and the offset must be less than half of the specified accuracy of the sensor.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Sensor Cartridge Calibration Certificate for Particulate Matter Sensor Cartridge BIC2783

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Status
PM _{2.5}	1.94	≤ 5.0	0.955	≥ 0.75	Pass
PM ₁₀	6.41	≤ 10.0	0.786	≥ 0.5	Pass

In compliance with our Indicative MCERTS accreditation, all particulate sensors are reviewed for a period against our reference equipment.

Sensor parameters are fixed following formal testing at the UK's National Physical Laboratory in 2022.

These tests confirm nominal sensor performance, either through RMS error or R² correlations.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Gas Sensor Cartridge Calibration Certificate

Sensor Cartridge BIC2742

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	Accuracy Specification ($\mu\text{g}/\text{m}^3$)	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Slope of regression	Offset of regression ($\mu\text{g}/\text{m}^3$)	Maximum Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Average Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Status
NO ₂	8.0			0.81	≥ 0.69	1.00	0.0	84.7	29.6	Pass
NO	8.0	3.83	≤ 4.0			1.00	0.1	155.6	15.3	Pass
O ₃	15.0	4.85	≤ 7.5			0.97	0.3	70.4	36.0	Pass

All EarthSense cartridges are progressed through a strict quality and calibration assessment prior to shipping.

All tests are performed in real-world conditions.

In conditions with relatively low concentrations of the target gas, the RMS error must be less than half the specified accuracy.

For higher ambient conditions, a strict R² criteria is applied. In all cases, the slope must be 1 ± 0.1 and the offset must be less than half of the specified accuracy of the sensor.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Sensor Cartridge Calibration Certificate for Particulate Matter Sensor Cartridge BIC2742

Calibration Summary

Location: *EarthSense manufacturing facility*
Start Date: *2024-01-15 00:00:00*
End Date: *2024-01-22 00:00:00*

Pollutant	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Status
PM _{2.5}	1.71	≤ 5.0	0.955	≥ 0.75	Pass
PM ₁₀	6.41	≤ 10.0	0.787	≥ 0.5	Pass

In compliance with our Indicative MCERTS accreditation, all particulate sensors are reviewed for a period against our reference equipment.

Sensor parameters are fixed following formal testing at the UK's National Physical Laboratory in 2022.

These tests confirm nominal sensor performance, either through RMS error or R² correlations.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Gas Sensor Cartridge Calibration Certificate

Sensor Cartridge BIC2778

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	Accuracy Specification ($\mu\text{g}/\text{m}^3$)	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Slope of regression	Offset of regression ($\mu\text{g}/\text{m}^3$)	Maximum Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Average Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Status
NO ₂	8.0			0.81	≥ 0.69	1.00	0.0	84.7	29.6	Pass
NO	8.0	3.58	≤ 4.0			1.00	0.0	155.6	15.3	Pass
O ₃	15.0	3.73	≤ 7.5			0.98	0.3	70.4	36.0	Pass

All EarthSense cartridges are progressed through a strict quality and calibration assessment prior to shipping.

All tests are performed in real-world conditions.

In conditions with relatively low concentrations of the target gas, the RMS error must be less than half the specified accuracy.

For higher ambient conditions, a strict R² criteria is applied. In all cases, the slope must be 1 ± 0.1 and the offset must be less than half of the specified accuracy of the sensor.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Sensor Cartridge Calibration Certificate for Particulate Matter Sensor Cartridge BIC2778

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Status
PM _{2.5}	1.94	≤ 5.0	0.955	≥ 0.75	Pass
PM ₁₀	5.27	≤ 10.0	0.785	≥ 0.5	Pass

In compliance with our Indicative MCERTS accreditation, all particulate sensors are reviewed for a period against our reference equipment.

Sensor parameters are fixed following formal testing at the UK's National Physical Laboratory in 2022.

These tests confirm nominal sensor performance, either through RMS error or R² correlations.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Gas Sensor Cartridge Calibration Certificate

Sensor Cartridge BIC2785

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	Accuracy Specification ($\mu\text{g}/\text{m}^3$)	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Slope of regression	Offset of regression ($\mu\text{g}/\text{m}^3$)	Maximum Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Average Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Status
NO ₂	8.0			0.79	≥ 0.69	1.00	0.0	84.7	29.6	Pass
NO	8.0			0.92	≥ 0.69	0.99	0.4	155.6	15.3	Pass
O ₃	15.0	3.46	≤ 7.5			0.99	0.2	70.4	36.0	Pass

All EarthSense cartridges are progressed through a strict quality and calibration assessment prior to shipping.

All tests are performed in real-world conditions.

In conditions with relatively low concentrations of the target gas, the RMS error must be less than half the specified accuracy.

For higher ambient conditions, a strict R² criteria is applied. In all cases, the slope must be 1 ± 0.1 and the offset must be less than half of the specified accuracy of the sensor.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Sensor Cartridge Calibration Certificate for Particulate Matter Sensor Cartridge BIC2785

Calibration Summary

Location: *EarthSense manufacturing facility*
Start Date: *2024-01-15 00:00:00*
End Date: *2024-01-22 00:00:00*

Pollutant	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Status
PM _{2.5}	1.82	≤ 5.0	0.960	≥ 0.75	Pass
PM ₁₀	6.27	≤ 10.0	0.795	≥ 0.5	Pass

In compliance with our Indicative MCERTS accreditation, all particulate sensors are reviewed for a period against our reference equipment.

Sensor parameters are fixed following formal testing at the UK's National Physical Laboratory in 2022.

