

Annual Progress Report (APR)



2020 Air Quality Annual Progress Report (APR) for
Dundee City Council

In fulfilment of Part IV of the
Environment Act 1995

Local Air Quality Management

September 2020

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Executive Summary: Air Quality in Our Area

Air Quality in Dundee

Dundee City Council (DCC) has an Air Quality Management Area (AQMA) covering the whole city, as a result of exceedances of the Air Quality Objectives (AQOs) for nitrogen dioxide (NO₂) (annual mean and hourly mean) and particulate matter (PM₁₀) (annual mean). The main source contributing to these exceedances is road traffic, however the increasing popularity of wood burning stoves and other biomass sources has the potential to increase local background concentrations.

Dundee City Council currently monitors for NO₂, PM₁₀ and PM_{2.5}, the latest results and trends are discussed in Chapter 3. The majority of monitoring locations are showing an improving trend in pollutant concentrations, however potential for exceedances of the AQOs exist at the following locations:

- the city centre bus corridor;
- the inner ring road;
- adjacent to the trunk road network; and
- main arterial routes.

Dundee City Council produced its Air Quality Action Plan in 2011 and has a Corporate Air Quality Steering Group which co-ordinates actions to improve air quality in the city. The group contains representatives from various council services including: corporate policy; fleet management; planning; transportation and environmental health. The group also includes representatives from other major employers, including Dundee University and NHS Tayside.

The Scottish Environment Protection Agency (SEPA) consult with the council on new industrial process applications and provide an annual update on existing processes in the city. Dundee City Council continues to work with Transport Scotland, SEPA and the regional transport partnership TACTRAN as part of the National Low Emission Framework (NLEF) process to develop a low emission zone for Dundee and also to discuss whether any additional actions are possible to reduce pollutant concentrations at relevant locations close to the trunk road network in Dundee.

Actions to Improve Air Quality

Dundee City Council has taken forward a number of measures during the current reporting year of 2019 in pursuit of improving local air quality. Some of the actions taken during the past year have included:

- Both ECO Stars schemes for larger commercial vehicles and for taxi / private hire vehicles continued to run during 2019. There was a 19.7% increase in the number of members to the Dundee ECO Stars larger commercial vehicles scheme, with 188 members (7188 vehicles) signed up by the year end. The ECO Stars scheme for taxis/private hire vehicles maintained its membership at 17 (517 vehicles) by the 31st December 2019.
- The Drive Dundee Electric campaign continued its successful engagement with current and potential electric vehicle (EV) owners (both in public and business). This included the filming of episodes of the YouTube show 'Fully Charged' in Dundee, with local taxi drivers, businesses, council spokespersons, and local EV users being interviewed. Various charging hubs throughout the city were visited, while Drive

Dundee Electric had a stall at the event and used the opportunity to promote EV charging facilities.

- The continued promotion of EV vehicles and assistance to those who choose to switch to EV has helped result in 18% of Dundee's taxis now being fully electric vehicles. There are 97 pure electric taxis in Dundee which is a 5% increase from 2018.
- Dundee City Council again supported and participated in 'Clean Air Day' on June 20, with a small event held on the Nethergate to help promote travel alternatives that are beneficial to air quality and health. In the lead up to Clean Air Day, local school children helped promote awareness of the day by painting messages on bus shelters in the city centre. A number of schools also participated in an air quality banner competition that was run by the SEPA.
- Dundee City Council continued to help promote public transport as an attractive and affordable alternative to private car use. In 2019 Dundee City Council teamed up with local bus operators again to offer a 20p fare promotion (Holiday Hop) to children travelling with adults during the Easter, summer, and October school holiday periods. When compared to baseline data from 2016, the promotion contributed to 74% (Easter 2019) / 94% (Summer 2019) / 86% (October 2019) increases in bus patronage over these periods.
- An inhouse Cycling Projects Officer in place to provide support on multiple behaviour changes and active travel infrastructure projects. In 2019 the Cycling Scotland Annual Report showed an increased number of people commuting by bike (up to 8.5%) in Dundee.
- By the end of 2019 DCC had 116 electric vehicles in its fleet. During the year DCC became the first UK local authority to have over 100 EVs in their fleet.
- A Schools Active Travel team was established at Ancrum Centre in April 2019 and began working with Dundee schools. DCC is now the best local authority in Scotland in terms of the percentage of primary schools offering Bikeability.
- Dundee continues to lead the way in electric vehicle (EV) uptake with the installation of 20 publicly available charging points and 7 Dundee City Council privately owned points during 2019, including the first of three multi-storey charging hubs opening in October 2019 at Greenmarket. The hub consists of 10 new chargers, controller-receiver technology which allows dynamic load managements all of which are located under solar canopies.
- The 2019 Local Development Plan was adopted in February 2019. The 'Supplementary Guidance Air Quality & Land Use Planning' document was adopted in conjunction with this.
- A citywide Climate Action Plan in support of the transition to a net-zero and climate resilient future was developed through the Dundee Partnership. In line with Scottish Government and Council objectives for the Cleaner Air For Scotland (CAFS) strategy, tackling air quality and decarbonising transport are key objectives of this plan. This Plan was launched in December 2019.
- A DCC staff travel survey was carried out in October 2019 to help progress with the development of a Staff Travel Plan that is proposed to be launched in 2020.

Local Priorities and Challenges

Dundee City Council expects the following measures to be completed over the course of the next reporting year:

- A continued expansion of the infrastructure to support uptake of ULEV as well as continued free parking for pure EV vehicles in the multi-storey car parks of the Olympia, Greenmarket, Bell Street and Gellatly Street.
- Drive Dundee Electric will continue to help raise awareness and encourage uptake of low emission vehicles at various events throughout the year.
- Continuation of both ECOSTARS Schemes for Heavy Duty Vehicles and Taxis / Private Hire vehicles to encourage engagement with and participation of these transport providers in the achievement of air quality improvements in the city.
- Continued support for Active Travel related projects including the delivery of the School Active Travel Delivery programme, the embedding of the Sustrans Cycling Strategy Officer within City Development and the new team taking on the running of the Active Travel Hub at the Waterfront.
- Additional support for the E-bike public bike hire scheme that is expected to launch in late 2020 (delayed from 2019) at locations in parts of the city with higher levels of pollution and health inequality.
- Continued active participation with the Cleaner Air for Scotland Governance Group and the review of the 2015 CAFS Strategy being undertaken in 2020.
- The completion and launch of the new Staff Travel Plan during 2020.
- The development of the Dundee Low Emission Zone will progress in line with guidance provided in the National Low Emission Framework and in line with the revised indicative introduction date of the first half of 2022 as announced in the 2020/21 Programme for Government. DCC will be represented in all the tiers of governance set up to deliver the low emission zones in Scotland.
- The Paramics Traffic Model for Dundee will be used in conjunction with the National Modelling Framework Air Quality City Model for the development of the Dundee Low Emission Zone. Scenario testing of proposed LEZ design options will be carried out in 2020.
- Take forward the other proposed Local Air Quality Management tasks highlighted in **Section 6.3**.

