Belfast City Council

2021 Updating and Screening Assessment for Belfast City Council

In fulfilment of Environment (Northern Ireland) Order 2002

Local Air Quality Management

Date: June 2021

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Executive Summary

Belfast City Council has completed this 2021 Updating and Screening Assessment in accordance with the provisions of the Environment (Northern Ireland) Order 2002 and the Northern Ireland Local Air Quality Management Policy Guidance document LAQM.PGNI (09).

In completing this Updating and Screening Assessment, we have undertaken a review of potentially significant sources of air pollution across the city in order to identify new sources, sources with increased emissions and locations close to air pollution sources where public exposure did not previously exist.

In addition, we have completed a review of recent ambient air quality monitoring data for the city in order to identify locations where new or existing exceedances of Air Quality Strategy objectives and European Commission limit values are occurring. This review has also identified locations where ambient air quality has improved and exceedances are no longer occurring.

Belfast City Council has declared four Air Quality Management Areas (AQMAs) across the city for exceedances of the nitrogen dioxide (NO_2) annual mean Air Quality Strategy objective. A review of the monitoring data for these Air Quality Management Areas and for the city generally indicates that there have been further improvements in nitrogen dioxide levels across the city. As a result, Belfast City Council considers that there may be an opportunity for revocation of the Air Quality Management Areas along the Ormeau Road and Upper Newtownards Road, where monitoring data demonstrates recent sustained improved annual mean nitrogen dioxide concentrations, with levels consistently below the annual mean objective. Accordingly, the council will liaise with the Department of Agriculture, Environment and Rural Affairs (DAERA), Department for Infrastructure (DfI) and other relevant competent authority partners regarding the revocation process.

However, we are aware that last year's (2020) pollution levels were very much impacted by the Covid-19 pandemic movement restrictions on the public. Accordingly, there have been significant changes in emissions of some air pollutants, especially from the road

transport sector; which have notably impacted nitrogen dioxide annual mean concentrations at roadside locations where we have recorded typical reductions in the order of 30%, in comparison to previous years' concentrations. These reductions in nitrogen dioxide annual mean concentrations are much greater than anticipated, and on that basis, we will treat these 2020 nitrogen dioxide annual mean results with caution and follow Defra guidance when undertaking any future years projections that incorporate this atypical data.

Monitored levels of benzene and sulphur dioxide remain well below the objectives and show no reason for concern.

There have been no monitored exceedances of Air Quality Strategy Objectives for any pollutant other the nitrogen dioxide in recent years across the city, and no new emission sources have been identified that would have the potential to alter this position. However, the council is aware of recent evidence from national studies showing that domestic solid fuel burning contributes more than previously thought to particulate matter emissions. The contribution of solid fuel combustion to fine particulate matter ($PM_{2.5}$) concentrations has also been recognised within the UK Clean Air Strategy 2019.

Moreover, the National Atmospheric Emission Inventory, '*Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland 1990-2017*' publication highlights that for Northern Ireland in 2017, residential, commercial and public sector combustion accounted for 52% of overall $PM_{2.5}$ emissions, and that this sector was dominated (82%) by emissions from residential combustion.

Belfast City Council and the Department of Environment, Agriculture and Rural Affairs (DAERA) have therefore decided to undertake a detailed assessment for the city, for fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) pollutants. This consultant led project commenced in February 2021 and will report by early 2023.

The most recent Air Quality Action Plan (AQAP) for the city concluded at the end of 2020. A final review of implementation of the various mitigation measures included within 2015-2020 AQAP was undertaken and reported by the council to the Department of Agriculture Environment and Rural Affairs (DAERA) as part of the council's 2020 Action Plan Progress Report, submitted in June 2020.

Whilst previous AQAPs have delivered improvements in ambient air quality across the city, a limited number of NO_2 hotspots still remain. Moreover, fine particulate matter ($PM_{2.5}$) has emerged as an additional ambient air pollutant of concern for the city.

Consequently, the council with relevant partners has just developed a new draft AQAP for the city, which is currently undergoing a public consultation process, until 3rd August 2021. Once finalised, the plan will be submitted to Defra for technical appraisal.

The aim of the new Air Quality Action Plan 2021-2026 is to continue to reduce NO_2 emissions from transport sources and to promote and enable a shift towards more sustainable modes of transport in order to achieve compliance with UK Air Quality Strategy Objectives for NO_2. Where necessary, an additional aim of this Action Plan is to identify, develop and implement mitigation measures to address concentrations of fine particulate matter ($PM_{2.5}$) across the city.

In terms of new sources of ambient air pollution, the council has not identified any new transport sources that require a detailed assessment. In addition, it is the council's view that we do not need to proceed to a detailed assessment for any new or existing industrial, commercial or domestic sources within the city.

Furthermore, we have assessed the impact of a fuel storage depot at Airport Road West within the Port of Belfast previously, and of the recently opened petrol stations, none meet the requirements for a detailed assessment.

Finally, the council is not aware of any new poultry farms or fugitive sources of particulate material within the city confines.

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1 Introduction

1.1 Description of Local Authority Area

Belfast is the capital of Northern Ireland and as such, the city, and its wider metropolitan area, is the largest settlement in the region and the second largest city on the island of Ireland with a population of around 343,542. The city lies at the head of Belfast Lough in the lower reaches of the Lagan Valley and is flanked by the Black Mountain to the west and Castlereagh Hills to the east. The Belfast City Council district area sits at the heart of the growing population of the wider Belfast Metropolitan Urban Area, which also comprises part of the surrounding areas of Lisburn and Castlereagh City Council, North Down and Ards District Council, Antrim and Newtownabbey District Council and Mid and East Antrim District Council.

In terms of historical air quality issues, Belfast used to experience sustained elevated levels of sulphur dioxide (SO_2) and particulate matter (PM_{10}), associated principally with the widespread use of solid fuel for domestic heating. However, through the introduction of the Council's smoke control programme in the late 1960s, the Clean Air (Northern Ireland) Order 1981 and the more recent availability of natural gas to domestic, commercial and industrial sectors, levels of particulate matter and sulphur dioxide have declined substantially to the extent that we do not experience exceedances of any air quality strategy objectives, or indeed European Commission limit values, for either of these pollutants. Accordingly, the number of locations where we monitor these ambient pollutants has been reduced over recent years in accordance with the government's risk and exposure-based approach to local air quality management.

Although Belfast city does not experience exceedances of any air quality strategy objectives, or European Commission limit values, for particulate matter (PM_{10}), we are aware of growing concerns around the effects of fine particulate matter ($PM_{2.5}$) on human health. Therefore, although not included in Regulations at present for Northern Ireland councils, Belfast City Council has proactively opted to report $PM_{2.5}$ monitoring data as part of this Updated Screening Assessment. Moreover, we are aware of the recent evidence from national studies showing that domestic solid fuel burning contributes more than previously thought to particulate emissions.

At the end of 2017, Defra issued a practical guide on open fires and wood burning stoves. The guide provides steps that should be taken to reduce the health impacts of burning solid fuel. This guidance can be found on the Defra smoke control webpage: https://uk-air.defra.gov.uk/library/reports?report_id=948.

The contribution of solid fuel combustion to fine particulate matter ($PM_{2.5}$) concentrations has been also recognised within the UK Clean Air Strategy 2019 and the Clean Air Strategy NI (Public Discussion Document, DAERA November 2020). Therefore, Belfast City Council has decided to undertake a detailed assessment for the city, for fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) pollutants. This project commenced in February 2021.

In recent years, emissions of nitrogen oxides, associated principally with road transport, have become more prominent. This is a similar situation to that experienced in many other major cities and conurbations across the United Kingdom. Accordingly, as a result of the first round of the review and assessment process, which was completed in 2004, Belfast City Council opted to declare four Air Quality Management Areas across the city. We published our first Air Quality Action Plan for the city back in 2006 and it was completed substantially in 2010, with around 90% of planned actions delivered to schedule. Of the outstanding 10% of actions, it was considered that the majority of these would have had limited additional impact within our Air Quality Management Areas.

Although Belfast City Council is directed to comply with the provisions of the Air Quality Strategy for England, Scotland, Wales and Northern Ireland via Part III of the Environment (Northern Ireland) Order 2002, the council is aware also of the pressing need to achieve European Commission air quality limit values at national level in accordance with the schedules prescribed in Directive 2008/50/EC in respect of ambient air quality and cleaner air for Europe and the 4th Daughter Directive. It should be noted that the deadline for achieving limit values for nitrogen dioxide was 1st January 2010 but unfortunately this was not achieved at all locations across the city.

In order to address the remaining ‘hot spot’ areas of elevated nitrogen dioxide, the council along with relevant partners developed a 2015-2020 Air Quality Action Plan (AQAP) for the city that contained a manageable number of proven air quality mitigation measures. This AQAP concluded at the end of 2020. A final review of the implementation of the various

mitigation measures included within 2015-2020 AQAP was undertaken and reported by the council to the Department of Agriculture Environment and Rural Affairs (DAERA) as part of the council's 2020 Action Plan Progress Report, submitted to DAERA in June 2020.

Whilst previous AQAPs have delivered improvements in ambient air quality across the city, a limited number of NO_2 hotspots still remain. Moreover, fine particulate matter ($PM_{2.5}$) has emerged as an additional ambient air pollutant of concern for the city.

Accordingly, the council, relevant authorities and other partner organisations have already developed a new Air Quality Action Plan for the city, which is currently undergoing a public consultation exercise. The aim of the new Air Quality Action Plan 2021-2026 is to continue to reduce nitrogen dioxide emissions from transport sources and to promote and enable a shift towards more sustainable modes of transport in order to achieve compliance with UK Air Quality Objectives for NO_2. Where necessary, an additional aim of this Action Plan is to identify, develop and implement mitigation measures to address concentrations of fine particulate matter ($PM_{2.5}$) across the city. Following conclusion of the consultation process, the Air Quality Action Plan will be sent to Defra for technical appraisal.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management process as set out in the Environment (Northern Ireland) Order 2002, the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on 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 exceedances are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

The objective of this Updating and Screening Assessment (USA) is therefore to identify any matters that have changed, which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. In addition,

the USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM within Northern Ireland are set out in the Air Quality Regulations (Northern Ireland) 2003, and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre (µg/m^3) (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in Northern Ireland

Pollutant	Air Quality Objective Concentration	Air Quality Objective Measured as	Date to be achieved by
Benzene	16.25µg/m^3	Running annual mean	31.12.2003
	3.25µg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5µg/m^3	Annual mean	31.12.2004
	0.25µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40µg/m^3	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40µg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

As part of the review and assessment process, Belfast City Council completed a 2nd and 3rd stage review and assessment of air quality throughout the city in early 2004. This assessment concluded that modelled and monitored exceedances of short and longer-term objectives for both nitrogen dioxide and particulate matter were occurring in the city and would be likely to continue to do so in some locations beyond 2010. Consequently, in August 2004 the council, in consultation with other relevant authorities, declared four Air Quality Management Areas (AQMA), comprising of the M1 Motorway and Westlink corridor, Cromac Street to the junction of Short Strand, Woodstock Link and the Albertbridge Road, the Upper Newtownards Road and the Ormeau Road.

The M1-Westlink AQMA was declared on the basis that annual and hourly-mean nitrogen dioxide concentrations would exceed the December 2005 Air Quality Strategy objectives. In addition, particulate matter annual and 24-hour mean concentrations were predicted also to exceed relevant objectives in this location. The three other Air Quality Management Areas were declared on the grounds that the annual mean nitrogen dioxide objective would be exceeded at these locations during 2005 and beyond. A subsequent source apportionment study, completed for each of the Air Quality Management Areas, indicated that the principal source of the exceedances was emissions associated with road transport.

Current Air Quality Management Areas are described and depicted in more detail as follows:

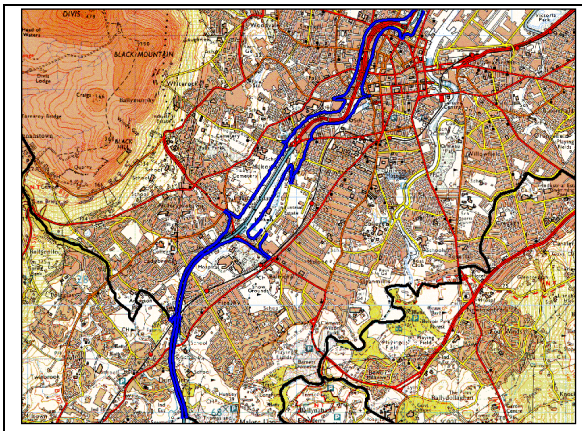
1. The M1 / Westlink corridor from the Belfast City boundary at Sir Thomas and Lady Dixon Park to the end of the Westlink at the junction with Great George's Street and York Street including Stockman's Lane and Kennedy Way. This area was declared for predicted exceedances of both the nitrogen dioxide and particulate material annual mean air quality strategy objectives as well as exceedances of the particulate matter 24-hour mean objective and the nitrogen dioxide 1-hour mean objective. The boundary of the Air Quality Management Area is denoted in blue and has been set to take account of dispersion modelling uncertainties. This AQMA was revoked for exceedances of particulate matter objectives in September 2015, but it continues to exceed the air quality objectives for nitrogen dioxide.
2. Cromac Street to the junction with East Bridge Street and then from East Bridge Street to the junction with the Ravenhill and Albertbridge Roads and Short Strand. This

AQMA was declared for predicted exceedances of the nitrogen dioxide annual mean Air Quality Strategy objective.

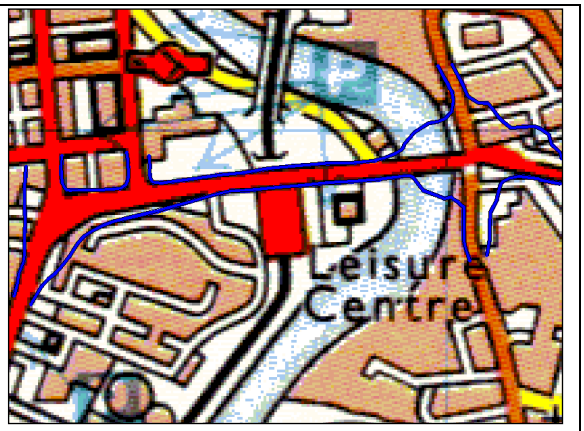
3. The Upper Newtownards Road from the North Road junction to the Belfast City boundary at the Ulster Hospital, incorporating the Knock Road to the City boundary at Laburnum Playing Fields and Hawthornden Way. This AQMA was declared for predicted exceedances of the nitrogen dioxide annual mean Air Quality Strategy objective.
4. The Ormeau Road from the junction with Donegall Pass to the city boundary at Galwally. This area was declared for predicted exceedances of the nitrogen dioxide annual mean Air Quality Strategy objective.

It should be noted that the Belfast City Council boundary is denoted by a solid black line within the following Air Quality Management Area maps, although it should also be noted that the council's 1993 boundary was revised and in some cases enlarged during 2015 under the reform of local government.

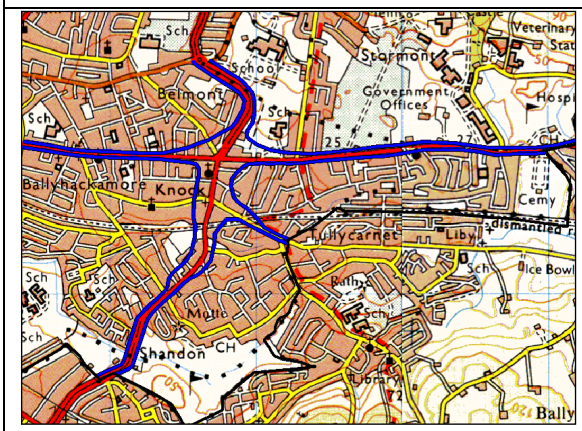
Figure 1 Map of AQMA Boundaries.



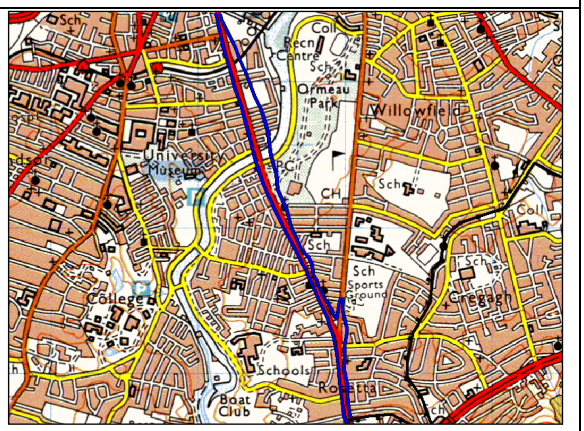
1. **M1-Westlink AQMA**



2. **Cromac Street and Albertbridge Street AQMA**



3. **Upper Newtownards Road AQMA**



4. **Ormeau Road AQMA**

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A further detailed air quality review and assessment was completed by Belfast City Council in 2010, informed by the outcome of the 2009 Updating and Screening Assessment. Accordingly, the 2010 Detailed Assessment considered the potential for exceedances of nitrogen dioxide objectives at a number of further locations across the city, including at the junction of the Sydenham Bypass with the Lower Newtownards Road, Shaftesbury Square, Donegall Road and Albertbridge Road, and at locations throughout the city centre. Although atmospheric dispersion modelling studies, undertaken as part of the detailed review and assessment process, did suggest exceedances of the nitrogen dioxide annual mean objective at some the of above-mentioned locations, the review and assessment identified also that there was no relevant public exposure at these locations during 2010. As a result, the 2010 Detailed Air Quality Review and Assessment for Belfast City Council concluded that there was no need to declare further Air Quality Management Areas or to expand or revoke the existing AQMAs. This conclusion was accepted by DAERA.

Ambient air quality monitoring results, as presented in previous annual progress and updating and screening assessment reports, identified sustained improvements in particulate matter concentrations within the M1 Motorway / A12 Westlink Air Quality Management Area, confirming that it had been in compliance with the particulate matter (PM_{10}) objectives for a number of years. This resulted in the Westlink / M1 AQMA being revoked for particulate matter 24 hour and annual mean objectives in September 2015.

The current stage of the Review and Assessment process requires that an Updated Screening Assessment be completed. This report therefore addresses the requirements of the April 2021 Defra LAQM.TG(16) technical guidance publication in identifying any significant changes that have occurred since the previous round of Review and Assessment, which may have the potential to affect the local air quality.

For reference and additional background information, historical Belfast City Council air quality review and assessment reports are listed in the following table, and are available to download from the Department of Agriculture, Environment & Rural Affairs for Northern Ireland ‘Northern Ireland Air Quality’ website via the follow weblink https://www.airqualityni.co.uk/laqm/district-council-reports.