These tests confirm nominal sensor performance, either through RMS error or R² correlations.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Gas Sensor Cartridge Calibration Certificate

Sensor Cartridge BIC2765

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	Accuracy Specification ($\mu\text{g}/\text{m}^3$)	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Slope of regression	Offset of regression ($\mu\text{g}/\text{m}^3$)	Maximum Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Average Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Status
NO ₂	8.0			0.76	≥ 0.69	1.13	0.7	84.7	29.6	Pass
NO	8.0			0.98	≥ 0.69	1.00	-0.0	155.6	15.3	Pass
O ₃	15.0	4.01	≤ 7.5			0.98	0.3	70.4	36.0	Pass

All EarthSense cartridges are progressed through a strict quality and calibration assessment prior to shipping.

All tests are performed in real-world conditions.

In conditions with relatively low concentrations of the target gas, the RMS error must be less than half the specified accuracy.

For higher ambient conditions, a strict R² criteria is applied. In all cases, the slope must be 1 ± 0.1 and the offset must be less than half of the specified accuracy of the sensor.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Sensor Cartridge Calibration Certificate for Particulate Matter Sensor Cartridge BIC2765

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Status
PM _{2.5}	1.68	≤ 5.0	0.956	≥ 0.75	Pass
PM ₁₀	6.89	≤ 10.0	0.787	≥ 0.5	Pass

In compliance with our Indicative MCERTS accreditation, all particulate sensors are reviewed for a period against our reference equipment.

Sensor parameters are fixed following formal testing at the UK's National Physical Laboratory in 2022.

These tests confirm nominal sensor performance, either through RMS error or R² correlations.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Gas Sensor Cartridge Calibration Certificate

Sensor Cartridge BIC2166

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2022-06-01 00:00:00*

End Date: *2022-06-07 00:00:00*

Pollutant	Accuracy Specification ($\mu\text{g}/\text{m}^3$)	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Slope of regression	Offset of regression ($\mu\text{g}/\text{m}^3$)	Maximum Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Average Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Status
NO ₂	8.0			0.69	≥ 0.69	1.01	0.1	42.0	10.7	Pass
NO	8.0	1.88	≤ 4.0			0.94	0.1	12.3	1.5	Pass
O ₃	15.0	5.09	≤ 7.5			0.99	0.1	97.3	57.6	Pass

All EarthSense cartridges are progressed through a strict quality and calibration assessment prior to shipping.

All tests are performed in real-world conditions.

In conditions with relatively low concentrations of the target gas, the RMS error must be less than half the specified accuracy.

For higher ambient conditions, a strict R² criteria is applied. In all cases, the slope must be 1 ± 0.1 and the offset must be less than half of the specified accuracy of the sensor.

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Sensor Cartridge Calibration Certificate for Particulate Matter Sensor Cartridge BIC2166

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2022-06-01 00:00:00*

End Date: *2022-06-07 00:00:00*

Pollutant	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Status
PM _{2.5}	3.01	≤ 5.0	0.891	≥ 0.75	Pass
PM ₁₀	2.70	≤ 10.0	0.741	≥ 0.5	Pass

In compliance with our Indicative MCERTS accreditation, all particulate sensors are reviewed for a period against our reference equipment.

Sensor parameters are fixed following formal testing at the UK's National Physical Laboratory in 2022.

These tests confirm nominal sensor performance, either through RMS error or R² correlations.

Approved for customer shipment: *Kiran Mistry*



Quality standards approval: *Dr. Roland Leigh*



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Gas Sensor Cartridge Calibration Certificate

Sensor Cartridge BIC2766

Calibration Summary

Location: *EarthSense manufacturing facility*

Start Date: *2024-01-15 00:00:00*

End Date: *2024-01-22 00:00:00*

Pollutant	Accuracy Specification ($\mu\text{g}/\text{m}^3$)	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Slope of regression	Offset of regression ($\mu\text{g}/\text{m}^3$)	Maximum Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Average Ref. Concentration ($\mu\text{g}/\text{m}^3$)	Status
NO ₂	8.0			0.78	≥ 0.69	1.10	0.4	84.7	29.6	Pass
NO	8.0	3.26	≤ 4.0			1.00	-0.1	155.6	15.3	Pass
O ₃	15.0	4.39	≤ 7.5			0.98	0.3	70.4	36.0	Pass

All EarthSense cartridges are progressed through a strict quality and calibration assessment prior to shipping.

All tests are performed in real-world conditions.

In conditions with relatively low concentrations of the target gas, the RMS error must be less than half the specified accuracy.

For higher ambient conditions, a strict R² criteria is applied. In all cases, the slope must be 1 ± 0.1 and the offset must be less than half of the specified accuracy of the sensor.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh



EARTHSENSE

TRUSTED AIR QUALITY INSIGHT

EarthSense Systems Ltd.

Zephyr Sensor Cartridge Calibration Certificate for Particulate Matter Sensor Cartridge BIC2766

Calibration Summary

Location: *EarthSense manufacturing facility*
Start Date: *2024-01-15 00:00:00*
End Date: *2024-01-22 00:00:00*

Pollutant	RMSE ($\mu\text{g}/\text{m}^3$)	RMSE Pass Criteria ($\mu\text{g}/\text{m}^3$)	R ²	R ² Pass Criteria	Status
PM _{2.5}	1.75	≤ 5.0	0.952	≥ 0.75	Pass
PM ₁₀	7.04	≤ 10.0	0.783	≥ 0.5	Pass

In compliance with our Indicative MCERTS accreditation, all particulate sensors are reviewed for a period against our reference equipment.

Sensor parameters are fixed following formal testing at the UK's National Physical Laboratory in 2022.

These tests confirm nominal sensor performance, either through RMS error or R² correlations.

The co-located EarthSense reference station measurements have been ratified according to LAQM TG22 standards by Geoff Broughton (AQDM).

Approved for customer shipment:

Kiran Mistry



Quality standards approval:

Dr. Roland Leigh