How to Get Involved

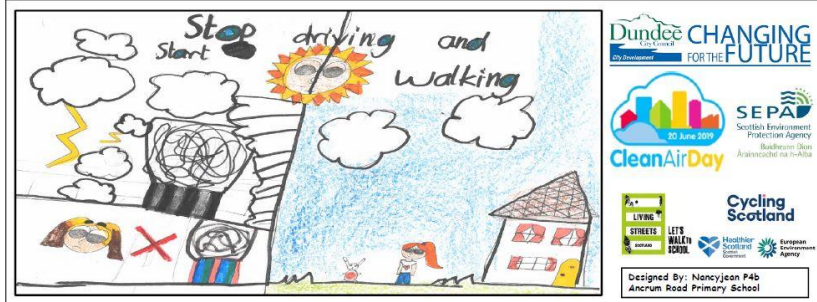
Further information on air quality in Dundee can be found on the website at the following location: <http://www.dundeecity.gov.uk/air-quality/>

This includes advice on how we can all help to improve air quality in Dundee, such as: using public transport; car-sharing & car clubs; no-idling; electric vehicles; cycling; walking; and not burning wood or having a garden bonfire.

“Raising awareness of Clean Air Day through the painting of prominent city centre bus stops by pupils of Rosebank Primary School”



“Clean Air Day 2019 banner competition winning designs”



	<p>Three environmental posters are displayed. Each poster includes the Dundee City Council logo, 'CHANGING FOR THE FUTURE', 'CleanAirDay 20 June 2019', and logos for SEPA, Cycling Scotland, and the European Environment Agency. The first poster is designed by Emily Low from Barnhill Primary School. The second is designed by Marylisa Kaneloska from Barnhill Primary School. The third is designed by Phoebe Samson from Forthill Primary School.</p>
<p>“A staff travel survey was carried out in October 2019 to help progress with the development of a Staff Travel Plan that is proposed to be launched in 2020”</p>	<p>sustainable DUNDEE</p> <p>703 Completed Survey Responses</p> <p>40% travel less than 5 miles to work</p> <p>Over 50% work in the City Centre</p> <p>55% drive their car to work</p> <p>19% use public transport (mostly bus)</p> <p>16% travel to work on foot or bike</p> <p>1.3% by electric car/bike</p> <p>STAFF TRAVEL SURVEY 2019</p> <p><small>*Rides by moped/motorcycle or car sharing.</small></p>

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1. Local Air Quality Management

This report provides an overview of air quality in Dundee City Council during 2019. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) 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 an exceedance is considered likely the local authority must 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. This Annual Progress Report (APR) summarises the work being undertaken by Dundee City Council to improve air quality and any progress that has been made.

Table 1.1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide (NO ₂)	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m ³	Annual mean	31.12.2005
Particulate Matter (PM ₁₀)	50 µg/m ³ , not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m ³	Annual mean	31.12.2010
Particulate Matter (PM _{2.5})	10 µg/m ³	Annual mean	31.12.2020
Sulphur dioxide (SO ₂)	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m ³	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m ³	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m ³	Running 8-Hour mean	31.12.2003
Lead	0.25 µg/m ³	Annual Mean	31.12.2008

2. Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12 months, setting out measures it intends to put in place in pursuit of the objectives.

A summary of AQMAs declared by Dundee City Council can be found in Table . Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=365

Table 2.1– Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	Description	Action Plan
Dundee City Council AQMA	<ul style="list-style-type: none"> • NO₂ annual mean • PM₁₀ annual mean • NO₂ hourly mean 	Dundee	<p>The whole of the local government area of the City of Dundee was declared an AQMA in respect of the annual mean objective for NO₂ in July 2006.</p> <p>In October 2010 the AQMA Order was amended to include the annual mean objective for PM₁₀.</p> <p>The AQMA was further amended in March 2013 to include the hourly mean objective for NO₂</p>	<p>Air Quality Action Plan for Nitrogen Dioxide (NO₂) and Fine Particulate Matter (PM₁₀)-January 2011</p> <p>https://www.dundeecc.gov.uk/sites/default/files/publications/Dundee%20CC%20FinalAQAP_Jan11.pdf</p>

2.2 Cleaner Air for Scotland

Cleaner Air for Scotland – The Road to a Healthier Future (CAFS) is a national cross-government strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health and fulfil Scotland’s legal responsibilities as soon as possible. A series of actions across a range of policy areas are outlined, a summary of which is available at <https://www.gov.scot/Publications/2015/11/5671/17>. Progress by Dundee City Council against relevant actions within this strategy is demonstrated below.

2.2.1 Transport – Avoiding travel – T1

All local authorities should ensure that they have a corporate travel plan (perhaps within a carbon management plan) which is consistent with any local air quality action plan. Dundee City Council has an existing Council Travel Plan to encourage staff to reduce the number of single occupancy car journeys made while on Council business and when commuting to

work and to incentivise the use of public transport and walking and cycling and car sharing. In addition, a Travel Policy exists containing a Business Travel hierarchy considering both staff business travel within and out with Dundee.

A staff travel survey was undertaken in October 2019 in conjunction with Climate Week, with over 700 responses from Dundee City Council employees being received. Information from this survey has been used to assist the creation of updated guidance to staff and to formalise staff travel policies. A draft Staff Travel Plan has been written with a proposed launch date in 2020.

2.2.2 Climate Change – Effective co-ordination of climate change and air quality policies to deliver co-benefits – CC2

Scottish Government expects any Scottish local authority which has or is currently developing a Sustainable Energy Action Plan to ensure that air quality considerations are covered.

Dundee City Council declared a climate emergency in June 2019 and has worked through the Dundee Partnership to develop and launch in December 2019 a citywide Climate Action Plan in support of the transition to a net-zero and climate resilient future. In line with Scottish Government and Council objectives for CAFS, tackling air quality and decarbonising transport are key objectives of this plan. Of the 62 actions in the plan, 18 are related to air quality. In an effort to co-ordinate and deliver a clear and consistent message for the city, a 'Sustainable Dundee' brand was established under which all sustainability and climate change initiatives are promoted.

2.2.3 Further Actions

In parallel to continuing with the implementation of the AQAP measures, Dundee City Council, along with the other three major city authorities, was represented on the CAFS Governance Group during 2019. DCC remains committed to working with the Scottish Government and its partner organisations to deliver CAFS aim of improving Scotland's air quality to be the best in Europe.