Table 1.2 Historical Belfast City Council Air Quality Reports.

• Belfast - Progress Report - 2020 - Published: 11th November 2020
• Belfast - Progress Report - 2019 - Published: 30th June 2019
• Belfast - Updating and Screening Assessment - 2018 - Published: 17th December 2018
• Belfast - Progress Report - 2017 - Published: 17th November 2017
• Belfast - Progress Report - 2016 - Published: 21st October 2016
• Belfast - Updating and Screening Assessment - 2015 - Published: 21st October 2016
• Belfast - LAQM Progress Report - 2014 - Published: 14th November 2014
• Belfast - LAQM Progress Report - 2013 - Published: 1st April 2013
• Belfast - Updating and Screening Assessment report - 2012 - Published: 3rd October 2012
• Belfast - Progress Report - 2011 - Published: 30th April 2011
• Belfast - Detailed Assessment - September 2010 - Published: 30th September 2010
• Belfast - Progress Report - 2010 - Published: 30th April 2010
• Belfast - Updating and Screening Assessment - 2009 - Published: 30th April 2009
• Belfast - Joint Air Quality Progress and Action Plan Progress Report - 2007 - Published: 30th April 2007
• Belfast - Detailed Assessment - April 2007 - Published: 30th April 2007
• Belfast - Joint Air Quality Progress and Action Plan Progress Report - 2008 - Published: 10th June 2008
• Belfast - Updating and Screening Assessment - 2006 Appendix - Published: 31st July 2006
• Belfast - Updating and Screening Assessment - 2006 - Published: 31st July 2006
• Belfast - Health Impact Assessment of the Draft Air Quality Action Plan for Belfast - Published: 1st May 2006
• Belfast - Progress Report - Published: 1st September 2005

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Belfast City Council operates four automatic monitoring stations across the city in order to help inform its air quality management processes and to provide real time information to the public in relation to air pollution levels across the city centre and within our Air Quality Management Areas.

Accordingly, to ensure that the data from our sites is both accurate and representative, the monitors at each site are calibrated on a biweekly (Stockman's Lane AURN site) or on a four-weekly basis by the council's technical staff in accordance with the procedures detailed in the Defra Automatic Urban and Rural Network (AURN) local site operators' manual. In addition, data management, quality assurance and quality control and service and maintenance support are all provided by appointed contractors. The data from our sites is made available to the Department of Agriculture, Environment and Rural Affairs and is reported on the 'Northern Ireland Air' website in near real time. For consistency, all automatic monitoring data reported in this Updating and Screening Assessment report has been obtained from the 'Northern Ireland Air Quality' website. Automatic data reported in this report relates to the calendar year (i.e. January – December). 2020 data capture levels exceeded the Department's 75% data capture threshold for the calculation of annual statistics at all council sites. Further information regarding our QA/QC procedures and processes can be obtained in Appendix A to this report.

In addition to the council's automatic monitoring sites, Defra operates an urban background monitoring site at Lombard Street in Belfast City Centre. Unfortunately, during 2020, data capture levels at the Belfast Centre site were below the Department's 75% data capture threshold for nitrogen dioxide (68%).

In relation to correction of our automatic monitoring data, this process is generally of principal concern with regard to the treatment of particulate matter monitoring data. In 2019, the Belfast Centre site employed Filter Dynamics Measurement System (FDMS) equipped Tapered Element Oscillating Microbalances (TEOMs) for particulate matter (PM_{10}) monitoring up until September whereupon the FDMS equipped TEOMs were replaced by Palas Fidas 200, which complies with DEFRA's UK PM Pollution Climate

standard. Government equivalence tests have determined that both of types of equipment meet the equivalence criteria and, on that basis, no correction factor needs to be applied to this monitoring data.

The Stockman's Lane site is equipped with a Beta Attenuation Monitor (BAM) with a heated inlet for monitoring particulate matter. Government technical guidance highlights that a BAM, equipped with a heated inlet, meets the equivalence criteria for PM_{10} monitoring, provided that the results are corrected for slope. This correction involves dividing measured concentrations by a factor of 1.035. It should be noted that the data presented on the Northern Ireland Air website and in this report has already been corrected to the reference equivalent.

During 2019, Belfast City Council replaced ageing NOx API M200A analysers at two of its monitoring sites; namely the Upper Newtownards Road and Stockman's Lane. In addition, the unheated BAM 1020 particulate matter (PM_{10}) analyser at Stockman's Lane was also replaced with a heated inlet variant in order to continue to collect high quality data and to achieve >90% data collection rates throughout the year. In 2020 the council also replaced a further API M200 NOx analyser at the Ormeau Road site.

A location map showing automatic monitoring site locations across the Belfast City Council area is presented in the following Figure 2, with further site-specific monitoring details provided in Table 2.1.

Figure 2 Location Map of Automatic Monitoring Sites across Belfast.

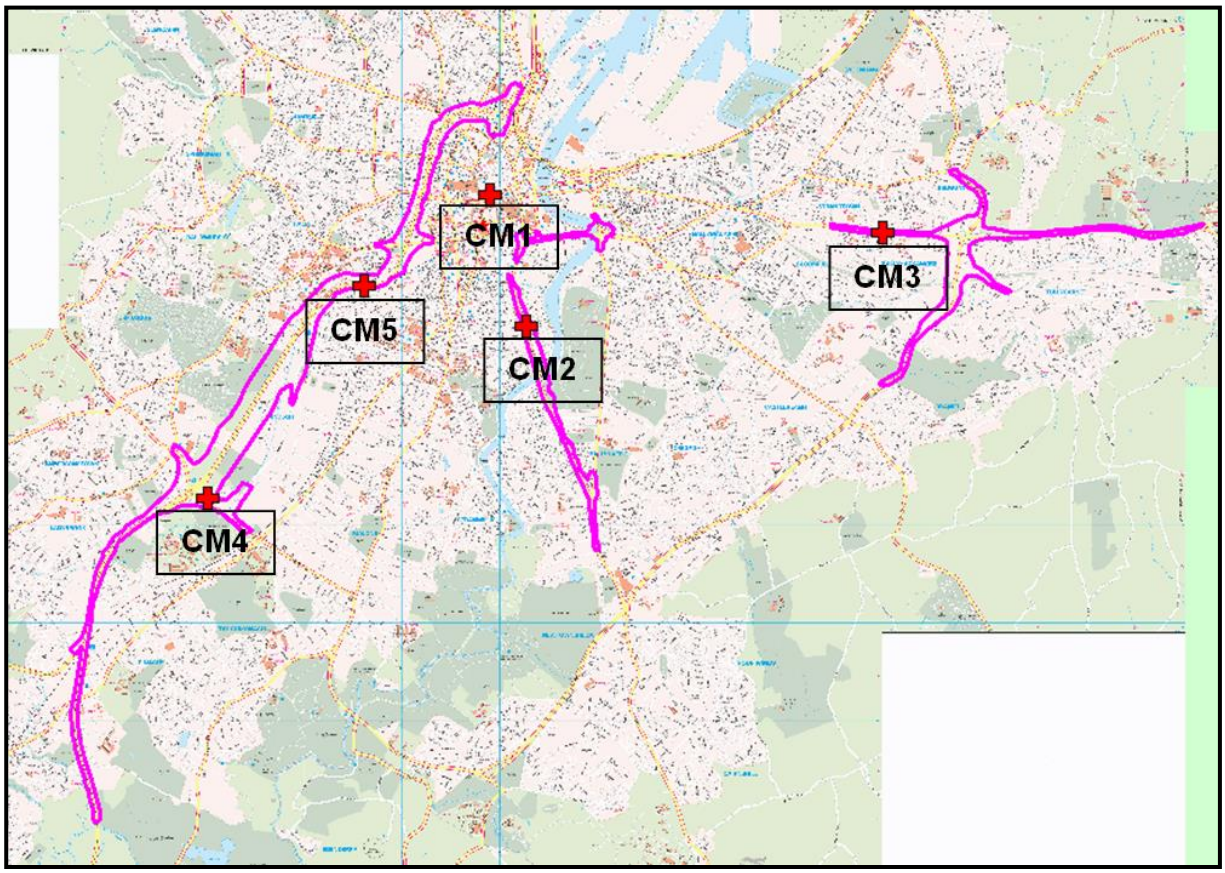

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Table 2.1 Details of Automatic Monitoring Sites.

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m)	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
CM1	Belfast Centre AURN site Lombard Street	Urban Background	333898	374358	4.0	Nitrogen dioxide, sulphur dioxide, carbon monoxide, ozone and particulate matter (PM_{10} and $PM_{2.5}$)	N	Chemiluminescence, UV Fluorescence, IR Absorption, UV Absorption, Light-Scattering Monitor (Palas Fidas 200)	Y (monitoring site is located in a city centre pedestrian precinct)	26 m	Y
CM2	Belfast Ormeau Road	Roadside	334272	373012	1.3	Nitrogen dioxide	Y	Chemiluminescence	Y (6 m)	3 m	Y
CM3	Belfast Ballyhackamore	Roadside	337911	373972	1.3	Nitrogen dioxide	Y	Chemiluminescence	Y (7 m)	2 m	Y
CM4	Belfast Stockmans Lane	Roadside	331010	371252	3.5	Nitrogen dioxide and particulate matter (PM_{10})	Y	Chemiluminescence Beta Attenuation Monitor	Y (12 m)	3 m	Y
CM5	Belfast Westlink Roden Street	Roadside	332617	373431	2.6	Nitrogen dioxide	Y	Chemiluminescence	Y (17 m)	5 m	Y

2.1.2 Non-Automatic Monitoring Sites

The government's risk and exposure-based approach to local air quality management means that Belfast City Council's principal focus has been on addressing citywide ambient nitrogen dioxide levels over recent years. Accordingly, in order to understand how nitrogen dioxide levels are varying across the city and in addition to our automatic analysers, the council operates a range of passive diffusion tubes for nitrogen dioxide at a range of both background and roadside locations across the city.

The NOx tube monitoring network has changed considerably since the declaration of the Air Quality Management Areas in 2004. The extensive council monitoring network currently comprises 67 tubes throughout the city at 59 locations, which provide annual NO_2 data to assist in the review and assessment process and to aid developers in conducting air quality impact assessments, where deemed necessary. Since the 2020 Progress Report, we have added an additional 4 tubes to the network. These locations are detailed in Figure 2.2 and Table 2.2.

Nitrogen dioxide diffusion tubes comprise a small clear plastic tube containing a chemical reagent supported on stainless steel grids that absorb the pollutant directly from the surrounding ambient air. In this case, triethanolamine is used as the reagent to monitor levels of ambient nitrogen dioxide. Belfast City Council's diffusion tubes are exposed for successive four or five week periods, in general accordance with the Defra Diffusion Tube Monitoring Calendar and, as a result, they provide a good general indication of average nitrogen dioxide concentrations, thereby allowing a comparison with the annual mean objective.

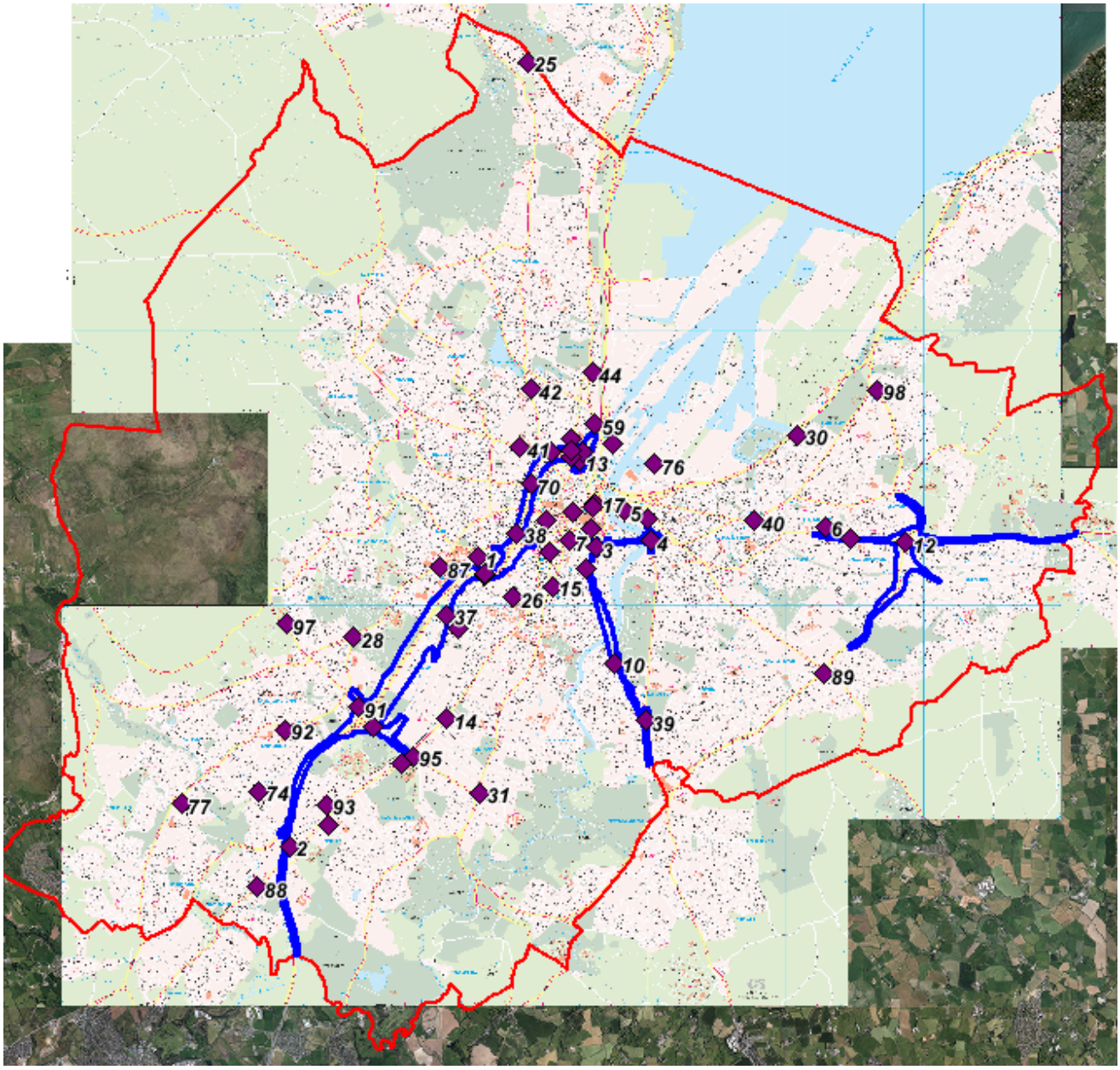
To ensure that experimental error is minimised in the preparation and analysis of its nitrogen dioxide diffusion tubes, Belfast City Council has appointed Gradko International Ltd to supply, analyse and report data for its diffusion tubes. Gradko employs a 20% triethanolamine solution for monitoring ambient nitrogen dioxide and adheres to the requirements of the government's 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users' publication.

To further ensure that its diffusion tube monitoring data is as accurate as possible, the council co-locates a number of diffusion tubes with reference method compliant chemiluminescent nitrogen dioxide analysers at the Lombard Street, Newtownards Road,

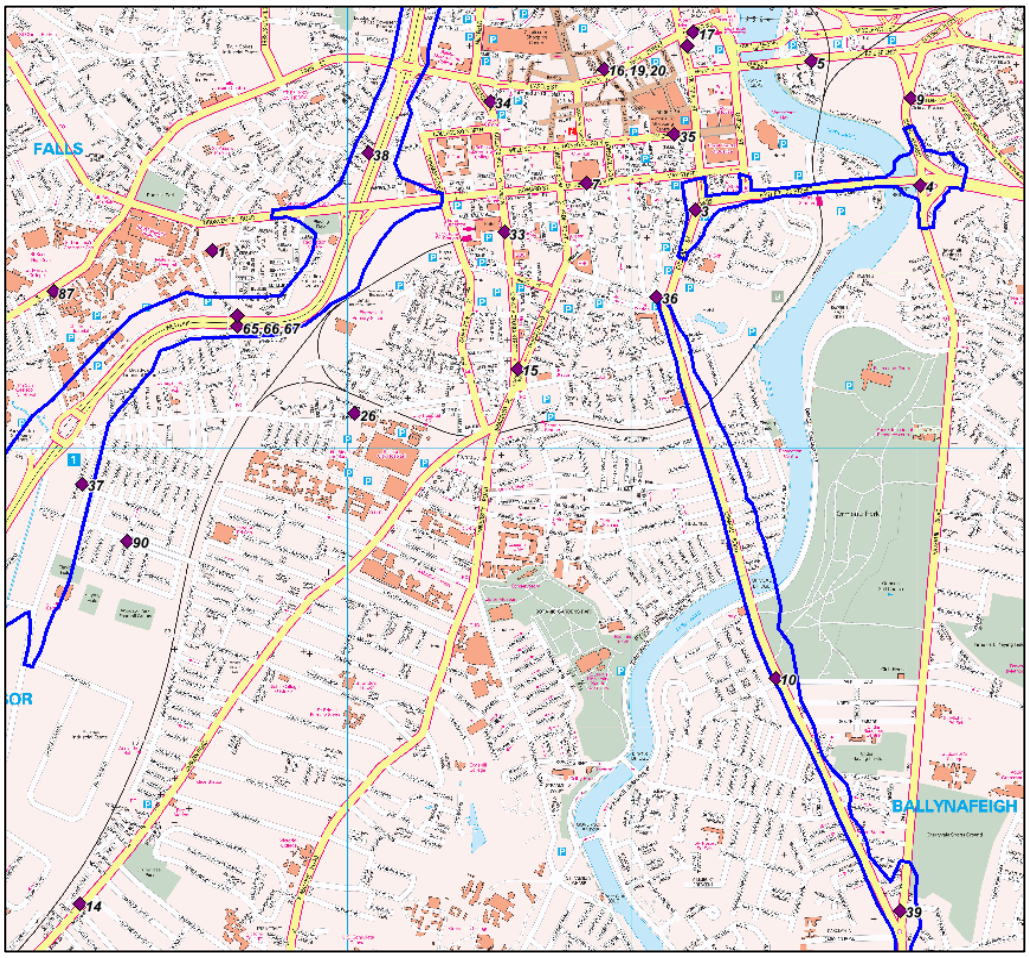
Westlink/Roden Street and Stockman's Lane monitoring sites. This process allows a bias adjustment factor (with a 95% confidence interval as an estimate of the uncertainty on the bias adjustment factor) to be calculated and used to correct the diffusion tube monitoring data. In the case of the diffusion tube data presented in this report, the monitoring data has been corrected using a local bias adjustment factor derived from three roadside co-location studies undertaken at the Upper Newtownards Road, Westlink/Roden Street and Stockman's Lane monitoring sites. The bias calculation and data scaling were undertaken using Defra's new Diffusion Tube Data Processing Tool. Outputs from the spreadsheet for treatment of Belfast City Council's 2020 data are included in Appendix A to this report.

Figure 3 – Location Maps of Non-Automatic Nitrogen Dioxide Monitoring Sites overlaid on Belfast City Council's Air Quality Management Areas.

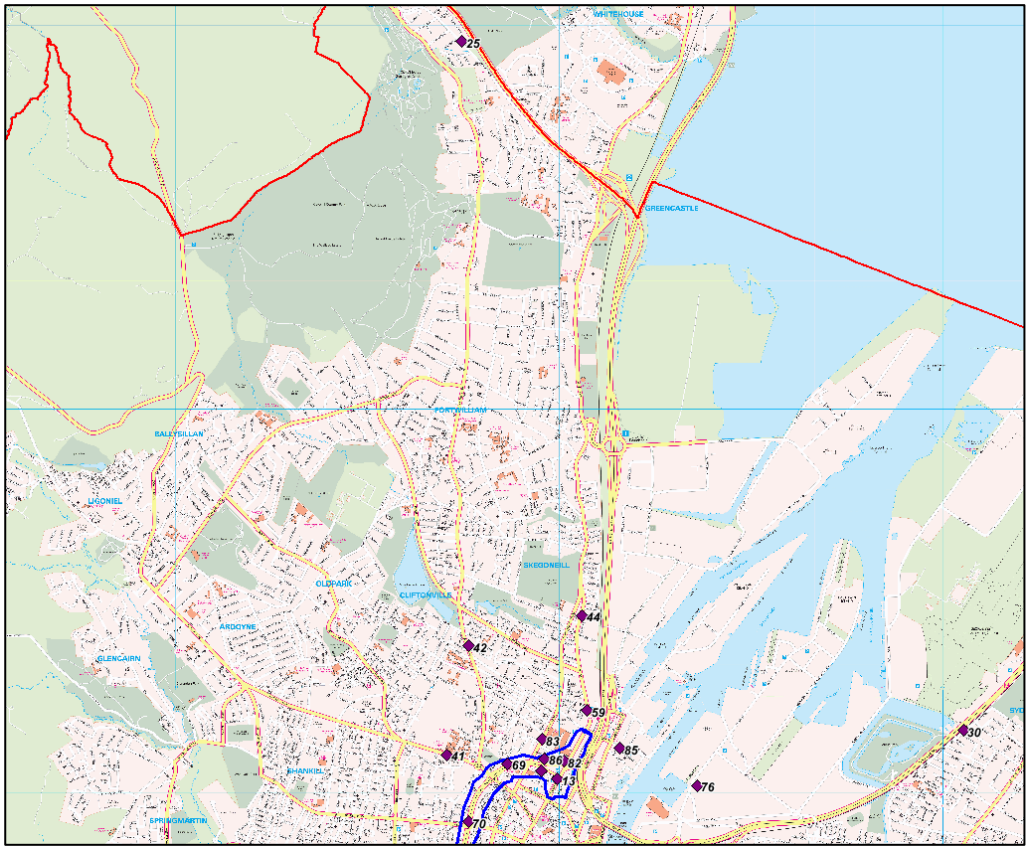
Belfast City Council boundary



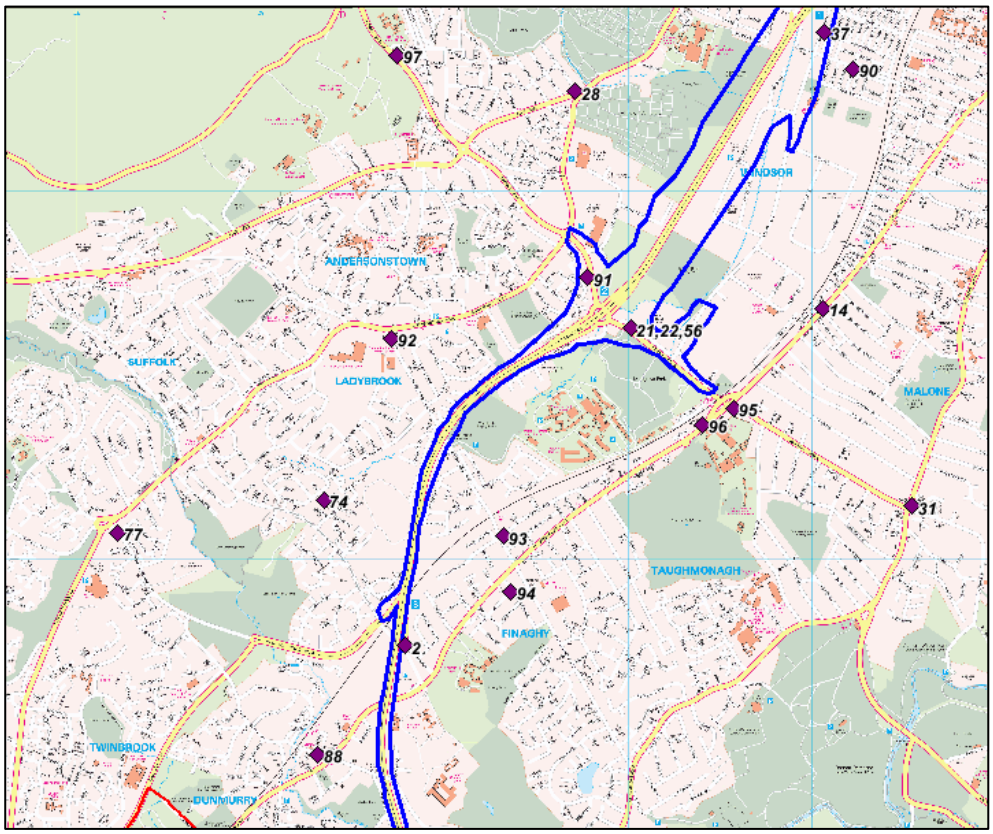
Belfast City Centre



North Belfast



South and West Belfast



East Belfast

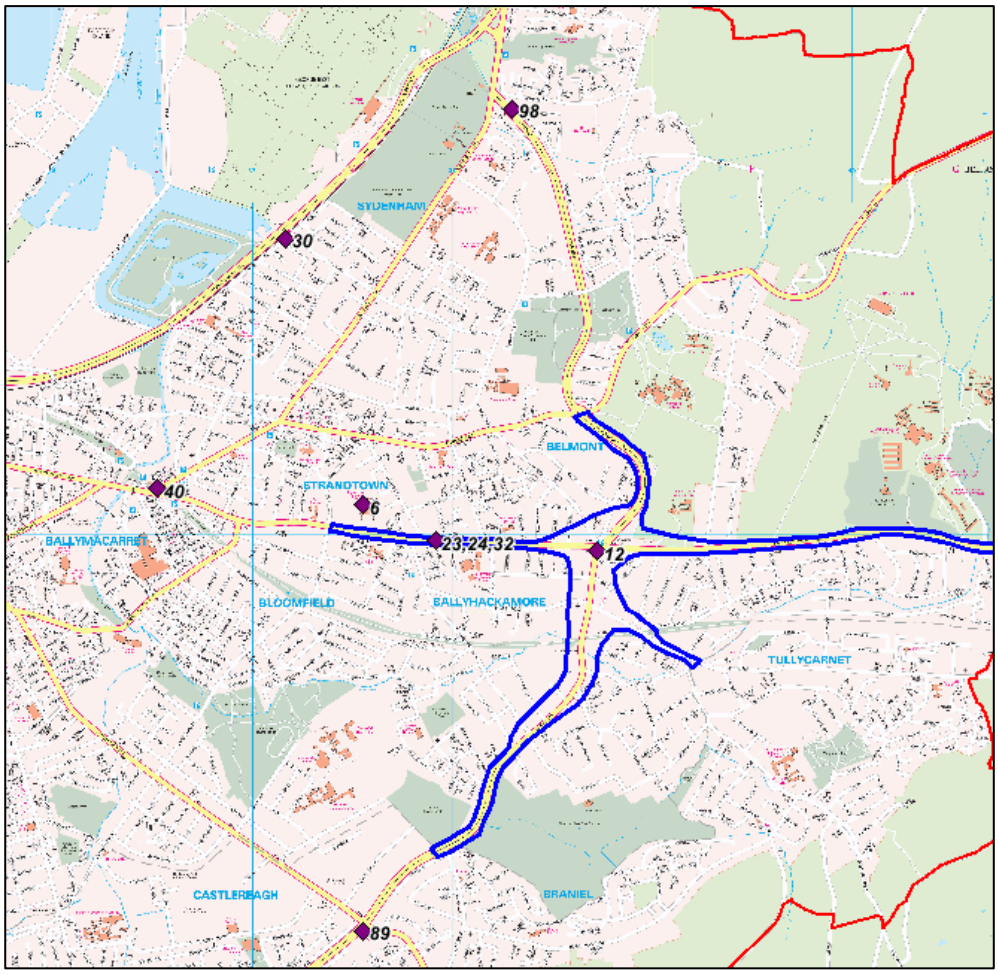


Table 2.2 Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
1	Royal Victoria Hospital	Urban Background	332522	373708	3.8	NO_2	N	N	>70	>80	N/A
2	Black's Road	Roadside	329782	369522	2.7	NO_2	Y	N	27	3	Y
3	61 Cromac Street	Roadside	334220	373853	3.0	NO_2	Y	N	10	3	Y
4	Ravenhill Road	Roadside	335014	373942	3.0	NO_2	Y	N	45	5	Y
5	Queen's Bridge	Roadside	334630	374385	3.0	NO_2	N	N	10	2	Y
6	North Road	Urban Background	337551	374151	3.0	NO_2	N	N	On School Wall	135	N/A
7	Donegall Square South	Roadside	333837	373950	3.0	NO_2	N	N	N	5.5	Y
9	Short Strand	Roadside	334980	374254	3.2	NO_2	N	N	21	1	Y
10	301 Ormeau Road	Roadside	334503	372176	3.0	NO_2	Y	N	1	6	Y
12	Knock Road	Roadside	338718	373918	2.5	NO_2	Y	N	17	1.5	Y
13	Great George's Street	Kerbside	333981	375102	3.0	NO_2	Y	N	25	0.5	Y
14	Lisburn Road	Roadside	332056	371364	2.7	NO_2	N	N	6.5	3	Y
15	Shaftesbury Square	Kerbside	333594	373283	2.7	NO_2	N	N	N	1	Y
16,19,20	Lombard Street	Urban Background	333898	374358	3.5	NO_2	N	Y	N	26	Y
17	Albert Clock	Roadside	334212	374489	3.1	NO_2	N	N	3.5	2.5	Y
21,22,56	Stockmans Lane	Roadside	331007	371254	3.0	NO_2	Y	Y	12	3.5	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
23,24,32	Ballyhackamore	Roadside	337911	373972	3.0	NO_2	Y	Y	36	2	Y
25	Whitewell Road	Roadside	333230	380877	2.7	NO_2	N	N	5	1	Y
26	Donegall Road	Kerbside	333022	373122	2.7	NO_2	N	N	2	1	Y
28	Falls Road and Andersonstown	Roadside	330707	372547	3.0	NO_2	N	N	15	2	Y
30	Station Road	Roadside	337160	375482	2.7	NO_2	N	N	20	2	Y
31	Malone Road	Roadside	332544	370283	3.0	NO_2	N	N	18	2	Y
33	Great Victoria Street	Roadside	333548	373772	3.2	NO_2	N	N	N	1.5	Y
34	College Square East	Roadside	333498	374241	3.0	NO_2	N	N	3	3	Y
35	Chichester Street	Roadside	334147	374123	3.5	NO_2	N	N	3	2	Y
36	Cromac & Ormeau Avenue	Kerbside	334085	373542	2.5	NO_2	Y	N	3	1	Y
37	Glenmachan Street	Roadside	332063	372871	3.0	NO_2	Y	N	3	2	Y
38	Crèche on M1/Westlink	Roadside	333069	374055	3.0	NO_2	Y	N	7	1.5	Y
39	Ormeau Road (junction with Ravenhill Road)	Roadside	334943	371342	3.0	NO_2	Y	N	3	2	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
40	Upper Newtownards Road & Holywood Road	Roadside	336519	374233	3.0	NO_2	N	N	40	3	Y
41	Crumlin Road	Roadside	333116	375292	3.5	NO_2	N	N	25	2	Y
42	228 Antrim Road	Roadside	333288	376143	2.7	NO_2	N	N	3	2	Y
44	Shore Road (Ivan Street end)	Roadside	334174	376384	3.0	NO_2	N	N	2.5	3.5	Y
59	York Street	Roadside	334214	375638	2.7	NO_2	Y	N	5	2	Y
63	Queens Square	Roadside	334192	374441	2.7	NO_2	N	N	Building Façade	5	Y
65,66,67	Westlink AQMS	Roadside	332617	373431	2.6	NO_2	Y	Y	17	5	Y
68	Opposite Westlink AQMS	Roadside	332610	373474	2.5	NO_2	Y	N	70	2	Y
69	Peter's Hill	Kerbside	333588	375224	3.5 (above the canyon)	NO_2	Y	N	48	1	Y
70	Henry Place	Kerbside	333281	374767	3.5 (above the canyon)	NO_2	Y	N	23	1	Y
74	Ardmore Park	Roadside	329336	370319	2.7	NO_2	N	N	6	1.5	Y
76	Titanic Quarter	Roadside	335073	375049	2.7	NO_2	N	N	3	1.5	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
77	Poleglass	Roadside	328214	370138	2.7	NO_2	N	N	15	1.5	Y
82	Molyneux Street	Roadside	334028	375241	2.7	NO_2	Y	N	3	11	Y
83	North Queen Street	Roadside	333857	375412	2.7	NO_2	N	N	9.5	2	Y
84	Portland Place	Roadside	333856	375163	2.7	NO_2	Y	N	5.5	4	Y
85	Sailortown	Roadside	334469	375341	2.7	NO_2	N	N	12	11	Y
86	Little Georges Street	Roadside	333877	375260	2.5	NO_2	Y	N	4	2	N
87	RVH Falls Road	Roadside	331962	373560	2.7	NO_2	N	N	6.5	3	Y
88	Dunmurry Lane	Roadside	329305	368931	2.7	NO_2	N	N	3	2	Y
89	Upper Knockbreda Rd	Kerbside	337547	372019	2.5	NO_2	N	N	18	1	Y
90	Tates Avenue	Roadside	332221	372667	2.5	NO_2	N	N	11	2	Y
91	Stockman's Crescent	Roadside	330772	371532	2.5	NO_2	Y	N	4.5	2	N
92	Andersonstown Road	Roadside	329707	371200	2.5	NO_2	N	N	10	1.5	Y
93	Diamond Gardens	Roadside	330313	370121	2.5	NO_2	N	N	3	2	Y
94	Orpen Road	Roadside	330355	369817	2.5	NO_2	N	N	6	2	Y
95	Balmoral Avenue	Roadside	331568	370818	2.7	NO_2	N	N	8	2	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
96	Upper Lisburn Road	Roadside	331400	370729	2.7	NO_2	N	N	16	3	Y
97	Monagh Bypass	Roadside	329737	372743	2.7	NO_2	N	N	10	3	Y
98	Knocknagoney	Roadside	338297	376131	2.7	NO_2	N	N	5	2	Y

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

Tables 2.3 and 2.4 summarise recent monitoring data from the council's nitrogen dioxide automatic analysers for 2020 and preceding years from 2016. In all cases, exceedances of the Air Quality Strategy Objectives are highlighted in bold. In addition, trends in annual mean monitoring data for nitrogen dioxide are summarised in Figure 4.

Annual mean concentrations at the Belfast Centre AURN site remain below the 40 µg/m^3 annual mean objective for nitrogen dioxide as denoted by the solid red line on the graph. As data capture for 2020 was only 68% at this AURN site, data was "annualised" as prescribed in Boxes 7.9 and 7.10 of LAQM.TG16 (Appendix A).

Apart from Belfast Centre (Lombard Street site) there are only two other long-term, continuous, urban background monitoring sites in Northern Ireland, which measure nitrogen dioxide, Ballymena Ballykeel and Derry Rosemount. Both sites exceeded the required 85% data capture in 2020 and as the result were identified as acceptable sites to be used in the 'annualisation process' for the Belfast Centre site.

The Belfast Ormeau Road site experienced extensive problems with air conditioning during 2012 and 2013, which prevented the monitoring equipment from working to full capacity. As this was a recurring problem, a decision was made towards the end of 2013 to upgrade the site infrastructure. Taking account of procurement requirements and liaison with NIE, this upgrade took a considerable length of time, to the point that data capture from this site was such that it was considered unreliable to report for 2013. In addition, we would express some reservations about the reliability of the 2012 monitoring data, as it does not appear to follow any established trends. Following the site upgrade however, the annual mean concentration has remained reasonably constant at 27 µg/m^3 in 2014, 27 µg/m^3 in 2015, 28 µg/m^3 in 2016, 25 µg/m^3 in 2017, 26 µg/m^3 in 2018 and 24 µg/m^3 in 2019. Although results for 2020 at this location are markedly lower compared to previous years (17 µg/m^3), they still appear to be representative, given that all sites have followed a similar trend, due to behavioural changes caused by the Covid-19 pandemic. The impact

of the various Covid-19 lockdowns upon traffic emissions and consequent monitoring results is discussed in Appendix B.

On the basis of this data, which demonstrates nitrogen dioxide concentrations significantly below the annual mean air quality objective, the council had considered the case for revoking the Ormeau Road Air Quality Management Area (AQMA) for exceedance of the nitrogen dioxide annual mean objective. The council has subsequently liaised with the Department of Agriculture, Environment and Rural Affairs regarding the potential for revocation but it has been agreed that since nitrogen dioxide annual mean monitoring data from the Ormeau Road site contributes to the derivation of the Draft Programme for Government Framework 2016 – 2021 Indicator 37: Improve air quality, the AQMA will remain in place for the next few years.

From the data in Table 2.3, it can be seen that annual mean concentrations of nitrogen dioxide along the Upper Newtownards Road have remained in the range 27 – 35 µg/m^{-3} since 2016, meaning that the nitrogen dioxide annual mean objective is now being consistently achieved along the Upper Newtownards Road. As noted above, the 2020 annual mean shows a drop to 20 µg/m^3, again due to significant reductions in traffic numbers, as a result of the Covid-19 pandemic restrictions.