The detailed National Modelling Framework (NMF) AQ City Model for Dundee was completed by SEPA in 2019 with data used from the 2017 traffic counts being supplemented by fleet and bus route information provided by local bus operators. Additional traffic counts were also undertaken during May 2019 as a part of the development of the Greater Dundee City Paramics traffic model which were also used to update the NMF AQ City Model. In conjunction with the National Low Emission Framework (NLEF) document published by the Scottish Government in January 2019, the NMF AQ City Model was used to identify potential low emission zone design options for Dundee. A public consultation exercise and stakeholder events on aspects relating to the design and introduction of the Dundee LEZ were carried out during October and November 2019.

The creation of the Greater Dundee City Paramics traffic model was further progressed during 2019 and will further assist the development of the Dundee LEZ when the model is completed and ready to use in early 2020. A reference case traffic model will be created against which a number of LEZ option scenarios will be run by the traffic model, with the outputs from this being fed back in to the NMF AQ City Model.

The outputs from the NMF AQ City Model will be a main focus of the appraisal process contained in the NLEF document guiding the development of the Dundee LEZ, and the identification of any other transport focussed interventions that could be used to bring further improvements to air quality in the city.

In addition, the AQ City Model has been used to help identify locations of potential NO₂ exceedances that have not previously been included in our monitoring network. Further details of this modelling work output are contained within section 4.1 of this report and in Figure C:31 found in Appendix C:3.

2.3 National Low Emission Framework (NLEF) Stage 1 Screening Appraisal for Dundee City Council

The NLEF¹, which is now part of the review and assessment process for LAQM reporting in Scotland, contributes to the Cleaner Air for Scotland strategy by aiming to improve local air quality in areas where air quality objectives are exceeded, or likely to be exceeded, primarily due to emissions from transport.

The NLEF is directly linked to Air Quality Action Planning (AQAP) for local authorities with Air Quality Management Areas (AQMAs), and will help to identify actions to improve local air quality within AQMAs. The NLEF appraisal takes the form of a two-stage process, as summarised in Table :

Table 2.2– NLEF Appraisal Process

Stage		Outcome	Actions Required
1	Screening	<ul style="list-style-type: none"> decision on whether to proceed to stage two assessment 	<ul style="list-style-type: none"> screening process to identify actions that will benefit air quality within the AQMA screening evidence should form part of the Annual Progress Report, with the decision agreed by Scottish Government and SEPA
2	Assessment	<ul style="list-style-type: none"> decision to proceed with introduction of LEZ or identification of alternative transport-related measures required to improve air quality Stage two assessment report agreed by Scottish Government and SEPA 	<ul style="list-style-type: none"> NMF approach to support assessment of sources of pollution and options quantitative impact assessment (based on predicted change in pollutant concentrations) consideration of consequential impacts (e.g. congestion, export of pollution)

The Stage 1 Screening Assessment is not required to be completed by those Local Authorities which have already introduced or are in the process of introducing Low Emission Zones. Dundee City Council is in the process of introducing a Low Emission Zone for Dundee per the Scottish Government’s 2017 Programme for Government commitment which has been revised with a new indicative date for introduction in the first half of 2022. The Stage 2 Assessment is being undertaken as part of the process to identify the necessary scope of the Dundee Low Emission Zone. See **2.2.3** for further details regarding progress during 2019 and work proposed to be undertaken during 2020.

¹ <https://www.gov.scot/publications/national-low-emission-framework/pages/2/>
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2.4 Progress and Impact of Measures to address Air Quality in Dundee City Council

Dundee City Council has taken forward a number of measures during the current reporting year of 2019 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.3. More detail on these measures can be found in the Air Quality Action Plan relating to each AQMA

Key completed measures are:

- An inhouse Cycling Projects Officer in place to provide support on multiple behaviour changes and active travel infrastructure projects. In 2019 the Cycling Scotland Annual Report showed an increased number of people commuting by bike (up to 8.5%) in Dundee.
- By the end of 2019 DCC had 116 electric vehicles in its fleet. During the year DCC became the first UK local authority to have over 100 EVs in their fleet.
- The 'Holiday Hop' promotion with local bus operators ran again in 2019 during the April, summer and October school holidays. When compared to baseline data from 2016, the promotion contributed to 74% (Easter 2019) / 94% (Summer 2019) / 86% (October 2019) increases in bus patronage.
- In 2019 there was a 19.7% increase in the number of members to the Dundee ECO Stars larger commercial vehicles scheme, with 188 members (7188 vehicles) now signed up.
- The ECO Stars fleet recognition scheme for taxis/private hire vehicles maintained its membership at 17 (517 vehicles) by the 31st December 2019. There are 97 pure electric taxis in Dundee. This equates to 18% of the taxi trade which is a 5% increase from 2018.
- A Schools Active Travel team was established at Ancrum Centre in April 2019 and began working with Dundee schools. DCC now the best local authority in Scotland in terms of the percentage of primary schools offering Bikeability.
- The first of three multi-storey charging hubs opened in October 2019 at Green Market. The hub consists of 10 new chargers, controller-receiver technology which allows dynamic load managements all of which are located under solar canopies.
- The 2019 Local Development Plan was adopted in February 2019. The 'Supplementary Guidance Air Quality & Land Use Planning' document was adopted in conjunction with this.
- During 2019, a citywide Climate Action Plan in support of the transition to a net-zero and climate resilient future was developed through the Dundee Partnership. In line with Scottish Government and Council objectives for CAFS, tackling air quality and decarbonising transport are key objectives of this plan. This Action Plan was launched in December 2019.
- A DCC staff travel survey was carried out in October 2019 to help progress with the development of a Staff Travel Plan that is proposed to be launched in 2020.

Dundee City Council expects the following measures to be completed over the course of the next reporting year:

- A continued expansion of the infrastructure to support uptake of ULEV as well as continued free parking for pure EV vehicles in the multi-storey car parks of the Olympia, Greenmarket, Bell Street and Gellatly Street.
- Drive Dundee Electric will continue to help raise awareness and encourage uptake of low emission vehicles at various events throughout the year.
- Continuation of both ECOSTARS Schemes for Heavy Duty Vehicles and Taxis / Private Hire vehicles to encourage engagement with and participation of these transport providers in the achievement of air quality improvements in the city.
- Continued support for Active Travel related projects including the delivery of the School Active Travel Delivery programme, the embedding of the Sustrans Cycling Strategy Officer within City Development and the new team taking on the running of the Active Travel Hub at the Waterfront.
- Additional support for the E-bike public bike hire scheme that is expected to launch in late 2020 (delayed from 2019) at locations in parts of the city with higher levels of pollution and health inequality.
- Continued active participation with the Cleaner Air for Scotland (CAFS) Governance Group and the review of the 2015 CAFS Strategy being undertaken in 2020.
- The completion and launch of the new Staff Travel Plan during 2020.
- The development of the Dundee Low Emission Zone will progress in line with guidance provided in the National Low Emission Framework and in line with the revised indicative introduction date of the first half of 2022 as announced in the 2020/21 Programme for Government. DCC will be represented in all the tiers of governance set up to deliver the low emission zones in Scotland.
- The Paramics Traffic Model for Dundee will be used in conjunction with the National Modelling Framework Air Quality City Model for the development of the Dundee Low Emission Zone. Scenario testing of proposed LEZ design options will be carried out in 2020.
- Take forward the other proposed Local Air Quality Management tasks highlighted in **Section 6.3**.