However, the Knock Road non-automatic roadside diffusion tube, located at the junction of the Upper Newtownards Road, Hawthornden Way and the Knock Road has recorded exceedances of the annual mean objective in previous years up until 2017. The 2017 calendar year was the first year when the annual mean concentration at the Knock Road junction fell below the air quality objective (36 µg/m^3), which was still the case in 2020 (30.7 µg/m^3). The council will therefore continue to monitor nitrogen dioxide concentrations along the Upper Newtownards Road and at the junction with the Knock Road for a few further years in order to determine whether this improvement in ambient conditions is sustained and what implications it may have for the Air Quality Management Area.

Moreover, it should be noted that the Belfast Rapid Transit Glider commenced operation along this route from September 2018. In order to facilitate operation of the Glider, a bus lane has been established on the Upper Newtownards Road, Albertbridge Road and East Bridge Street, which operates from 07.00 to 19.00, Monday to Saturday inclusive. Glider operations together with introduction of the bus lane are likely to have had a beneficial

impact on traffic movements and pollution levels along the Upper Newtownards Road, Albertbridge Road and East Bridge Street.

Unfortunately, despite the completion of significant structural improvements to the M1 Motorway and A12 Westlink corridor, nitrogen dioxide concentrations at Stockman's Lane have remained high. However, 2020 was the first year when the annual mean (33 µg/m^3) fell below the objective level of 40 µg/m^3, again likely due to Covid-19 travel restrictions. Whilst reductions in nitrogen dioxide annual mean concentrations at the Stockman's Lane site had been following a relatively consistent declining trend over recent years (the 2019 nitrogen dioxide annual mean was 45 µg/m^{-3} which is a 8% reduction from the 2018 annual mean of 49 µg/m^{-3}), the Covid-19 pandemic has had an obvious impact on the 2020 annual mean, resulting in a 36% reduction from 2019 levels. It is unclear at this stage how long-lasting the behavioural changes associated with the Covid pandemic that have led to this reduction will persist, but it is envisaged that changing working habits and working locations may act as a catalyst to assist in the continued reduction of annual mean concentrations over the coming years.

The nitrogen dioxide 2020 annual mean concentration (24 µg/m^3) monitored at the Westlink Roden Street during 2019 has also significantly decreased in comparison to the previous year's annual mean (34 µg/m^3). The annual mean air quality objective has not been exceeded at the Westlink Roden Street since 2011. However, one roadside diffusion tube, located at Henry Place further along the Westlink corridor, recorded an exceedance of the annual mean objective in 2020 (41.1µg/m^3).Therefore, the council will continue its monitoring within the Westlink Corridor / M1 Air Quality Management Area to identify any exceedances and nitrogen dioxide concentrations and trends.

Historically, modelled and monitored exceedances of the 1-hour mean objective for nitrogen dioxide were encountered only in the vicinity of the M1 Motorway / A12 Westlink corridor. As a result, this is the only Air Quality Management Area within Belfast that has been declared on the basis of exceedances of the 1-hour objective.

From ambient monitoring data for the Stockman's Lane and Westlink/Roden Street monitoring sites, as summarised in Table 2.4, it can be seen that the number of exceedances of the hourly objective has substantially decreased over recent years, both now demonstrating compliance with the 200 µg/m^{-3} objective, not to be exceeded more

than 18 times per year - since 2013. In fact, there were no recorded 1 hour mean concentrations greater than 200 μg/m^3 at either site during 2019 or 2020. As there are residential properties located directly adjacent to the carriageway at Stockman's Lane and most of these properties have gardens facing onto the roadway, thereby providing for short-term relevant public exposure, we will continue to monitor at this location in order to identify any further exceedances and establish trends.

Table 2.3 Results of Automatic Monitoring for Nitrogen Dioxide: Annual Mean NO_2 Monitoring Results (µg/m^3) for Comparison with the Annual Mean Objective

Site ID	Site Type	Within AQMA? Which AQMA?	Valid Data Capture for period of monitoring %[a]	Valid Data Capture 2020 % [b]	Annual Mean Concentration (µg/m^3)				
					2016* [c]	2017* [c]	2018* [c]	2019* [c]	2020 [c]
Belfast Centre	Urban Background	N	68	68	29.0	25.0	27	26[c]	19[c]
Belfast Ormeau Road	Roadside	Y (CM2)	87	87	28.0	25.0	26	24	17
Belfast Ballyhackamore	Roadside	Y (CM3)	94	94	35.0	31.0	29	27	20
Belfast Stockmans Lane	Roadside	Y (CM4)	97	97	**50.0**	**52.0**	**49**	**45**	33
Belfast Westlink Roden Street	Roadside	Y (CM5)	98	98	39.0	34.0	40	34	24

In **bold**, exceedance of the NO_2 annual mean AQS objective of 40µg/m^3.

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

[c] Means should be “annualised” as per LAQM.TG16, if monitoring was not carried out for the full year.

*Annual mean concentrations for previous years are optional.

Figure 4 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Automatic Monitoring Sites

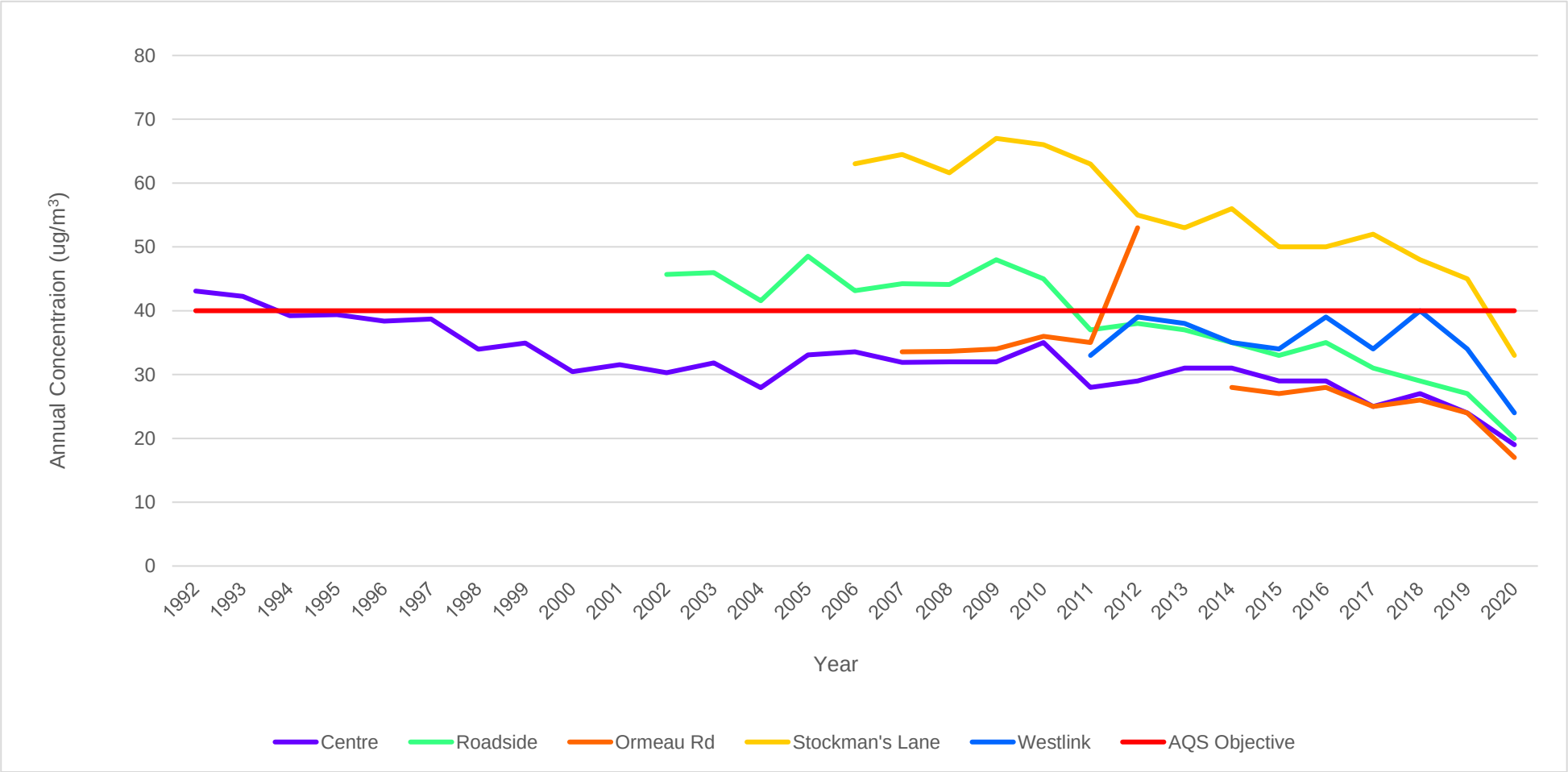


Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Number of Exceedances of 1-hour mean objective (200µg/m^3)

Site ID	Site Type	Within AQMA? Which AQMA?	Valid Data Capture for period of monitoring %[a]	Valid Data Capture 2020 % [b]	2016* [c]	2017* [c]	2018* [c]	2019* [c]	2020 [c]
Belfast Centre	Urban Background	N	68	68	1	1	0	0 (93)	0 (86)
Belfast Ormeau Road	Roadside	Y (CM2)	87	87	2	0	0	0 (86)	0
Belfast Ballyhackamore	Roadside	Y (CM3)	94	94	1	0	0	0	0
Belfast Stockmans Lane	Roadside	Y (CM4)	97	97	10	2	3	0	0
Belfast Westlink Roden Street	Roadside	Y (CM5)	98	98	1	0	0	0	0

In **bold**, exceedance of the NO_2 hourly mean AQS objective (200µg/m^3 – not to be exceeded more than 18 times per year

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

[c] If the period of valid data is less than 85%, include the 99.8th percentile of hourly means in brackets

* Number of exceedances for previous years are optional.

Diffusion Tube Monitoring Data

In order to obtain a better understanding of how levels of nitrogen dioxide are varying across the city over time and to investigate those locations where previous rounds of the review and assessment process have highlighted areas of concern, Belfast City Council has placed 67 diffusion tubes at 59 relevant locations across the city. Data from these tubes for 2020 has been summarised in Table 2.5 alongside historical data, where it is available in Table 2.6.

In terms of the outcome of the 2020 nitrogen dioxide diffusion tube monitoring, it is noted that concentrations have significantly decreased in comparison to the 2019 monitoring year results at most locations, given the changes in transport behaviour associated with the Covid-19 pandemic. It is also worth noting that the pandemic and associated lock downs have had a detrimental impact on diffusion tube data collection, resulting in a two-month exposure period of tubes during the months of April and May 2020. This is discussed further in Appendix B. It should also be noted that the 2020 bias adjustment factor (0.79) was slightly lower than the 2019 factor (0.91). Moreover, last year Belfast City Council added an additional 4 NOx tubes to the Belfast diffusion tube monitoring network.

Only one annual mean exceedance occurred during 2020 at Henry Place (41.1 µg/m^3). This tube is located within existing the M1 Motorway / A12 Westlink Air Quality Management Area and has been the subject of mitigation measures for some time. Nevertheless, Defra NO_2 distance calculations have been provided for the above location to estimate concentrations at relevant receptor locations.

The Diffusion Tube Processing Tool has predicted an annual mean concentration of 28.7µg/m^3, which indicates that no exceedance is likely at the relevant receptor location (Appendix A). However, there may be risk of exceedance at relevant receptors on the opposite side of the M1 Motorway to this location, where there is no local monitoring data available for 2020. A new diffusion tube has therefore been installed in 2021 at North Queen Park to identify if receptors in this area are exposed to exceedances.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2020

Site ID	Location	Site Type	Within AQMA? Which AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2020 (Number of Months or %) [a]	2020 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.79[b]
1	Royal Victoria Hospital	Urban Background	N	N	92%	17.6
2	Black's Road	Roadside	Y (Westlink)	N	83%	33.3
3	61 Cromac Street	Roadside	Y (Cromac Street & Albertbridge Rd)	N	92%	22.4
4	Ravenhill Road	Roadside	Y (Cromac Street & Albertbridge Rd)	N	**67%**	20.5
5	Queen's Bridge	Roadside	N	N	**42%**	20.7
6	North Road	Urban Background	N	N	**67%**	10.8
7	Donegall Square South	Roadside	N	N	92%	22.8
9	Short Strand	Roadside	N	N	92%	30.5
10	301 Ormeau Road	Roadside	Y (Ormeau Rd)	N	92%	21.6
12	Knock Road	Roadside	Y (Upper Newtownards Rd)	N	92%	24.8
13	Great George's Street	Kerbside	Y (Westlink)	N	92%	32.8
14	Lisburn Road	Roadside	N	N	75%	23.5
15	Shaftesbury Square	Kerbside	N	N	75%	25.1
16,19,20	Lombard Street	Urban Centre	N	Triplicate and Co-located	89%	19.5
17	Albert Clock	Roadside	N	N	92%	26.5
21,22,56	Stockmans Lane	Roadside	Y (Westlink)	Triplicate and Co-located	92%	29.9
23,24,32	Ballyhackamore	Roadside	Y (Upper Newtownards Rd)	Triplicate and Co-located	92%	18.9
25	Whitewell Road	Roadside	N	N	92%	16.1
26	Donegall Road	Kerbside	N	N	83%	21.9

Site ID	Location	Site Type	Within AQMA? Which AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2020 (Number of Months or %) [a]	2020 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.79[b]
28	Falls Road and Andersonstown	Roadside	N	N	92%	19.3
30	Station Road	Roadside	N	N	92%	16.6
31	Malone Road	Roadside	N	N	75%	22.8
33	Great Victoria Street	Roadside	N	N	92%	24.9
34	College Square East	Roadside	N	N	83%	22.1
35	Chichester Street	Roadside	N	N	92%	27.8
36	Cromac & Ormeau Avenue	Kerbside	Y (Ormeau Rd)	N	92%	21.4
37	Glenmachan Street	Roadside	Y (Westlink)	N	92%	27.9
38	Crèche on M1/Westlink	Roadside	Y (Westlink)	N	92%	20.8
39	Ormeau Road (junction with Ravenhill Road)	Roadside	Y (Ormeau Rd)	N	92%	26.0
40	Upper Newtownards Road & Holywood Road	Roadside	N	N	92%	18.9
41	Crumlin Road	Roadside	N	N	92%	20.6
42	228 Antrim Road	Roadside	N	N	75%	25.1
44	Shore Road (Ivan Street end)	Roadside	N	N	75%	21.3
59	York Street	Roadside	Y (Westlink)	N	75%	26.8
63	Queens Square	Kerbside	N	N	**67%**	25.3
65,66,67	Westlink AQMS	Roadside	Y (Westlink)	Triplicate and Co-located	92%	27.8

Site ID	Location	Site Type	Within AQMA? Which AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2020 (Number of Months or %) [a]	2020 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.79[b]
68	Opposite Westlink AQMS	Roadside	Y (Westlink)	N	83%	33.6
69	Peter's Hill	Kerbside	Y (Westlink)	N	92%	30.6
70	Henry Place	Kerbside	Y (Westlink)	N	92%	**41.1**
74	Ardmore Park	Roadside	N	N	92%	24.3
76	Titanic Quarter	Roadside	N	N	92%	18.1
77	Poleglass	Roadside	N	N	92%	18.3
82	Molyneux Street	Roadside	Y (Westlink)	N	92%	26.7
83	North Queen Street	Roadside	N	N	**67%**	26.5
84	Portland Place	Roadside	Y (Westlink)	N	92%	25.5
85	Sailortown	Roadside	N	N	92%	22.9
86	Little Georges Street	Roadside	Y (Westlink)	N	92%	26.4
87	RVH Falls Road	Roadside	N	N	**58%**	24.1
88	Dunmurry Lane	Roadside	N	N	92%	17.7
89	Upper Knockbreda Rd	Kerbside	N	N	92%	23.0
90	Tates Avenue	Roadside	N	N	92%	20.5
91	Stockman's Crescent	Roadside	Y (Westlink)	N	92%	17.7
92	Andersonstown Road	Roadside	N	N	83%	22.5
93	Diamond Gardens	Roadside	N	N	92%	17.8
94	Orpen Road	Roadside	N	N	83%	13.3
95	Balmoral Avenue	Roadside	N	N	83%	25.5
96	Upper Lisburn Road	Roadside	N	N	83%	20.1
97	Monagh Bypass	Roadside	N	N	92%	16.4

Site ID	Location	Site Type	Within AQMA? Which AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2020 (Number of Months or %) [a]	2020 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.79[b]
98	Knocknagoney	Roadside	N	N	92%	31.4

In **bold**, exceedance of the NO_2 annual mean AQS objective of 40µg/m^3.

Underlined, annual mean > 60µg/m^3, indicating a potential exceedance of the NO_2 hourly mean AQS objective.

[a] Means should be "annualised" as per LAQM.TG16, if full calendar year data capture is less than 75%.

[b] If an exceedance is measured at a monitoring site not representative of public exposure, NO_2 concentration at the nearest relevant exposure should be estimated based on the NO_2 fall-off with distance calculator, and results should be discussed in a specific section.