Table 2.3 Progress on Measures to Improve Air Quality

KEY TO TABLE

Potential Air Quality Benefits

Small	0 - 0.5 µg/m ³
Medium	0.5 - 1.0 µg/m ³
High	greater than 1.0 µg/m ³
n/a	not applicable

Action Plan Measure Priority Level	
High	
Medium	
Low	

Timescale (Years from 2011)	
Short	1 - 2
Medium	3 - 5
Long	6 +

2020 updates (on progress in 2019) in green.

(Previous Annual Progress Reports, Updating and Screening Assessments, and Progress Reports referred to in this table can be accessed at: <https://www.dundee.gov.uk/service-area/neighbourhood-services/community-safety-and-protection/air-quality-in-dundee/air-quality-reports>)

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
1	Measure M1: Existing Road Infrastructure Improvements	Transport, planning and infrastructure	► City Centre Improvements - Union St.	DDC City Development Department (Transportation Division)			Implementation of improvements	High	<p>Union Street Road Infrastructure improvements were completed December 2011. Two-way traffic was maintained. Pavement widths were altered and the bus stops have been removed to reduce congestion and bus idling. Bus services redistributed to bus stops on Whitehall Street and Nethergate.</p> <p style="color: green;">The City Air Quality model for Dundee created by SEPA through the National Modelling Framework (NMF) includes this area. The Stage Two Assessment Process of the National Low Emission Framework (NLEF) progressed during 2019 with potential designs for the Dundee Low Emission Zone being developed. The Paramics Traffic Model is due to be ready for use in early 2020 and once available the potential LEZ scenarios will be modelled in this with outputs from the Traffic Model then fed back to the Air Quality model.</p>	<p>Completed 2011</p> <p style="color: green;">2020</p>	<p>NO₂ concentrations in Union St showed a consistent downward trend to well below the objective from 2010 until monitoring was removed in 2015.</p> <p style="color: green;">In 2019 there were further reductions in NO₂ and PM₁₀ concentrations at the Whitehall St continuous monitor, with slight reductions in NO₂ concentrations at a majority of the NO₂ diffusion tube locations in the area.</p>
1 Cont		Transport planning and infrastructure	► NW Arterial Route Improvement - Lochee Rd					Not Estimated	<p>Alterations carried out at Lochee Road/Rankine Street in February 2012 removed central reservation to free up road space and reduce congestion</p> <p style="color: green;">Investigations into potential interventions to reduce both emissions and traffic congestion on the Lochee Road corridor will continue to be explored during the LEZ development process. These investigations will take a route corridor approach and take cognisance of potential traffic displacement onto other, less</p>	<p>Completed 2012</p> <p style="color: green;">2020</p>	<p>The automatic monitor in Lochee Road recorded annual mean NO₂ concentrations above the AQO in 2019, but this was below that recorded in 2006 when the AQMA was first declared.</p> <p style="color: green;">The average long-term trend of annual mean NO₂ at all monitoring locations in Lochee Road is slightly</p>

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									<p>appropriate roads in residential areas.</p> <p>The City Air Quality model for Dundee created by SEPA through the National Modelling Framework (NMF) includes this area. The Stage Two Assessment Process of the National Low Emission Framework (NLEF) progressed during 2019 with potential designs for the Dundee Low Emission Zone being developed. The Paramics Traffic Model is due to be ready for use in early 2020 and once available the potential LEZ scenarios will be modelled in this with outputs from the Traffic Model then fed back to the Air Quality model.</p>		<p>downwards.</p> <p>The number of hourly NO₂ levels exceed reduced to 2 instances in 2019, well below the 18 instances permitted each year.</p> <p>The PM₁₀ annual concentrations at the Lochee Road and Logie Street monitoring sites also reduced in 2019 and met the AQO.</p>
1 Cont		Transport planning and infrastructure	► Arterial Route Improvements - Stannergate					Not estimated	<p>Consultants engaged in 2013 to carry out traffic micro-simulation modelling and air dispersion modelling.</p> <p>Final draft of the AD Modelling was received in April 2016, with the summary of findings presented in the 2016 Annual Progress Report.</p> <p>The City Air Quality model for Dundee created by SEPA through the National Modelling Framework (NMF) includes this area. The Stage Two Assessment Process of the National Low Emission Framework (NLEF) progressed during 2019 with potential designs for the Dundee Low Emission Zone being developed. The Paramics Traffic Model is due to be ready for use in early 2020 and once available the potential LEZ scenarios will be modelled in this with outputs from the Traffic Model then fed back to the Air Quality model.</p>	Completed 2016 2020	<p>2019 NO₂ annual average concentrations on the A92 between Broughty Ferry Road and Stannergate round-a-bout met the AQO objective, with slight reductions observed at diffusion tubes located on the south side of the trunk road.</p> <p>In 2019 the annual mean and daily mean objectives for PM₁₀ were again met at the Stannergate Osiris.</p>
1 Cont		Transport planning and infrastructure	► City Centre Improvements - Meadowside			2013 +		Not Estimated	<p>Meadowside – in 2012 a trial lane closure at the north end of street to increase separation distance between traffic and receptors was put in place. A temporary paving surface was introduced in October 2013 to allow the impact on monitored concentrations to be studied for a 12month period. Permanent street infrastructure changes were completed in Feb/March 2016.</p> <p>The City Air Quality model for Dundee created by SEPA through the National Modelling Framework (NMF) includes this area. The Stage Two Assessment Process of the National Low Emission Framework (NLEF) progressed during 2019 with potential designs for the Dundee Low Emission Zone being developed. The Paramics Traffic Model is due to be ready for use in early 2020 and once available the potential LEZ scenarios will be modelled in this with outputs from the Traffic Model then fed back to the Air Quality model</p>	Completed 2016 2020	<p>The monitoring results since 2015 demonstrate that the air quality improvements attributable to this infrastructure change have been maintained.</p> <p>In 2019 the annual average NO₂ concentration at the Meadowside was again well below the AQO level. A slight improvement in the annual average PM₁₀ concentration was also observed.</p> <p>Slight reductions in NO₂ annual average concentrations were observed at diffusion tubes located around the Hilltown / Victoria Road junction in 2019.</p>
1 Cont	Transport planning and infrastructure	► City Centre Upgrade 13 traffic signals with fibre optic connections			Funding contribution Awarded in 2016/17 Reallocated	2017/18		Not estimated	<p>A Fibre network is to be implemented to improve Traffic Signals communication (and revenue saving) with the Control Room in Dundee House. This network will improve reliability and efficiency of Urban Traffic Management and Control (UTC)</p> <p>The Fibre optic network project was completed in 2019.</p>	2018	