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes, adjusted for bias (µg/m^3): 2016 to 2020

Site ID	Site Type	Within AQMA? Which AQMA?	2016[a] (Bias Adjustment Factor = **0.89**)	2017 [a] (Bias Adjustment Factor = **0.78**)	2018 [a] (Bias Adjustment Factor = **0.86**)	2019 [a] (Bias Adjustment Factor = **0.91**)	2020 [a] (Bias Adjustment Factor = **0.79**)
1	Royal Victoria Hospital	N	22	18	20	21	17.6
2	Black's Road	Y (Westlink)	40	36	36	**42**	33.3
3	61 Cromac Street	Y (Cromac Street & Albertbridge Rd)	37	31	30	36	22.4
4	Ravenhill Road	Y (Cromac Street & Albertbridge Rd)	31	26	27	28	20.5
5	Queen's Bridge	N	30	25	26	27	20.7
6	North Road	N	17	14	12	14	10.8
7	Donegall Square South	N	33	29	31	32	22.8
9	Short Strand	N	**44**	39	40	40	30.5
10	301 Ormeau Road	Y (Ormeau Rd)	32	27	28	30	21.6
12	Knock Road	Y (Upper Newtownards Rd)	**41**	36	35	35	24.8
13	Great George's Street	Y (Westlink)	**50**	36	**44**	**45**	32.8
14	Lisburn Road	N	28	26	26	27	23.5
15	Shaftesbury Square	N	34	31	32	31	25.1
16,19,20	Lombard Street	N	28	25	25	26	19.5
17	Albert Clock	N	38	33	39	40	26.5
21,22,56	Stockmans Lane	Y (Westlink)	**49**	**50**	**48**	**45**	29.9
23,24,32	Ballyhackamore	Y (Upper Newtownards Rd)	36	31	24	27	18.9

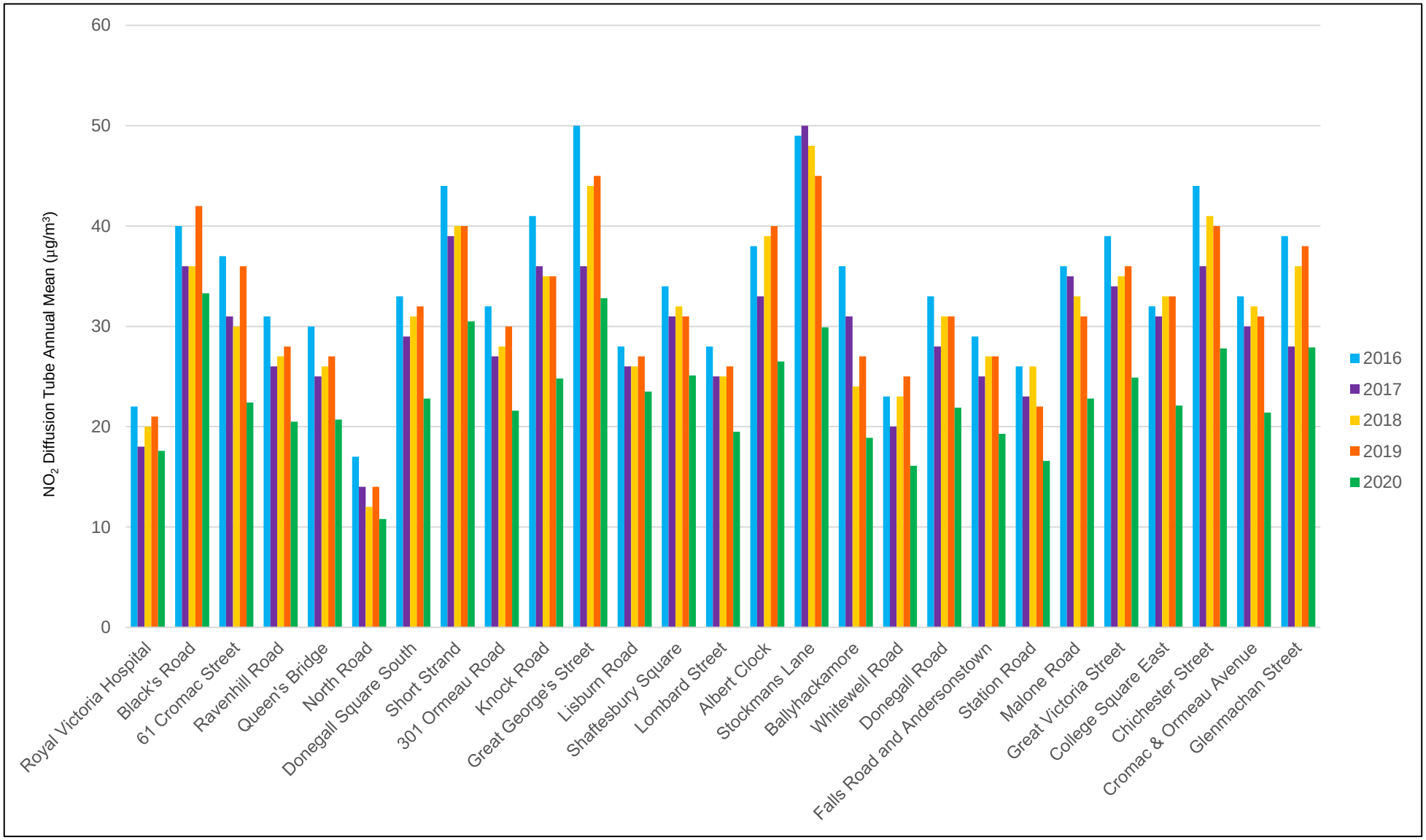
Site ID	Site Type	Within AQMA? Which AQMA?	2016[a] (Bias Adjustment Factor = **0.89**)	2017 [a] (Bias Adjustment Factor = **0.78**)	2018 [a] (Bias Adjustment Factor = **0.86**)	2019 [a] (Bias Adjustment Factor = **0.91**)	2020 [a] (Bias Adjustment Factor = **0.79**)
25	Whitewell Road	N	23	20	23	25	16.1
26	Donegall Road	N	33	28	31	31	21.9
28	Falls Road and Andersonstown	N	29	25	27	27	19.3
30	Station Road	N	26	23	26	22	16.6
31	Malone Road	N	36	35	33	31	22.8
33	Great Victoria Street	N	39	34	35	36	24.9
34	College Square East	N	32	31	33	33	22.1
35	Chichester Street	N	**44**	36	**41**	40	27.8
36	Cromac & Ormeau Avenue	Y (Ormeau Rd)	33	30	32	31	21.4
37	Glenmachan Street	Y (Westlink)	39	28	36	38	27.9
38	Crèche on M1/Westlink	Y (Westlink)	34	24	27	28	20.8
39	Ormeau Road (junction with Ravenhill Road)	Y (Ormeau Rd)	32	29	31	36	26.0
40	Upper Newtownards Road & Holywood Road	N	27	25	26	27	18.9
41	Crumlin Road	N	32	26	28	27	20.6
42	228 Antrim Road	N	36	29	33	31	25.1
44	Shore Road (Ivan Street end)	N	30	28	28	30	21.3
59	York Street	Y (Westlink)	**41**	32	38	36	26.8
63	Queens Square	N	36	32	35	34	25.3
65,66,67	Westlink AQMS	Y (Westlink)	N/A	N/A	N/A	34	27.8
68	Opposite Westlink AQMS	Y (Westlink)	N/A	N/A	N/A	**45**	33.6

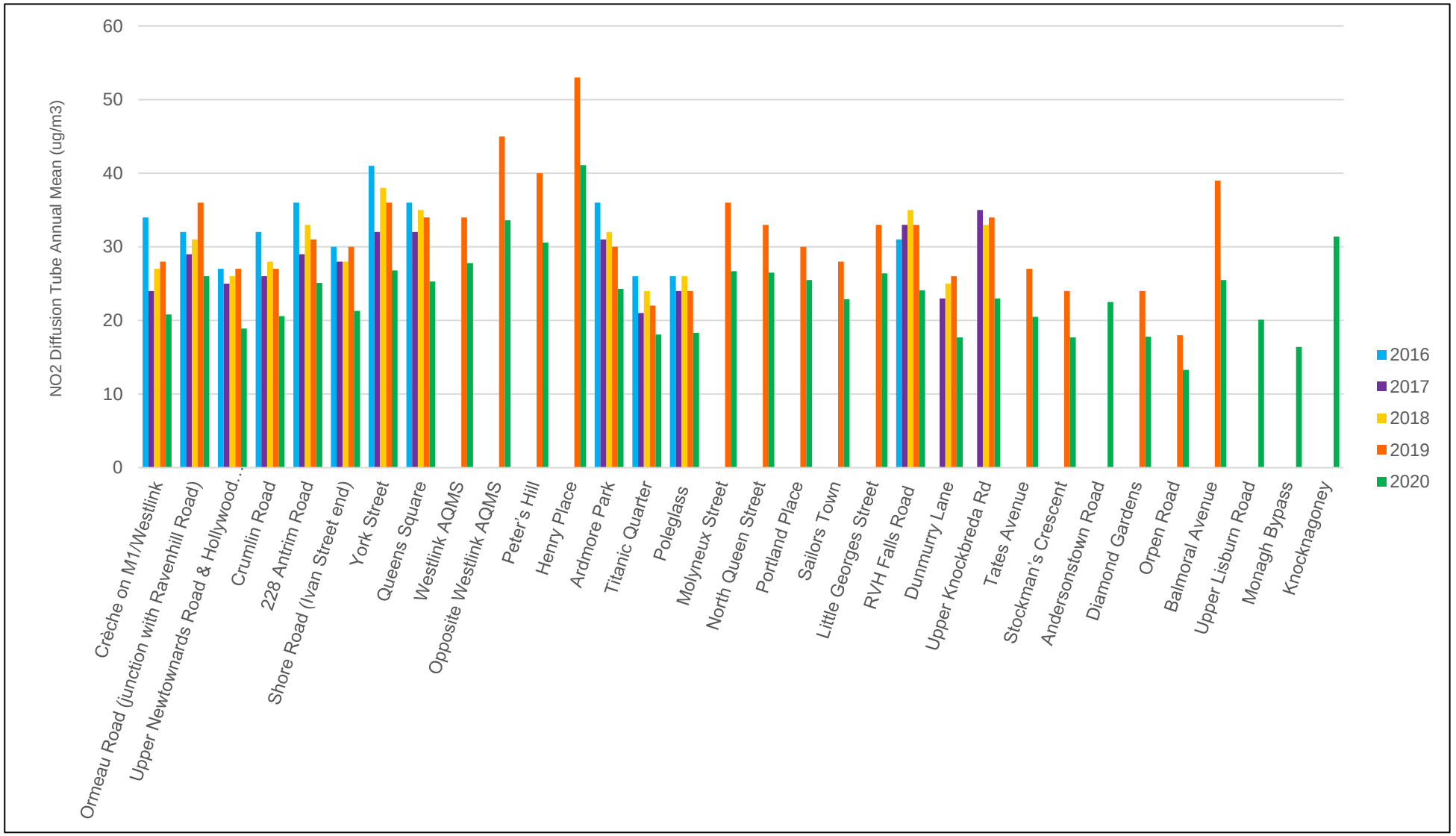
Site ID	Site Type	Within AQMA? Which AQMA?	2016[a] (Bias Adjustment Factor = **0.89**)	2017 [a] (Bias Adjustment Factor = **0.78**)	2018 [a] (Bias Adjustment Factor = **0.86**)	2019 [a] (Bias Adjustment Factor = **0.91**)	2020 [a] (Bias Adjustment Factor = **0.79**)
69	Peter's Hill	Y (Westlink)	N/A	N/A	N/A	40	30.6
70	Henry Place	Y (Westlink)	N/A	N/A	N/A	**53**	**41.1**
74	Ardmore Park	N	36	31	32	30	24.3
76	Titanic Quarter	N	26	21	24	22	18.1
77	Poleglass	N	26	24	26	24	18.3
82	Molyneux Street	Y (Westlink)	N/A	N/A	N/A	36	26.7
83	North Queen Street	N	N/A	N/A	N/A	33	26.5
84	Portland Place	Y (Westlink)	N/A	N/A	N/A	30	25.5
85	Sailortown	N	N/A	N/A	N/A	28	22.9
86	Little Georges Street	Y (Westlink)	N/A	N/A	N/A	33	26.4
87	RVH Falls Road	N	31	33	35	33	24.1
88	Dunmurry Lane	N	N/A	23	25	26	17.7
89	Upper Knockbreda Rd	N	N/A	35	33	34	23.0
90	Tates Avenue	N	N/A	N/A	N/A	27	20.5
91	Stockman's Crescent	Y (Westlink)	N/A	N/A	N/A	24	17.7
92	Andersonstown Road	N	N/A	N/A	N/A	N/A	22.5
93	Diamond Gardens	N	N/A	N/A	N/A	24	17.8
94	Orpen Road	N	N/A	N/A	N/A	18	13.3
95	Balmoral Avenue	N	N/A	N/A	N/A	39	25.5
96	Upper Lisburn Road	N	N/A	N/A	N/A	N/A	20.1
97	Monagh Bypass	N	N/A	N/A	N/A	N/A	16.4
98	Knocknagoney	N	N/A	N/A	N/A	N/A	31.4

In **bold**, exceedance of the NO_2 annual mean AQS objective of 40µg/m^3.

Underlined, annual mean > 60µg/m^3, indicating a potential exceedance of the NO_2 hourly mean AQS objective.

[a] Means should be "annualised" as per LAQM.TG16, if full calendar year data capture is less than 75%.


60
50
40
30
20
10
0
NO2 Diffusion Tube Annual Mean (µg/m3)
2016
2017
2018
2019
2020
Royal Victoria Hospital
Black's Road
61 Cromac Street
Ravenhill Road
Queen's Bridge
North Road
Donegall Square South
Short Strand
301 Ormeau Road
Knock Road
Great George's Street
Lisburn Road
Shaftesbury Square
Lombard Street
Albert Clock
Stockmans Lane
Ballyhackamore
Whitewell Road
Donegall Road
Falls Road and Andersonstown
Station Road
Malone Road
Great Victoria Street
College Square East
Chichester Street
Cromac & Ormeau Avenue
Glenmachan Street


NO2 Diffusion Tube Annual Mean (ug/m3)
60
50
40
30
20
10
0
2016
2017
2018
2019
2020
Crèche on M1/Westlink
Ormeau Road (junction with Ravenhill Road)
Upper Newtownards Road & Hollywood...
Crumlin Road
228 Antrim Road
Shore Road (Ivan Street end)
York Street
Queens Square
Westlink AQMS
Opposite Westlink AQMS
Peter's Hill
Henry Place
Ardmore Park
Titanic Quarter
Poleglass
Molyneux Street
North Queen Street
Portland Place
Sailors Town
Little Georges Street
RVH Falls Road
Dunmurry Lane
Upper Knockbreda Rd
Tates Avenue
Stockman's Crescent
Andersonstown Road
Diamond Gardens
Orpen Road
Balmoral Avenue
Upper Lisburn Road
Monagh Bypass
Knocknagoney

2.2.2 Particulate Matter (PM_{10})

As a result of a historic reliance upon solid fuel for domestic heating, Belfast used to experience frequent exceedances of the 24-hour and annual mean objectives for particulate matter (PM_{10}) across the city. However, with completion of the city's smoke control programme and the widespread availability of natural gas to all sectors, emissions of particulate matter have decreased significantly since around 2000. As a result, the council was able to decommission its Belfast Clara Street particulate matter monitoring site in east Belfast in 2007.

However, as domestic and industrial emissions were addressed, so emissions of particulate matter from road transport along the M1 Motorway and A12 Westlink corridor gained in prominence. Upon completion of the council's first review and assessment of air quality in 2004, it was concluded that the M1 Motorway and A12 Westlink corridor should be declared as an Air Quality Management Area on the basis of modelled and monitored exceedances of the 24-hour and annual mean objectives for particulate matter.

As embodied in the subsequent 2006 Air Quality Action Plan for Belfast, a range of structural improvements, designed to relieve traffic congestion, were completed for the M1 Motorway and A12 Westlink. As a result, monitored levels of particulate matter began to decline within this Air Quality Management Area. Monitoring data for this site is summarised and reviewed in Tables 2.7, 2.8 and in Figure 6.

In terms of exceedances of the 40 μgm^{-3} particulate matter annual mean objective, there have been no exceedances of the annual mean objective within this AQMA since 2008. Monitoring data from the Belfast Westlink site at Roden Street, which was established in 2010 and is located within the M1 Motorway / A12 Westlink Air Quality Management Area, indicated no exceedances of particulate matter objectives up until 2014 whereupon PM_{10} monitoring was discontinued at this site. Particulate matter monitoring continues however at the Stockman's Lane site.

Reflecting upon the particulate matter 24-hour mean objective data, as summarised in Table 2.8, the data has remained comfortably below the objective at all sites during recent years.

On the basis of historical monitoring data, which demonstrated sustained improvements in particulate matter, the council revoked the M1 Motorway / A12 Westlink Air Quality Management Area for exceedances of the particulate matter annual and 24-hour mean objectives in September 2015.

2020 results, with an annual mean of 17µgm^{-3} recorded at the Stockman's Lane site are similar to 2019 results (18µgm^{-3}), even with Covid-19 restrictions. It is considered however that data for more monitoring locations across the city would be needed to accurately investigate the impact of the Covid-19 lockdowns on particulate matter concentrations; the consistency in annual means recorded at the Stockman's Lane could be due to increased levels of 'working from home' during the pandemic, which may have resulted in increased domestic combustion processes, replacing commercial combustion particulate matter emissions, which are likely to have been reduced due to Covid-19 restrictions. Nevertheless, data from the past several years indicates a continuing downward trend in PM_{10} concentrations within the M1 Motorway / A12 Westlink Air Quality Management Area.

Table 2.7 Annual Mean PM_{10} Monitoring Results (µg/m^3) for Comparison with the Annual Mean Objective

Site ID	Site Type	Within AQMA? Which AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2020 %[b]	Confirm Gravimetric Equivalent (Y or N/A)	2016* [c]	2017* [c]	2018* [c]	2019* [c]	2020 [c]
CM1 Belfast Centre Lombard Street	Urban Background	N	100	100	Y	16	12	16	15	12
CM4 Belfast Stockmans Lane	Roadside	Y (Westlink)	98	98	Y	22	21	15	18	17

In **bold,** exceedance of the PM_{10} annual mean AQS objective of 40µg/m^3.

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

[c] Means should be “annualised” as per LAQM.TG16 if monitoring was not carried out for the full year.

* Optional.

Table 2.8 Results of Automatic Monitoring for PM_{10}: Number of Exceedances of 24-hour mean Objective (50µg/m^3)

Site ID	Site Type	Within AQMA? Which AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2020 %[b]	Confirm Gravimetric Equivalent	2016* [c]	2017* [c]	2018* [c]	2019* [c]	2020 [c]
CM1 Belfast Centre Lombard Street	Urban Background	N	100	100	Y	7	1(22)	0	2	1
CM4 Belfast Stockmans Lane	Roadside	Y (Westlink)	98	98	Y	3	2	0	4	1

In **bold**, exceedance of the PM_{10} daily mean AQS objective (50µg/m^3 – not to be exceeded more than 35 times per year).