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No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
1 Cont		Transport planning and infrastructure	► City Centre Improvements – Seagate / St. Andrews Street			2014/15		Not estimated	<p>In late 2014, consultants were commissioned to undertake a review of transport activity on the Seagate with a specific focus on identifying actions that would address its poor air quality. The report concluded that there were no affordable actions that could ensure AQ thresholds were met, but a range of actions could help reduce emissions. Air Dispersion modelling demonstrated that if all buses and HDVs were Euro VI then no exceedances of the NO₂ or PM₁₀ objectives would persist in the city centre.</p> <p>Traffic modelling undertaken by SYSTRA with 2016/17 funding showed that the proposed transport management options would be unacceptable on traffic congestion, access and air quality grounds.</p> <p>The City Air Quality model for Dundee created by SEPA through the National Modelling Framework (NMF) includes this area. The Stage Two Assessment Process of the National Low Emission Framework (NLEF) progressed during 2019 with potential designs for the Dundee Low Emission Zone being developed. The Paramics Traffic Model is due to be ready for use in early 2020 and once available the potential LEZ scenarios will be modelled in this with outputs from the Traffic Model then fed back to the Air Quality model.</p>	<p>Completed 2017</p> <p>2020</p>	<p>NO₂ annual average concentrations in some locations in the Seagate area exceeded the annual mean objective in 2019 however were slightly lower than 2018 levels.</p> <p>PM₁₀ annual average concentrations were again below the annual mean objective.</p>
1 Cont		Transport planning and Infrastructure	City Centre Improvements – Crichton Street/ Whitehall Street /Nethergate		2016/17	2017/18		Not estimated	<p>Consultants were commissioned in March 2017 to examine the current bus movements through the city centre. The executive summary of this report is in Appendix C.5 of the 2018 DCC Annual Progress Report. The information from this project will help inform the NMF / NLEF assessment process being undertaken by Dundee City Council.</p> <p>The City Air Quality model for Dundee created by SEPA through the National Modelling Framework (NMF) includes this area. The Stage Two Assessment Process of the National Low Emission Framework (NLEF) progressed during 2019 with potential designs for the Dundee Low Emission Zone being developed. The Paramics Traffic Model is due to be ready for use in early 2020 and once available the potential LEZ scenarios will be modelled in this with outputs from the Traffic Model then fed back to the Air Quality model.</p>	<p>Completed 2017</p> <p>2020</p>	

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions	
2	Measure M2: DCC will enhance the Urban Traffic Management and Control (UTMC) system to reduce congestion	Traffic management	<ul style="list-style-type: none"> ▶ Real-time traffic monitoring. ▶ Improved control regime to smooth out peak traffic. 	DCC City Development Department (Transportation Division)	Implementation of UTMC improvements and carry out annual review to measure % reduction in congestion in line with target	2013+	<ul style="list-style-type: none"> ▶ 10% reduction in congestion (journey times) in targeted areas during peak times before and after implementation of measure. ▶ Annual review of impact 	Small	UTMC scheme was implemented in March 2013 to expand UTMC to two congested junctions in Lochee Rd AQ hotspots.	Completed 2013		
					2014+					<p>Seagate / Commercial Street traffic light refurbishment to improve bus and traffic flows completed Feb 2013. Coupled with increased enforcement of waiting restrictions to reduce congestion.</p> <p>The introduction of MOTES was not pursued due to limited effect.</p> <p>TACTRAN funding provided in 2014/15 to expand Bluetooth Traffic Speed Monitoring System to Include the Lochee Road. This was completed by 31st March 2015. In 2016 the system was expanded along the eastern corridor on the A92 coming in from Arbroath and Broughty Ferry. Ongoing discussions re maintenance costs with Transport Scotland and IBI.</p> <p>Bluetooth journey time monitoring is now undertaken on all major arterial routes leading in to the city centre area.</p>		2018
2 Cont					Paramics/ AIRE modelling of key junctions –Kingsway / Forfar Rd & Lochee Rd corridor to test improvement options	2013		Not estimated	<p>Consultants were engaged in 2013 to carry out traffic micro-simulation modelling and air dispersion modelling. Final Modelling outputs were received in April 2016. A more detailed summary of the options is contained in Appendix C of the 2016 Annual Progress Report. These options included:</p> <p>Kingsway / Forfar Road Options studied included A90 Bypass and improvements to signal timings, the bypass being the most beneficial scenario.</p> <p>Lochee Road Corridor options studied – closure of Cleghorn Street/Lochee Road junction and improvements to bus fleets. Study also found signal timings along the corridor to be optimised. Improvements to the bus fleets was the most beneficial of the options tested.</p> <p>The City Air Quality model for Dundee created by SEPA through the National Modelling Framework (NMF) includes these areas. The Stage Two Assessment Process of the National Low Emission Framework (NLEF) progressed during 2019 with potential designs for the Dundee Low Emission Zone being developed. The Paramics Traffic Model is due to be ready for use in early 2020 and once available the potential LEZ scenarios will be modelled in this with outputs from the Traffic Model then fed back to the Air Quality model.</p>	Completed 2016	2020	

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No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
3	Measure M3: DCC to identify partnership and funding to continue benefits of Smarter Choices/Smarter Places. Dundee Travel Active Programme	Promoting travel alternatives	<ul style="list-style-type: none"> ▶ Identify and implement wider partnership to continue programme. ▶ Identify funding. 	DCC City Development Department (Transportation Division)			<ul style="list-style-type: none"> ▶ Increase % of people who walk and cycle to work in Dundee. ▶ Identify funding for education 	Small	<p>In 2019 the Cycling Scotland Annual Report showed an increased number of people commuting by bike (up to 8.5%) in Dundee.</p> <p>Cycling Projects Officer providing support on multiple behaviour changes and active travel infrastructure projects</p>	Ongoing	A reduction in transport / unnecessary journeys is predicted however this may be difficult to measure.
3		Promoting travel alternatives			Behavioural Change Primary School programme to promote sustainable travel options in all primary schools in Dundee. Funding Carried into 2018/19 to progress classroom workshop	2013+			A 'Schools Active Travel team' was established at Ancrem Centre in April 2019 and began working with Dundee schools. DCC is now the best local authority in Scotland in terms of %age of primary schools offering Bikeability	Ongoing	
3		Promoting travel alternatives			<p>3 "Doctor Bike" Safety Events planned for the City Square</p> <p>Funding to provide match funding for i-bike initiative sought in FY for 2015/16 to 2018/19</p>	<p>2013/14</p> <p>2015/16</p>			<p>Dr Bike events held regularly in the City Centre through 2019, including on Clean Air Day on 20 June 2019.</p> <p>I-Bike scheme no longer funded. A new in-house developed 'School Active Travel team' part funded by the AQ Action Plan grant scheme is now in place.</p>	Ongoing	
4	Measure M4: DCC will introduce measures to improve bus services and reduce emissions	Transport planning and infrastructure	<ul style="list-style-type: none"> ▶ Statutory Bus Quality Partnership. ▶ Voluntary Bus Quality Partnership 	DCC City Development Department (Transportation Division)		2011+	▶ Identification of new corridors that directly benefit air quality	Medium	<p>Opportunities investigated as part of Air Quality Low Emission Charter. Study commissioned in summer 2017 to review stance allocation in Dundee City centre with a particular focus on improving air quality. See Appendix C.5 of the 2018 Annual Progress Report for a summary of this report.</p> <p>Partnership working with bus operators is to be pursued using the new powers available within the Transport (Scotland) Act 2019. Partnership meetings are held to discuss strategic opportunities in future years.</p> <p>Funding was obtained in late 2019 through a LEZ Support Funding scheme to undertake a feasibility study to investigate key congested junctions where public transport has specific travel time problems. The study will help identify and develop outline bus priority measures / designs and other</p>	<p>Medium Term</p> <p>2017</p> <p>Ongoing</p> <p>2020</p>	

		Vehicle Fleet efficiency					► Average age, Euro class, fuel, type		innovative solutions to reduce bus delay.	2012+	
4 Cont	Measure M4, cont.	Vehicle Fleet efficiency	► Fleet Renewal – Emissions Improvements	DCC City Development Department (Transportation Division)		2011+	► Fleet age, Euro class, fuel type	Medium	DCC support the review of Bus Service Operators Grant (BSOG) payments and the Bus Emissions Abatement Retrofit Programme (BEAR) funding for retrofiting. Xplore Dundee continued investment in newer vehicles increasing the proportion of EURO VI buses within their fleet. This includes vehicles retro-fitted with abatement technology obtained via the BEAR funding scheme.	2013+	
		Vehicle Fleet efficiency					► Lobby Scottish Government for fuel duty rebates for low carbon fleet		Not formally pursued further in 2019.		
4 Cont		Vehicle Fleet efficiency			National Express Dundee will introduce 9 Diesel Electric Hybrid buses into their fleet in April / May 2013 as per Green Bus Fund 2 bid success	2013			In 2013 High profile launch event for the nine Hybrid Buses introduced by National Express Dundee – coupled with promotional work with local schools	2013 completed	New cleaner emission vehicles are now successfully in operation
		Vehicle Fleet efficiency			ECO Stars Dundee Fleet Management Recognition Scheme introduced	2013/14			See Measure 6		
	Measure M4, cont.	Traffic Management Vehicle Fleet Efficiency	► Tackling Idling Bus Emissions	DCC City Development Department (Transportation Division)		2011+	► Traffic Regulation Conditions within the city centre. ► 'No-idling' signs on bus routes. ► Driver Training/Awareness Raising	Small	Opportunities were investigated as part of Air Quality Low Emission Charter (Reported in AQAP 2012, Appendix 2). National Express Dundee and Stagecoach have invested in in-vehicle monitoring systems and vehicles with auto-shutoff technology	2012+	
4 Cont	Measure M4, cont.	Promoting low emission transport •	► Low Emission Zones (LEZ) for buses	DCC City Development Department (Transportation Division)		2013	► Investigate the Traffic Regulation Conditions for LEZ in City Centre. ► Route choice for clean buses see Park & Ride facilities	High	Opportunities being investigated as part of Air Quality Low Emission Charter. (Reported in AQAP 2012, Appendix 2) It is no longer necessary to pursue Traffic Regulations Conditions for LEZ in the city centre as the Transport (Scotland) Act 2019 which was enacted in October 2019 contains provisions that will enable local authorities to introduce and enforce LEZ's. see Measure 5 re Park and Ride Facilities	Med Term, 2015-2016+	

		Promoting low emission transport			Bus Emission Modelling being undertaken to test likely improvements associated with various scenarios including possible LEZ for buses by 2017	2013/14			Model of main City Centre Bus Corridor set up to model the impact of the following low emission Scenarios: S1 – 2017 All Buses Euro V S2 – 2017 All Buses Euro VI S3 – 2017 All Buses & HGVs Euro V S4 – 2017 All Buses & HGVs Euro VI Modelling Report of the above was completed in July 2015. A summary of findings available in Appendix C of 2016 Air Quality Annual Progress Report. The NMF and subsequent NLEF process will include this area during the appraisal process for determining appropriate designs for the development of Dundee's Low Emission Zone.	Completed	
										2020+	

	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
5	Measure M5: DCC will explore provision of Park and Ride facilities that do not have adverse impact on air quality	Alternatives to private vehicle use	► Provision of Park and Ride (P&R) facilities	DCC City Development Department (Transportation Division) & Tayside and Central Scotland Transport Partnership (TACTRAN)			► Report on identification and prioritisation of P&R facilities ► Implementation of scheme ► Passenger numbers	Medium	The Tay Cities Deal was announced in 2018 and did not include Park & Ride facilities, however it may be included within a review of strategic transport projects by Transport Scotland. During 2019 Dundee City Council supported neighbouring Fife Council's successful bid for LEZ complimentary measure funding to progress with the Tay Bridge Park & Ride project. The funding obtained will update previous work carried out in order to proceed with necessary planning application work in 2020.		
6	Measure M6: DCC will introduce measures to reduce emissions from Heavy Goods Vehicles	Freight and delivery management	► Perth & Dundee Retail Freight Consolidation Centre	DCC City Development Department (Transportation Division) & TACTRAN		2011+	► Implementation of scheme ► Vehicle fleet in the AQMA ► Study for the alternate system of retail freight	Small	Opportunities being investigated as part of Air Quality Low Emission Charter (See AQAP2012 Appendix 2) The production of a freight consolidation plan and provision of a small-scale freight consolidation centre has not been progressed.	Long term	
6 cont.	Measure M6 cont.	Freight and delivery management	► Freight Quality Partnership (FQP)	DCC City Development Department (Transportation Division) & TACTRAN			► Implementation of partnership ► Changes in hourly profile of HGVs in AQMA	Small	Dundee is included as part of TACTRAN's Regional Freight Quality Partnership The production of a freight consolidation plan and provision of a small-scale freight consolidation centre has not been progressed.	Long term	
6 cont.		Freight and delivery management			A freight routing planning tool will be launched by TACTRAN which should encourage HGVs to follow appropriate routes	Jan-13			The TACTRAN Freight Planning Tool was established in 2013.		