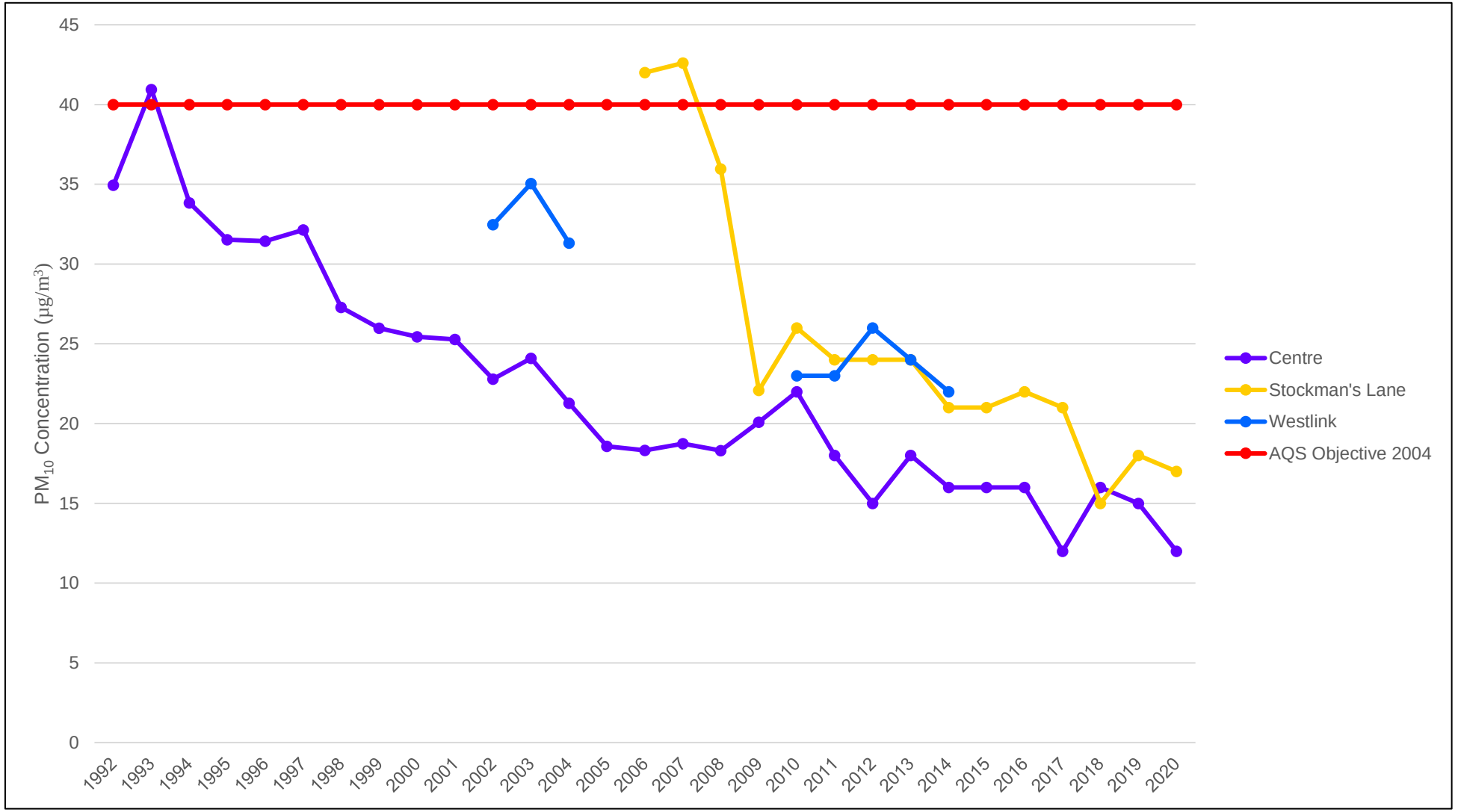
[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

[c] if data capture is less than 85%, include the 90.4th percentile of 24-hour means in brackets.

* Optional.

Figure 6 Trends in Annual Mean PM_{10} Concentrations



2.2.3 Sulphur Dioxide

As a result of a historic reliance upon solid fuel for domestic heating, Belfast City used to experience frequent and widespread exceedances of the 15-minute, 1-hour and 24-hour mean objectives for sulphur dioxide. However, with completion of the city's smoke control programme and the widespread availability of natural gas to all sectors, levels of sulphur dioxide have decreased dramatically since 2000. There have been no exceedances of any sulphur dioxide objective in the city since 2002. Sustained low levels of sulphur dioxide have meant that the council has been able to terminate ambient monitoring at all locations with the exception of the Belfast Centre AURN site at Lombard Street. No Air Quality Management Areas have been declared for sulphur dioxide across Belfast.

Recent sulphur dioxide monitoring data from the Belfast Centre site is summarised in Table 2.9. As indicated, no exceedance of any objective was observed during 2020.

Table 2.9 Results of Automatic Monitoring of SO_2: Number of Exceedances of Objectives (percentile in bracket)

Site ID	Site Type	Within AQMA? Which AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2020 %[b]	15-minute Means > 266µg/m^3	1-hour Means > 350µg/m^3	24-hour Means > 125µg/m^3
Belfast Centre Lombard Street	Urban Background	N	87	87	0	0	0

In **bold**, exceedance of the relevant AQS objective (15-min mean = 35 allowed/year; 1-hour mean = 24 allowed/year; 24-hour mean = 3 allowed/year).

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%).

[c] if data capture is less than 85%, include the relevant percentile in brackets (in µg/m^3): 15-min mean = 99.9th; 1-hour mean = 99.7th ; 24-hour mean = 99.2th percentile.

2.2.4 Benzene

Benzene concentrations have been monitored at the Belfast Centre and Belfast Roadside sites since 2002. The Belfast Centre site monitors benzene exposure for the City Centre whilst the Belfast Roadside site monitored benzene concentrations at a roadside location on the Upper Newtownards Road. Whilst monitoring concluded at the Belfast Roadside site in October 2007, no exceedances of the 2010 Air Quality Strategy objective (3.25 µg/m^3 annual mean) or the 2010 EU Limit Value (5 µg/m^3 annual mean) for benzene have been recorded in Belfast since 2002.

Previous rounds of R&A and monitoring results going back to 2016, provided in Table 2.10 below, confirm that there have been no exceedances of the running annual mean of 3.25 µg m^{-3} for benzene within Belfast. Therefore, a Detailed Assessment is not considered necessary.

Table 2.10 Results of monitoring for benzene: Annual mean concentrations for the Belfast Centre site

Site ID	Site type	Within AQMA? Which AQMA?	Valid Data Capture 2020%	Running annual mean concentrations (µg/m^3)				
				2016	2017	2018	2019	2020
Belfast Centre	Urban Background	N	100	0.49	0.46	0.45	0.44	0.37

2.2.5 Other pollutants monitored

Fine particulate matter ($PM_{2.5}$)

Fine particulate matter ($PM_{2.5}$) concentrations have been monitored at the Belfast Centre AURN site since 2008. Although it is not a statutory requirement for NI local authorities to report on $PM_{2.5}$ levels, as this pollutant is not covered by the LAQM regulations, Belfast City Council has included $PM_{2.5}$ results for 2020 in this progress report - Table 2.11 and Figure 7 below.

The annual mean for this pollutant in 2020 was 7µg/m^3, which is below the UK air quality target of 25 µg/m^3. Moreover, $PM_{2.5}$ concentrations recorded at the Belfast Centre site are also below the EU (stage 2) limit value of 20µg/m^3 to be achieved by 2020.

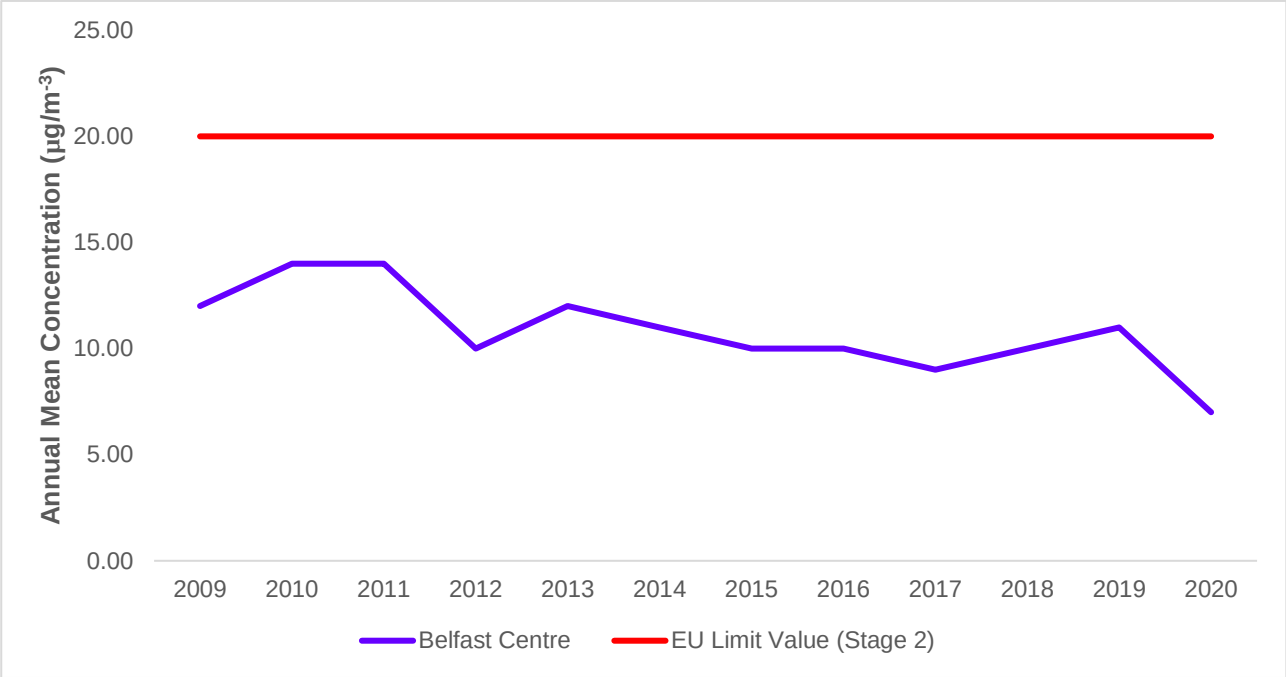
Although Belfast city does not experience exceedances of any air quality strategy objectives, or European Commission limit values, for particulate matter, we are aware of growing concerns around the effects of $PM_{2.5}$ on human health. Therefore, although not included in Regulations at present for Northern Ireland councils, Belfast City Council has proactively opted to monitor and assess ambient $PM_{2.5}$ concentrations within Belfast.

Moreover, Belfast City Council and DAERA have decided to undertake a detailed assessment for the city, for $PM_{2.5}$ and NO_2 pollutants. This project commenced in February 2021 and will report by early 2023.

Table 2.11 Results of Monitoring $PM_{2.5}$: Annual Mean Levels for the Belfast Centre Lombard Street 2016-2020.

Site ID	Site type	Within AQMA? Which AQMA?	Valid Data Capture 2020%	Annual mean concentrations (µg/m^3)				
				2016	2017	2018	2019	2020
Belfast Centre	Urban Background	N	100	10.0	9.0	10.0	11.0	7.0

Figure 7 Trends in Annual Mean $PM_{2.5}$ Concentrations at Belfast Centre Monitoring Site.



2.2.6 Summary of Compliance with AQS Objectives

Belfast City Council has examined the results from monitoring within its district for 2020. As concentrations outside of the AQMAs are all below the objectives at relevant locations, there is no need to proceed to a Detailed Assessment.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

It should be noted that within Northern Ireland, the Department for Infrastructure Roads has responsibility for transport planning and maintenance of the road network. Accordingly, DfI Roads maintains and improves the road network and infrastructure in order to keep it safe, effective and reliable. In the earlier rounds of the review and assessment process, the council obtained a copy of the Belfast road transportation model which comprised traffic data for around 5,600 road nodes across the city. In addition, the council bolstered this data through supplementary traffic counts in congested streets and we have undertaken monitoring at these locations through the use of diffusion tubes and automatic analysers. For this reason, we believe that we have a good understanding of traffic and development control patterns across the city and, on this basis, we believe that there are no newly identified congested streets with a vehicle flow above 5,000 vehicles per day and with residential properties close to the kerb that have not been adequately considered, either in previous rounds of the review and assessment process or by monitoring.

Belfast City Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1 hour or More Close to Traffic

Belfast City Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

In earlier rounds of the review and assessment process, Belfast City Council conducted screening assessments of the Belfast road network in order to identify locations with a high incidence of buses and / or heavy goods vehicles. In accordance with government's technical guidance LAQM.TG(16), an unusually high proportion can be taken to be greater

than 20% of heavy-duty vehicles. The only part of the road network within Belfast that historically approached this criterion was the M1 Motorway / A12 Westlink corridor with approximately 15% of heavy-duty vehicles. On this basis, a detailed review and assessment was completed, and this corridor was designated as an Air Quality Management Area for both short and longer-term exceedances of the nitrogen dioxide and particulate matter objectives. This Air Quality Management Area has been the subject of mitigation measures as part of the council's various Air Quality Action Plans for Belfast.

On the basis of monitoring data, which demonstrated sustained improvements in particulate matter concentrations, the council revoked the M1 Motorway / A12 Westlink Air Quality Management Area for exceedances of the particulate matter annual and 24-hour mean objectives in September 2015. The declarations for nitrogen dioxide remain.

Since the 2019 Progress Report, Belfast City Council confirms that there have been no newly identified roads that meet the above-mentioned criterion for high flows of buses and / or HGVs.

3.4 Junctions

Belfast City Council confirms that there are no new/newly identified busy junctions / busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

Belfast City Council confirms that there are no new / proposed roads that meet the criteria for review and assessment at this time.

3.6 Roads with Significantly Changed Traffic Flows

Belfast City Council confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

Belfast City Council confirms that there are no new relevant bus stations in the Local Authority area. It should be noted however that the Department for Infrastructure and Translink are presently in the process of constructing a new Belfast Transport Hub at

Great Victroia Street. Known as Weavers Cross, the new transport hub will provide a new integrated public transport interchange for Belfast comprising a new station concourse, 26 bus stands, 8 railway platforms, bus maintenance and parking, a bus access bridge, cycle and taxi provision, car parking, a new public square, public realm improvements, highway improvements and infrastructure improvements. The main works and infrastructure enhancement phases of the project are due to start in 2022 and are to be completed by 2025.

4 Other Transport Sources

4.1 Airports

Belfast City Council has previously considered the air quality impact of the George Best Belfast City Airport and, on the basis of ambient monitoring data for nitrogen dioxide, concluded that an Air Quality Management Area did not need to be declared for the airport. In order to provide ongoing surety regarding the air quality impact of the airport, we have maintained a nitrogen dioxide diffusion tube at Station Road in east Belfast adjacent to the nearest residential receptors to the airport. It should be noted that the Station Road diffusion tube is located so as to take account also of the impact of nearby road traffic on the Sydenham Bypass and of the Belfast to Bangor rail line.

Annual mean concentrations of nitrogen dioxide at Station Road have remained consistently around 22-26 $\mu g/m^3$ since 2007; comfortably below the annual mean objective of 40 $\mu g/m^3$. We are therefore content that any changes to airport operations over recent years have had little impact upon ambient air quality at the nearest relevant receptors. Therefore, it is considered that a further Detailed Assessment for this existing airport is not required at this juncture.

Furthermore, as part of the council's ongoing Detailed Assessment project for fine particulate matter and nitrogen dioxide, a new monitoring location is proposed directly adjacent to the George Best Belfast City Airport, along the Sydenham By-Pass. This will provide a more detailed analysis of emissions for the area in the coming years.

Belfast City Council confirms that there are no new airports in the Local Authority area.

4.2 Railways (Diesel and Stream Trains)

4.2.1 Stationary Trains

Belfast City Council confirms that there are no new locations, where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with the potential for relevant exposure within 15m.

4.2.2 Moving Trains

Belfast City Council confirms that there are no new locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports

Referring to the government's technical guidance regarding the treatment of ports and shipping, the screening assessment approach is to collect information regarding the number of ship movements per year, where such movements are confined to large ships, including cross-channel ferries, roll-on and roll-off vessels, container ships and cruise liners and movements' number between 5,000 and 15,000 per annum. This movement data is contrasted subsequently with the potential for relevant exposure within 250 metres of the shipping berths. We have obtained activity data from the Port of Belfast which has confirmed that the number of ship movements during 2020 was around 12,300. However, an analysis of the geographic location of the Port confirms that there is little potential for relevant public exposure within 250 metres for 15-minute periods. The majority of ferry terminals are now located within the Port confines at Westbank Road off Dargan Road. This area is predominantly used for industrial and commercial activities and there is no relevant exposure within 250m of the berths.

Belfast City Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

5.1 Industrial Installations

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been carried out

In Northern Ireland, the permitting of prescribed industrial activities under the Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 is undertaken by both local authorities and the Industrial Pollution and Radiochemical Inspectorate (IPRI) of the Department of Agriculture, Environment and Rural Affairs. IPRI has responsibility for the permitting of what are defined as Part A and B processes whereas district councils permit Part C processes. Part A processes have the greatest capacity to pollute and as a result can impact detrimentally upon air, land and water. For this reason, they require an integrated approach to controlling whereas Part B and Part C processes are regulated for emissions to air only.

In order to complete this 2020 Update and Screening Assessment, Belfast City Council liaised with the IPRI regarding Part A and B processes. The public register of Northern Ireland Part A and B processes is accessible on the DAERA / NIEA website via the following web link: https://appsd.daera-ni.gov.uk/ipri/

Belfast City Council confirms that since the last Updating and Screening Assessment in 2017, the following new or proposed industrial installations, situated within its area or nearby in a neighbouring authority, have been granted planning approval. These installations have been subject to air quality impact assessments.

- Energy Centre, Royal Victoria Hospital, Grosvenor Road, Belfast, – planning permission granted in 2019
- Combined Heat and Power Installation, 7 Airport Road, Belfast, approved through the planning process in 2016; additional information was submitted and reviewed as part of the application in 2018 and 2019; planning permission was granted in 2019

Air quality assessments in support of the above installations demonstrated that the proposal developments would not have an adverse impact on local air quality or on

relevant receptors. Accordingly, there was no need to proceed to a Detailed Assessment for any of these installations.

In addition, IPRI has confirmed that there have been no significant increases in the emission profiles of any existing permitted industrial processes.

In relation to Part C processes, the council's Industrial Pollution Control Officer has also confirmed that there are no new or proposed Part C industrial installations for which planning approval has been granted within the Belfast City Council area. Neither have there been significant increases in the emission profiles of existing Part C industrial processes or the introduction of new relevant exposure.

Belfast City Council has assessed new/proposed industrial installations and concluded that there is no need to proceed to a Detailed Assessment

5.1.2 Existing Installations where Emissions have Increased Substantially, or New Relevant Exposure has been Introduced

Belfast City Council confirms that there are no existing industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

Belfast City Council confirms that there are no new or significantly changed industrial installations with no previous air quality impact assessment.

5.2 Major Fuel Depots

There is a major fuel storage depot within the Port area of Belfast, but its impact has been considered in previous updating and screening and review and assessment reports.

5.3 Petrol Stations

Belfast City Council confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

Belfast City Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

Belfast City Council confirms that since the last Updating and Screening Assessment in 2017, there have been only two individual biomass installations located at Cambria Street and Duncrue Pass, within the council's area, for which a screening assessment has been carried out in accordance to the government's *Local Air Quality Management Technical Guidance document LAQM.TG(16)* and supporting assessment tool: *Biomass Emissions Screening Tool*.

Both assessments have demonstrated that the proposed installations will not have adverse impact on air quality in the vicinity of their sites. Planning permission was subsequently granted.