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6 cont.		Freight and delivery management			Dundee is participating in a pan European project (ENCLOSE) investigating city logistics with carbon and emission reduction as important factors under investigation	2013			The Dundee Sustainable Urban Logistics Plan (SULP) was developed to give legacy post ENCLOSE project in terms of energy efficient and 'green' city logistics. The Plan was approved by the City Development Committee on 27/10/2014.	completed	
6 Cont		Vehicle Fleet Efficiency			ECO Stars Dundee Fleet Management Recognition Scheme being introduced in 2013 Funding to continue the scheme will be applied for on an annual basis through the AQAP grant scheme.	2013			Dundee ECO Stars Fleet Recognition Scheme was successfully launched on the 13th December 2013 with 12 inaugural members. This is a fleet accreditation system that acknowledges greener fleets. The Corporate Air Quality Steering Group intends to seek funding for future years. Dundee City Council received funding from the Scottish Government's Air Quality Support Funding to allow continuation of the ECO Stars scheme for larger commercial vehicles and the separate scheme for Taxis and Private Hire Vehicles. Using the new national Framework Agreement, TRL was appointed in June 2019 to deliver these schemes for Dundee City Council. By the end of 2019 there were 188 members (7188 vehicles) in the commercial scheme, while membership of the Taxi & Private Hire Vehicles scheme 17 (515 vehicles) in the scheme for Taxi & Private Hire Vehicles.	Ongoing	A number of participating members are now demonstrating working towards operating cleaner /greener fleets.
		Promoting Low Emission Transport			Match funding for feasibility study for Ultra Low Emission Vehicles (ULEV) / Zero Emission Vehicles (ZEV) deliveries in 2015/16 FY				A Freight Consolidation business plan was prepared and although there were initial discussions with a potential operator to develop a small scale freight consolidation centre in the city, this has not been progressed.		

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
7	Measure M7: DCC will seek improvements in emissions standards, including NO ₂ and PM ₁₀ for the council fleet and public service vehicles	Promoting Low Emission Transport	►Development of Green Procurement Strategy ►To set target for Euro category/fuel type	►DCC Corporate Fleet Manager ►DCC Environment Department			►Approval of Strategy (Asset Management Plan) ►Average age fleet and Euro category, fuel type	Small	► See also Measure 14 The Fleet Section within Dundee City Council continue to replace older vehicles in its fleet with newer less polluting vehicles. By the end of 2019, there were 116 electric vehicles in its fleet. Charging infrastructure is planned at the Marchbanks depot to prepare for the arrival of the 2 pure electric refuse collection vehicles, 2 pure electric mini buses and one electric	2014+	

									sweeper expected to arrive by Summer 2020.		
		Promoting Low Emission Transport			The development of an Asset Management Plan which will incorporate environmental issues as part of the replacement criteria	2013/14			The Switched-on Towns and Cities funding has allowed DCC to purchase 56 electric vehicles. Of this, 13 have been delivered and deployed throughout the council depots and car pools.	ongoing	
		Promoting Low Emission Transport			Initial discussions for 2013/14 vehicle/plant replacement programme has identified improved emissions as a high priority	2013/14			See Measure 7 above		
		Vehicle Fleet Efficiency			Participation in ECO Stars Dundee-Fleet Management Recognition Scheme	2013			DCC Fleet Achieved 4-Star Rating in ECO Stars Recognition Scheme as recognition for reducing the environmental impact of the Council's Fleet.	Ongoing	

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
8	Measure M8: DCC in consultation with the Taxi Liaison Group will explore means of reducing emissions from taxis and private car hire vehicles in AQMA	Promoting low emission transport	<ul style="list-style-type: none"> ▶ Enforce No idling for taxis ▶ Increase cleaner taxis 	<ul style="list-style-type: none"> ▶ DCC Support Services ▶ DCC City Development Department ▶ Tayside Police 			<ul style="list-style-type: none"> ▶ Traffic Regulation Conditions for 'No Idling' of taxis ▶ Explore the potential of introducing Licensing Conditions for minimum taxi Euro category for certain classes of vehicles ▶ Provide 'No Idling' street signage ▶ Monitoring for idling in place 	Medium	<p>The ECO Stars fleet recognition scheme for taxis/private hire vehicles maintained its membership at 17 (517 vehicles) by the 31st December 2019.</p> <p>There are 97 pure electric taxis in Dundee. This equates to 18% of the taxi trade which is a 5% increase from 2018.</p>	Ongoing+	
8		Transport Management			As part of Air Quality Low Emission Charter,	2013/2014+			No further action in regards to the investigation of a traffic regulation condition for no idling for taxis is proposed		

					continue to investigate opportunities for: Traffic Regulation Conditions for 'No Idling' of taxis;						
8		Vehicle Fleet Efficiency			Explore the potential of introducing Licensing Conditions for minimum taxi Euro category for certain classes of vehicles;				In 2015 DCC introduced a condition within the school transport contracts requiring any successful applicant to become a member of the ECOSTARS Scheme for Taxi Operators by July 2016 In 2016 DCC introduced policies that any applications for new Taxi Licences & Private Hire Car would only be granted on the condition that only an electric vehicle from the approved list can be placed on service.	ongoing	
		Traffic Management			Provide 'No Idling' street signage; Monitoring for idling.				Not progressed as not included in 2019/20 funding application.		
		Promoting low emission transport			DCC also looking at collaborative work with taxi operators in developing an Electric Vehicle trial for taxis in Dundee				There are 97 pure electric taxis in Dundee. This equates to 18% of the taxi trade which is a 5% increase from 2018		
8		Vehicle Fleet Efficiency			Expansion of ECOSTARS to include taxi / private hire operators	2014/15			Funding to expand ECO Stars in Dundee to include taxi and private hire vehicle operators was obtained in 2014/15, with the scheme formally launched on the 11 th March 2015. The number of members of the ECO Stars Dundee taxis/private hire vehicles scheme was maintained at 17 (517 vehicles) during 2019.		