Belfast City Council has assessed all biomass combustion plants and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

Belfast City Council confirms that there is no relevant biomass combustion plant within the Local Authority area.

6.3 Domestic Solid Fuel Burning

Belfast City Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

Belfast City Council confirms that there are no new potential sources of fugitive particulate matter emissions within the Local Authority area.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Belfast City Council has presented a range of monitoring data within this Updating and Screening Assessment Report that addresses a number of the pollutants prescribed within the UK Air Quality Strategy. Although these pollutants are routinely measured across the city, the council's focus remains principally upon addressing the existing Air Quality Management Areas and those areas of the city centre where traffic congestion might lead to further exceedances of the nitrogen dioxide annual mean and hourly objectives. There were no monitored exceedances for any of the Air Quality Strategy objectives for sulphur dioxide, benzene and particulate matter during 2020.

Nevertheless, 2020 monitoring data for nitrogen dioxide confirms continuing exceedances of the annual mean for nitrogen dioxide within the M1 Motorway / A12 Westlink Air Quality Management Area at Henry Place. Defra NO_2 distance calculations have been provided for the above location to calculate expected concentrations at a relevant receptor location. The Diffusion Tube Processing Tool has predicted an annual mean concentration of 28.7µg/m^3, which indicates that no exceedance is likely at the relevant receptor location (Appendix A). However, there may be risk of exceedance at relevant receptors on the opposite side of the M1 Motorway to this location, where there is no local monitoring data available for 2020. A new diffusion tube has therefore been placed at North Queen Park to identify if receptors are exposed to exceedances in this area.

There were no other monitored exceedances of the Air Quality Strategy objectives for nitrogen dioxide within the council area during 2020. In fact, 2020 is the first year when the annual mean was below the objective level at the Stockman's Lane AQMS. Whilst the reduction in annual mean concentration has followed the declining trend, as in previous years, (the 2019 nitrogen dioxide annual mean was 45 µg/m^{-3} which is a 8% reduction from the 2018 annual mean of 49 µg/m^{-3}), the Covid-19 pandemic has had an obvious impact on the 2020 annual mean, with a 36% reduction from 2019 levels.

Historically, modelled and monitored exceedances of the 1-hour mean objective for nitrogen dioxide were encountered only in the vicinity of the M1 Motorway / A12 Westlink corridor. As a result, this is the only Air Quality Management Area within Belfast that has been declared on the basis of exceedances of the 1-hour objective.

From ambient monitoring data for the Stockman's Lane and Westlink/Roden Street sites, as summarised in Table 2.4, it can be seen that the number of exceedances of the hourly objective has substantially decreased over recent years, demonstrating compliance with the 200 µg/m^{-3} objective, not to be exceeded more than 18 times per year - since 2013. In fact, there were no exceedances of the 1-hour mean of 200 µg/m^3 at either site during 2019 or 2020.

The nitrogen dioxide annual mean concentration at the Ormeau Road AQMS has been reasonably constant over the past few years (27 µg/m^3 in 2014, 27 µg/m^3 in 2015, 28 µg/m^3 in 2016, 25 µg/m^3 in 2017, 26 µg/m^3 in 2018 and 24µg/m^3 in 2019). Although results for 2020 at this location are markedly lower when compared to previous years (17 µg/m^3), they still appear to be representative, given that all sites have followed the same trend, due to behavioural changes caused by the Covid-19 pandemic.

On the basis of this data, which demonstrates that nitrogen dioxide concentrations are significantly below the annual mean air quality objective, the council has previously considered the case for revoking the Ormeau Road Air Quality Management Area (AQMA) for exceedances of the nitrogen dioxide annual mean objective. During 2019, the council liaised with the Department of Agriculture, Environment and Rural Affairs regarding a potential revocation but it has subsequently been decided that since monitoring data from the Ormeau Road site forms part of the calculation of the Draft Programme for Government Framework 2016 – 2021 Indicator 37: Improve air quality, this AQMA and associated monitoring will remain in place over the next few years.

The magnitude of the decrease in nitrogen dioxide levels along the Upper Newtownards Road has been beyond the year-on-year reductions that might have been reasonably predicted using Defra's forward projection factors; even before Covid-19. From the data in Table 2.3, it can be seen that annual mean concentrations of nitrogen dioxide along the Upper Newtownards Road have remained in the range 27 – 35 µg/m^{-3} since 2016, meaning that the nitrogen dioxide annual mean objective is now being consistently achieved along the Upper Newtownards Road. As noted above, the 2020 annual mean revealed a drop to 20 µg/m^3, again due to significant reductions in traffic numbers, as a result of the Covid-19 pandemic restrictions.

However, the Knock Road non-automatic roadside diffusion tube, located at the junction of the Upper Newtownards Road, Hawthornden Way and the Knock Road has recorded exceedances of the annual mean objective in previous years up until 2017. The 2017 calendar year was the first year when the annual mean concentration at the Knock Road junction fell below the air quality objective (36µg/m^3), which is still the case in 2020 (30.7 µg/m^3). The council will therefore continue to monitor nitrogen dioxide concentrations along the Upper Newtownards Road and at the junction with the Knock Road in order to determine whether this improvement in ambient conditions is sustained and what implications it may have for this Air Quality Management Area. We will liaise with DAERA concerning revocation of this AQMA.

In conclusion, Belfast City Council will continue to monitor ambient nitrogen dioxide levels at all current monitoring locations in order to ensure that recent downward trends are maintained. We are however aware that the 2020 pollution year's levels were very much impacted by Covid-19 restrictions. The above-mentioned decreases in nitrogen dioxide annual mean concentrations are much greater than previously predicted and so we will keep these results under review and follow Defra's advice when undertaking any future year projections for air pollution levels in Belfast that incorporate this data.

Finally, Belfast City Council confirms that no new Air Quality Management Areas need to be declared for the city at this time. There have been no monitored exceedances of Air Quality Strategy Objectives for any pollutant other than nitrogen dioxide over recent years across the city, and no significant new sources of air pollution have been identified, which would have the potential to alter this position.

Nevertheless, the council is aware of the recent evidence from national studies showing that domestic solid fuel burning contributes more than previously thought to particulate emissions. The contribution of solid fuel combustion to for fine particulate matter ($PM_{2.5}$) concentrations has also been recognised within the UK Clean Air Strategy 2019.

Moreover, the National Atmospheric Emission Inventory, 'Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland 1990-2017' publication highlights that for Northern Ireland in 2017, residential, commercial and public sector combustion accounted for 52% of overall $PM_{2.5}$ emissions, and that this sector was dominated (82%) by emissions from residential combustion.

Belfast City Council and the Department for Environment, Agriculture and Rural Affairs (DAERA) have therefore decided to undertake a detailed assessment for the city, for fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) pollutants. This project commenced in February 2021 and will report by early 2023.

8.2 Conclusions from Assessment of Sources

The assessment of new or altered sources of air pollution for 2020 has led the council to conclude that there are no new roads or road junctions within the city that require a detailed assessment. In addition, there are no new roads that have a significant proportion of heavy-duty vehicles or significantly changed traffic flows. No new bus stations have been constructed in the city at this time and it is the council's view that the air quality impact of the George Best Belfast City Airport is well understood at relevant receptor locations through ambient monitoring data. There are no new locations in the city where stationary or moving trains are likely to detrimentally impact upon relevant receptors and the location of Port of Belfast means also that shipping is unlikely to impact detrimentally upon relevant receptors.

There were only two industrial installations (Part A) in Belfast City Council area and in a neighbouring authority, for which air quality assessments have been carried out; planning permission was subsequently granted for both. The air quality assessments in support of these installations have demonstrated that the installations will not have an adverse impact on local air quality or relevant receptors. Accordingly, there was no need to proceed to a Detailed Assessment.

No new major fuel storage depots have been established within Belfast since the last round of review and assessment and none of the new petrol stations that have since opened, required a detailed assessment due to a lack of relevant public exposure and the presence of emissions abatement equipment.

There are no poultry farms within the city and the council is aware of only two biomass combustion plants, which were granted planning permission, but did not require a Detailed Assessment. In addition, the council is not aware of any significant new areas of domestic solid fuel use.

Finally, the council is not aware of any new sources of significant fugitive particulate matter emission within the city confines.

8.3 Proposed Actions

In conclusion, the 2021 Updating and Screening Assessment has not identified the need to proceed to a Detailed Assessment for any pollutant under consideration.

The council is however aware of recent evidence from national studies showing that domestic solid fuel burning contributes more than previously thought to particulate emissions. Belfast City Council has therefore decided to undertake a detailed assessment for the city, for fine particulate matter $PM_{2.5}$ and nitrogen dioxide pollutants. This project commenced in February this year.

Furthermore, Belfast City Council has already highlighted that it operates an expansive air quality monitoring network across the city, predominantly for nitrogen dioxide. On this basis, the council is content that existing monitoring locations provide a detailed representation of pollution levels for the city and, as a consequence, do not need to be expanded at this time. Moreover, as part of the council's ongoing Detailed Assessment project for fine particulate matter and nitrogen dioxide, five new monitoring locations, employing small sensor air quality monitoring equipment, are proposed that will provide a more detailed analysis of particulate matter and nitrogen dioxide concentrations over the coming years.

To ensure that we continue to collect high quality data, Belfast City Council has replaced its ageing API NOx analysers at three monitoring sites; the Upper Newtownards Road, Stockman's Lane and Ormeau Road. The non-heated Met One Instruments BAM 1020 PM_{10} particulate matter analyser, located at the Stockman's Lane site, has also been upgraded to a new heated inlet instrument. The only analyser, which has not been replaced since the 2020 Progress Report, is the API Model 200E NOx analyser, located at Westlink/Roden street site, which still continues to perform satisfactorily and remains supported by the manufacturer.

With regard to our four Air Quality Management Areas, a review of the monitoring data within the AQMAs and for the city generally indicates that there have been some recent

improvements in annual mean nitrogen dioxide levels across the city. As a result, Belfast City Council will reconsider options for revocation of the Upper Newtownards Road AQMA and liaise with DAERA concerning the continuing need for the Ormeau Road AQMA, where monitoring data demonstrates sustained improvements in annual mean nitrogen dioxide concentrations, with levels now significantly below the Air Quality Objective. Accordingly, the council will liaise with the Department of Agriculture, Environment and Rural Affairs, Department for Infrastructure and other relevant authority partners regarding these potential revocations.

In conclusion, Belfast City Council will continue to monitor ambient nitrogen dioxide levels at all current monitoring locations in order to ensure that recent downward trends are maintained. We are however aware that 2020 nitrogen dioxide annual mean concentrations were very much impacted by Covid-19 restrictions. The decreases in nitrogen dioxide annual mean concentrations in 2020 and continuing into 2021 were much greater that would have been predicted and so we will keep these results under review and follow Defra's advice when undertaking any future year projections for air pollution levels in Belfast that incorprioate data for these two years.

In terms of forward actions, the council along with relevant partners are in the process of developing a new 5-year Air Quality Action Plan for the city that will cover the period 2021-2026. The new Action Plan is currently undergoing public consultation. The primary aim of this new Air Quality Action Plan is to continue to reduce NO_2 emissions from transport sources and to promote and enable a shift towards more sustainable modes of transport in order to achieve compliance with UK Air Quality Objectives for NO_2. Where necessary, an additional aim of this Action Plan is to identify, develop and implement mitigation measures to address concentrations of fine particulate matter ($PM_{2.5}$) across the city. Following conclusion of the public consultation process, the Action Plan will be forwarded to DAERA for technical appraisal.

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Appendices

Appendix A: Quality Assurance / Quality Control (QA/QC) Data

Appendix B: Impact of COVID-19 upon LAQM

Appendix A: Quality Assurance / Quality Control (QA/QC) Data

QA/QC of Diffusion Tube Monitoring

In 2020, Belfast City Council appointed Gradko International Ltd. to supply, analyse and report data for its diffusion tubes. Gradko employs a 20% triethanolamine solution for monitoring ambient nitrogen dioxide and adheres to the requirements of the government's 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users' publication.

Unfortunately, due to the Covid-19 pandemic, Gradko had to cease laboratory activities between March and May 2020, which meant that no new diffusion tubes were sent to replace tubes already in situ. Therefore, a two-month exposure period was carried out between 30th March 2020 and 3rd June 2020 for all diffusion tubes. The calculations used in this report have been time weighted to take account of this extended exposure period.

In addition, reduced data capture during 2020 has had an impact on the accuracy of some of the reported results and has also resulted in the need for annualisation of data for four diffusion tubes, which ordinarily would have surpassed the 75% data capture threshold (Ravenhill Road, North Road, Queens Square and North Queen Street). Queens Bridge and RVH Falls Road monitoring sites were the only locations that would have required annualisation, had it not been for Covid-19 restrictions.

Moreover, as Air PT samples could not be provided due to the Covid-19 restrictions, the laboratory carried out internal blind testing during September 2020. This cannot be considered the same as proficiency testing, but it has been included to provide reassurance of laboratory performance during this period.

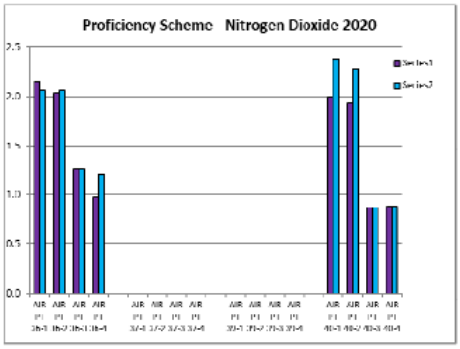
For the 2020 sampling year, Gradko's performance has been assessed as follows:

(A division of Gradko International Ltd.)
St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH
tel.: 01962 860331 fax: 01962 841339 email:diffusion@gradko.com

AIR PT Nitrogen Dioxide Proficiency Scheme Results 2020

Methods: GLM 7 – CARY 60 Spectrophotometer

AIR PT Proficiency Scheme - Nitrogen Dioxide 2020					
Date	Round	Assigned value	Procedure GLM 7		
			Measured concentration	z-Score	% Bias
Feb-20	AIR PT 36-1	2.06	2.15	0.58	4.4%
Feb-20	AIR PT 36-2	2.06	2.03	-0.19	-1.5%
Feb-20	AIR PT 36-3	1.26	1.26	0	0.0%
Feb-20	AIR PT 36-4	1.21	0.98	-2.43	-19.0%
May-20	AIR PT 31-1	Proficiency scheme not available			
May-20	AIR PT 31-2				
May-20	AIR PT 31-3				
May-20	AIR PT 31-4				
Aug-20	AIR PT 33-1	Proficiency scheme not available			
Aug-20	AIR PT 33-2				
Aug-20	AIR PT 33-3				
Aug-20	AIR PT 33-4				
Oct-20	AIR PT 34-1	2.38	1.99	-2.08	-16.4%
Oct-20	AIR PT 34-2	2.28	1.93	-1.90	-15.4%
Oct-20	AIR PT 34-3	0.87	0.87	0	0.0%
Oct-20	AIR PT 34-4	0.88	0.88	0.08	0.0%



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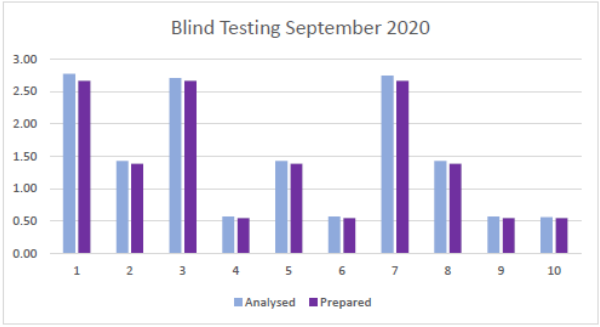
Sep-20

	Analysed	Prepared	%Bias
1	2.78	2.67	4.1
2	1.43	1.38	3.1
3	2.71	2.67	1.7
4	0.57	0.55	4.3
5	1.43	1.38	3.1
6	0.57	0.55	4.1
7	2.75	2.67	3.1
8	1.43	1.38	3.1
9	0.57	0.55	4.3
10	0.56	0.55	2.3
			Average %bias
	RSD 0.55	0.95	3.33
	RSD 1.38	0.04	
	RSD 2.67	1.15	



Diffusion Tube Annualisation

Annualisation was required for six non-automatic diffusion tube monitoring sites; Ravenhill Road (67% data capture), Queen's Bridge (42% data capture), North Road (67% data capture), Queen's Square (67% data capture), North Queen Street (67% data capture) and RVH Falls Road (58% data capture). All tubes were annualised using automatic monitoring results from Ballymena Ballykeel and Derry Rosemount automatic monitoring stations, all of which had >85% data capture.

Table A.1: Annualisation Summary for Diffusion Tubes

Annualisation Summary - Information Only

Diffusion Tube ID	Annualisation Factor Ballymena Ballykeel	Annualisation Factor Derry Rosemount	Annualisation Factor	Annualisation Factor	Average Annualisation Factor	Raw Data Time Weighted Annual Mean (µg/m3)	Annualised Data Time Weighted Annual Mean (µg/m3)
4	0.9894	0.9749			0.9821	26.3	25.8
5	0.9281	0.9077			0.9179	28.4	26.0
6	0.9462	0.9525			0.9494	14.4	13.6
63	0.9999	0.9918			0.9959	32.1	31.9
83	1.0643	1.0086			1.0364	32.2	33.4
87	0.8385	0.8622			0.8504	35.7	30.4

Diffusion Tube Bias Adjustment Factors

To further ensure that its diffusion tube monitoring data is as accurate as possible, the council co-locates a number of diffusion tubes with reference method compliant chemiluminescent nitrogen dioxide analysers at the Lombard Street, Newtownards Road, Westlink/Roden Street and Stockman's Lane monitoring sites. This process allows a bias adjustment factor (with a 95% confidence interval as an estimate of the uncertainty on the bias adjustment factor) to be calculated and used to correct the diffusion tube monitoring data. In the case of the diffusion tube data presented in this 2020 report, the monitoring data has been corrected using a bias adjustment factor derived from three roadside co-location studies undertaken at the Upper Newtownards Road, Westlink/Roden Street and Stockman's Lane monitoring sites.

In previous years, Belfast City council has employed a triplicate collocation study at the Belfast Centre Lombard Street AURN monitoring site in order to obtain a local diffusion tube bias adjustment factor for 'correcting' our diffusion tubes monitoring data.

However, in 2019 and 2020 due to low data capture (2020- 68%), the Belfast Centre site did not meet the criteria to be considered an adequate collocation study site. (9 valid periods of data with the analyser's data capture >=75%).

Belfast City Council therefore carried out triplicate collocation studies at three roadside automatic monitoring stations Upper Newtownards Road, Westlink/Roden Street and Stockman's Lane during 2020.

Precision calculations undertaken for all of the above sites in the co-location study indicated a "good" precision rating for all measurement periods. Automatic monitoring data capture rates were considered "good" at all sites with more than 90% data capture for all measurement periods.

Therefore, the Belfast local bias adjustment factor for 2020 was calculated based on all three roadside collocation studies and in accordance to LAQM Technical Guidance (TG16) sections 7.191-7.197. The overall bias factor for 2020 was calculated as 0.79.

The local bias adjustment factor was calculated using the Defra Diffusion Tube Processing Tool (with a 95% confidence interval as an estimate of the uncertainty on the bias adjustment factor). Calculations are presented within Table A.5.

The bias adjustment factors used to adjust the council's diffusion tube monitoring data in the last five years are summarised as follows:

Table A.2: Bias Adjustment Factors

Year	Local or National	If National, Version of National Spreadsheet	**Adjustment Factor**
2020	Local	-	0.79
2019	Local	-	0.91
2018	Local	-	0.86
2017	Local	-	0.78
2016	Local	-	0.89

NO_2 Fall-off with Distance from the Road

Only one annual mean exceedance occurred during 2020 at Henry Place (41.1µg/m^3). This tube is located within existing the M1 Motorway / A12 Westlink Air Quality Management Area and has been the subject of mitigation measures for some time. Nevertheless, Defra NO_2 distance calculations have been provided for the above location to predict annual mean concentrations at relevant receptor locations.

The Diffusion Tube Processing Tool has predicted a concentration of 28.7 µg/m^3, which indicates that no exceedance is likely at the relevant receptor location (Table A.3). However, there may be risk of exceedance at relevant receptors on the opposite side of the M1 Motorway to this location, where there is no local data available for 2020. A new diffusion tube has therefore been placed at North Queen Park to identify if receptors are exposed to any exceedances in the area.

Table A.3: NO2 Fall off With Distance Calculations

Fall off with Distance Inputs

Enter data into the pink cells

Diffusion Tube ID	Distance (m)		NO_2 Annual Mean Concentration (µg/m^3)		
	Monitoring Site to Kerb	Receptor to Kerb	Bias Adjusted and Annualised	Background	Predicted at Receptor
70	1.0	24.0	41.1	21.7	28.7

QA/QC of Automatic Monitoring

Belfast City Council operates four automatic monitoring stations across the city in order to help inform its air quality management processes and to provide real time information to the public in relation to air pollution levels across the city centre and within our Air Quality Management Areas.

Accordingly, to ensure that the data from our sites is both accurate and representative, the monitors at each site are calibrated on a biweekly (Stockman's Lane AURN site) or on a four-weekly basis by the council's technical staff in accordance with the procedures

detailed in the Defra Automatic Urban and Rural Network (AURN) local site operators' manual.

For our automatic nitrogen dioxide analysers, we complete a two-point calibration using zero air and a nitric oxide span gas of certified concentration. We obtain our calibration gases under contract from Air Liquide and BOC Ltd. who also provide similar gases to government owned AURN monitoring stations. By considering instrument operating parameters and the results of successive calibrations, we can make a determination regarding the ongoing performance of our analysers. Where an instrument is found not to be operating within normal operating parameters, we refer the matter promptly to *Enviro Technology*, who provided service and maintenance support for our equipment throughout 2020.

In addition, data management support including data collection, scaling, reporting and ratification is provided by *Ricardo-AEA Limited*. The data from our sites is made available to the Department of Agriculture, Environment and Rural Affairs and is reported on the 'Northern Ireland Air' website in near real time.

Finally, Belfast City Council has appointed suitably qualified equipment engineers (*NPL*) to provide quality assurance and quality control support for the monitoring equipment to ensure compliance with the requirements of the National Air Quality Strategy as detailed within the Defra Technical Guidance Document LAQM.TG(16). NPL staff visit our sites on a six-monthly basis and compare the performance of our analysers against a range of laboratory grade standards. NPL subsequently provides a series of calibration and scaling factors that are used to correct our automatic monitoring data. These scaling procedures enable the council to robustly compare our air quality data with Air Quality Strategy Objectives and European Union Limit Values.

For consistency, all automatic monitoring data reported in this Updating and Screening Assessment report has been obtained from the 'Northern Ireland Air' website. Automatic data presented in this report relates to the calendar year (i.e. January – December). 2020 ratified data capture levels exceeded the Department's 75% data capture threshold for the calculation of annual statistics at all council sites.

PM_{10} and $PM_{2.5}$ Monitoring Adjustment

In relation to the correction of our automatic monitoring data, this process is generally of principal concern with regard to the treatment of particulate matter monitoring data. In 2019, the Belfast Centre site employed Filter Dynamics Measurement System (FDMS) equipped Tapered Element Oscillating Microbalances (TEOMs) for particulate matter (PM_{10}) monitoring up until September whereupon the FDMS equipped TEOMs were replaced by Palas Fidas 200, which complies with DEFRA's UK PM Pollution Climate standard. Government equivalence tests have determined that both of types of equipment meet the equivalence criteria and, on that basis, no correction factor needs to be applied to this monitoring data.

The Stockman's Lane site is equipped with a Beta Attenuation Monitor (BAM) with a heated inlet for monitoring particulate matter. Government technical guidance highlights that a BAM, equipped with a heated inlet, meets the equivalence criteria for PM_{10} monitoring, provided that the results are corrected for slope. This correction involves dividing measured concentrations by a factor of 1.035. It should be noted that the data presented on the Northern Ireland Air website and in this report has already been corrected to the reference equivalent.

Automatic Monitoring Annualisation

Defra operates an urban background monitoring site at Lombard Street. Unfortunately, in 2020, data capture levels at the Belfast Centre site were below the Department's 75% data capture threshold for nitrogen dioxide (68%). Therefore, annualisation of data from this site was required, as demonstrated in Table A.4.

NO_2 Fall-off with Distance from the Road

No annual mean data from automatic NO_2 monitoring locations within Belfast required distance correction during 2020.

Table A.4:Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Ballymena Ballykeel	Annualisation Factor Derry Rosemount	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
Belfast Centre Lombard CM1	1.028	1.046	1.037	18	18.66	Background Site / Annual Mean / Period Mean 2020 (Pm) / Ratio (Am/Pm) Ballymena Ballykeel 10 9.73 1.027749229 Derry Rosemount 8 7.65 1.045751634 Average (Ra): 1.036750432 City Centre 18 After Annualisation: 18.66150777

Table A.5: Local Bias Adjustment Calculations

	STEP 3a Local Bias Adjustment Input 1	STEP 3b Local Bias Adjustment Input 2	STEP 3c Local Bias Adjustment Input 3
Periods used to calculate bias	11	10	11
Bias Adjustment Factor A	0.89 (0.84 - 0.94)	0.82 (0.78 - 0.86)	0.71 (0.67 - 0.75)
Diffusion Tube Bias B	13% (7% - 19%)	23% (17% - 29%)	42% (34% - 50%)
Diffusion Tube Mean (µg/m^3)	39.2	25.9	35.3
Mean CV (Precision)	3.4%	2.6%	3.4%
Automatic Mean (µg/m^3)	34.7	21.1	24.9
Data Capture	97%	99%	98%
Adjusted Tube Mean (µg/m^3)	35 (33 - 37)	21 (20 - 22)	25 (24 - 26)

Overall Diffusion Tube Precision	**Good Overall Precision**	**Good Overall Precision**	**Good Overall Precision**
Overall Continuous Monitor Data Capture	**Good Overall Data Capture**	**Good Overall Data Capture**	**Good Overall Data Capture**

Notes:

A single local bias adjustment factor has been used to bias adjust all 2020 diffusion tube results.

Appendix B: Impact of COVID-19 upon LAQM

The Covid-19 pandemic has had a significant impact on society throughout 2020 and into 2021. Inevitably, it has also had an impact on the environment, with implications for ambient air quality at local, regional and national scales. In addition, Covid-19 has presented various challenges for Local Authorities with respect to undertaking their statutory LAQM duties in the 2020 and 2021 reporting years.

These challenges are most notable in diffusion tube data collection for 2020. Unfortunately, many businesses had to shut during the pandemic to prevent the spread of Covid-19, one of which was Gradko Ltd., the laboratory which the council employs to carry out analyses on its diffusion tubes.

The lab formally ceased activities between March and May 2020, which meant that no new diffusion tubes were sent to replace the tubes already in situ. Therefore, a two-month exposure period was undertaken between 30th March 2020 and 3rd June 2020 for all diffusion tubes. The calculations used in this report have been time weighted to take account of this extended exposure period.

In addition, the reduced data capture has had an impact on the results reported and has also resulted in the need for annualisation calculations on an additional four diffusion tubes, which ordinarily would have surpassed the 75% data capture threshold (Ravenhill Road, North Road, Queens Square and North Queen Street). Queens Bridge and RVH Falls Road were the only locations which would have required annualisation, were it not for the Covid-19 restrictions.

Despite the challenges that the pandemic has generated, the events of 2020 have also provided Local Authorities and other organisations with an opportunity to quantify the air quality impacts associated with wide-scale extreme interventions and changes in behaviour such as reduced road traffic and working from home.

Figure B.1 below illustrates the overall percentage change in traffic numbers for Belfast during 2020 as compared to 2018/2019 pre-lockdown data. The graph demonstrates an initial drop-off of approximately 70% in traffic numbers at the height of the first lockdown in

March 2020. Figure B.2, which illustrates provisional monthly NO_2 mean concentrations at each automatic air quality monitoring station (AQMS) within Belfast, also follows a similar trend, depicting a significant drop-off in NO_2 concentrations at all AQMSs, except the A12 Westlink site during the same period, which is likely due to the A12 Westlink's function as an arterial route through Belfast from western and southern regions of Northern Ireland. The same is depicted during the second lockdown, with a correlation shown in both the drop-off of traffic on Belfast's roads and NO_2 concentrations.

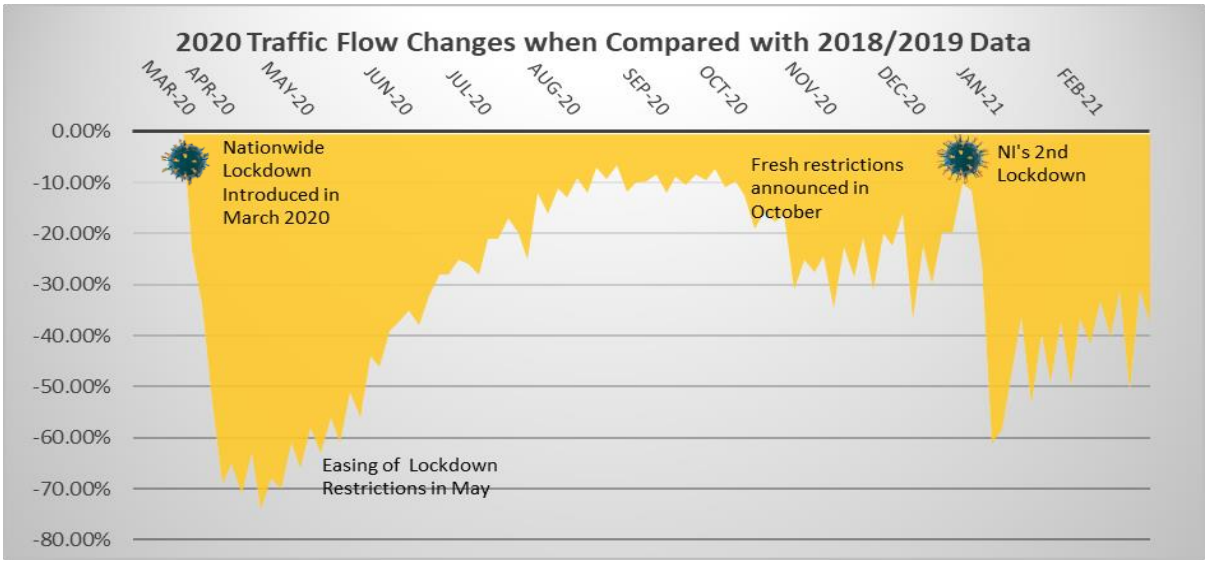


Figure B.1: DfI Published Covid-19 Traffic Flow Figures Comparison for 2020/21

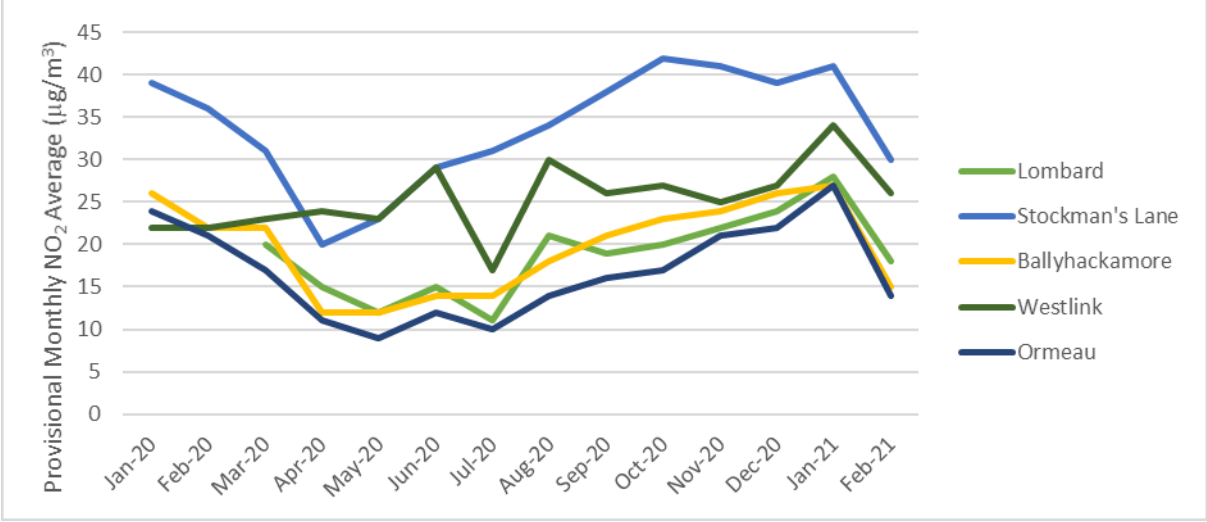


Figure B.2: Belfast AQMS Monthly NO_2 Averages during Covid-19 Pandemic

Whilst both graphs demonstrate the established link between road traffic and ambient NO_2 concentrations, they also show that when restrictions were eased in the summer and autumn months of 2020, road traffic did not fully return to normal levels, instead averaging off at around 90% of original levels. It remains unclear when, or even if pre Covid-19 traffic levels will return. As the past year has confirmed that businesses are able to 'work from home', it is also unclear whether some businesses might maintain this manner of working, even after restrictions have been finally lifted. If this is the case, the reduced levels of traffic depicted in Figure B.1 may well be the new 'normal' and in turn, be beneficial to ambient air quality across Belfast City.

A significant portion of the traffic flow reduction may also be associated with reduced public transport timetables, which were introduced at the beginning of the first lockdown in March 2020. Given the need to stay at home and reduce close contact with individuals as much as possible, it is no surprise that public transport use within Northern Ireland was significantly impacted. Figure B.3 below illustrates the impact of the pandemic on public transport use. The graph shows that use of NI Railways, Metro and Ulsterbus services was reduced to less than 50% of pre-lockdown levels.

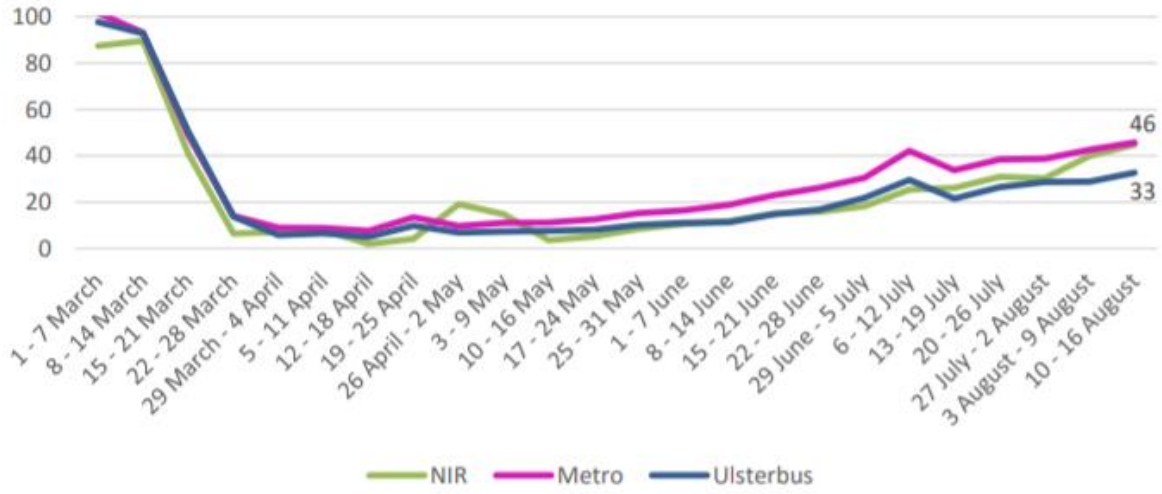


Figure B.3: Patronage (%) NIR, Metro and Ulsterbus 1st March – 16th August 2020, as compared with 2019

The challenges of maintaining safety and social distancing on public transport, and by extension the usage of this mode of transport, have been unfortunate consequences of the Covid-19 pandemic. It is unclear whether businesses will maintain their new 'work from home' arrangements after Covid-19 restrictions have been finally removed and how long public transport usage may therefore take to return to pre-lockdown levels.

Although public transport use has been significantly reduced in the past year, it should be noted that when restrictions were relaxed, patronage levels on some services, such as the Glider in West Belfast, recovered very quickly to over 70% of pre-Covid levels. This demonstrates the importance of this type of investment and how important public transport is to key workers and people, partcularly in areas of higher deprivation.

Furthermore, there is also some evidence that the pandemic has actually initiated an increase in the use of active travel in some cities. For example, Manchester has recorded a 22% increase in cycling when compared with pre-lockdown levels. This has boosted walking and cycling to the extent that it now accounts for 33% of all journeys within that city. Liverpool and Cardiff have also noted similar modal shifts in travel through 2020, while anecdotal evidence suggests that bike sales have also soared. Belfast has also experienced a similar improvement in the use of active travel, with usage of the Comber Greenway up by more than 75% between April 2020 and March 2021, when compared with pre-lockdown levels in the same period during 2019/20, comprised of around 55% cycling and 45% walking. With this in mind, Covid-19 may well have encouraged and hastened active travel improvements, meaning that the Department for Infrastructure and the council can use the pandemic recovery process as a catalyst to further improve levels of walking and cycling across Belfast.