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
9	Measure M9: DCC will investigate to initiate a Roadside Emission Testing (RET) scheme inside the AQMA and routes leading to AQMA	Traffic Management	► To investigate into the establishment of a programme of RET in the AQMA	►VOSA ►Tayside Police ►DCC Environment Department.			►Approval/non-approval of RET scheme ►Traffic Regulation Conditions if necessary.	Small	Project on hold until funding identified. Funding not sought for 2019/20 so no progress to year end.		
		Traffic Management			To seek funding to undertake feasibility study of introduction of RET	2015/16+				Project on hold Funding not sought for 2019/20 so no progress to year end.	

10	Measure M10: DCC will ensure local air quality is fully integrated into the Local Development Plan (LDP) process and development scenarios are appropriately assessed with respect to the potential impacts on air quality	Policy Guidance And Development Control	<ul style="list-style-type: none"> ► Provide AQ policy within Local Development Plan with commitment to improve air quality ► Produce air quality Supplementary Planning Guidance (SPG) 	<ul style="list-style-type: none"> ► DCC City Development (Planning Division) ► DCC Environment Department. 			<ul style="list-style-type: none"> ► Adoption of Local Development Plan ► Adoption of Air Quality SPG 	Small	The 2019 Local Development Plan was adopted in February 2019. Along with this Plan the Supplementary Guidance Air Quality & Land Use Planning document was also adopted.	2015 +	
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No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
11	Measure M11: DCC will ensure effective co-ordination between climate change and air quality strategies and action plan measures	Policy Guidance And Development Control	<ul style="list-style-type: none"> ► Strategy to be developed to improve co-ordination between climate change and air quality strategies and action plan measures 	<ul style="list-style-type: none"> ► DCC Corporate Planning Department ► DCC City Development - (Property Division) ► DCC Environment Department. 		2011+	<ul style="list-style-type: none"> ► Implementation of co-ordination strategy ► Reciprocal attendance of air quality and climate change working groups/steering committees 	Small	<p>The Sustainability & Climate Change Manager sits on the Corporate Air Quality Steering Group and also the Dundee Low Emission Zone Delivery Group to ensure synergy between AQ and CC policy. Dundee City Council declared a climate emergency in June 2019 and have worked through the Dundee Partnership to develop and launch in December 2019 a citywide Climate Action Plan in support of the transition to a net-zero and climate resilient future. In line with Scottish Government and Council objectives for CAFS, tackling air quality and decarbonising transport are key objectives of this plan. Of the 62 actions in the plan, 18 are related to air quality.</p> <p>In an effort to co-ordinate and deliver a clear and consistent message for the city, a 'Sustainable Dundee' brand was established under which all sustainability and climate change initiatives are promoted.</p>	ongoing	
12	Measure M12: DCC will continue its active involvement and support of TACTRAN	Policy Guidance And Development Control	<ul style="list-style-type: none"> ► Regularly attend meetings ► Provide feedback ► Provide necessary support 	<ul style="list-style-type: none"> ► DCC City Development Department. (Transportation Division) 			<ul style="list-style-type: none"> ► Number of TACTRAN policies and proposals implemented 	n/a	<p>DCC continue to support TACTRAN and focus on implementation of Regional Transport Strategy.</p> <p>Ongoing support of TACTRAN, with TACTRAN included in the Dundee LEZ Delivery Group. Funding obtained in 2018 was utilised in 2019 to incorporate the LEZ into the Regional Transport Model which is due to be completed in early 2020.</p>	On-going 2020	
13	Measure M13: ► DCC will promote the uptake and use of cleaner and/or alternative fuels where possible for transport	Promoting low emission transport	<ul style="list-style-type: none"> ► Determine strategy/advise note and annually review content 	DCC City Development Department (Transportation Division)			<ul style="list-style-type: none"> ► List of any promotion campaigns planned / implemented ► Number / proportion of cleaner vehicles 	Small	<p>See also measures 7 and 14</p> <p>The first of three multi-storey charging hubs opened in October 2019 at Green Market. The hub consists of 10 new chargers, controller-receiver technology which allows dynamic load managements all of which are located under solar canopies.</p>	2012+ on-going	

	► DCC will explore the development of electric charging point infrastructure		► Install Electric Charging Facilities in Car Parks				within fleets or clean fuels infrastructure in each financial year ► Number of electric charging points installed		<p>During 2019 the Drive Dundee Electric campaign continued its successful engagement with current and potential electric vehicle (EV) owners (both in public and business). This included the filming of episodes of the YouTube show 'Fully Charged' at the V&A Dundee in July. Local taxi drivers, businesses, council spokespeople, and local EV users were interviewed during the event. Various charging hubs throughout the city were visited, while Drive Dundee Electric had a stall at the event and used the opportunity to promote EV charging facilities.</p> <p>In 2019 Drive Dundee Electric worked together with DC Thompson and SWARCO to create three sponsored pieces for the Evening Telegraph and The Courier publications. All three pieces were well received from readers. DC Thompson first ran a questionnaire to allow Drive Dundee Electric and SWARCO decide on subject matters so we could focus on the education gaps when it comes to EV's, charging infrastructure and the benefits to air quality. Further sponsored pieces are proposed for 2020-21.</p> <p>The Drive Dundee Electric website was refreshed with new content and designed with a user-friendly format. The @DundeeElectric twitter account is still active and we now have 1549 followers.</p>		
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No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
14	Measure M14: DCC will establish and implement a rolling programme for replacing older more polluting vehicles with newer cleaner vehicles, which comply with the prevailing EURO standard	Vehicle Fleet Efficiency	► Development of Green Procurement Strategy	► DCC Corporate Fleet Manager		2011+	Number / proportion of new/improved vehicles within fleets in each financial year	Small	See also Measure 7 The Fleet Section within Dundee City Council continue to replace older vehicles in its fleet with newer less polluting vehicles. By the end of 2019, there were 116 electric vehicles in its fleet.	2014+	
15	Measure M15: DCC will improve the Council's vehicle fuel consumption efficiency by better management of	Vehicle Fleet Efficiency	► Develop fleet management plan to improve fuel efficiency.	► DCC Corporate Fleet Manager ► DCC Environment Department		2011+	► Implementation of smarter driver programme ► Preparation / Implementation of Fleet management plan	Small	See Also Measures 7,13,14 There are now a number of vehicles fitted with GIS route optimisation software to try and remove excess mileage.	2014+	

	fleet activities							►10% reduction by 2013 for staff business travel and Corporate Fleet		Ongoing as above	
		Vehicle Fleet Efficiency	► Investigate fleet activities in relation to pollution hotspots e.g. waste management fleet routes		Analysis of the information from the telematics system in relation to idling time etc.	2014+					

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
16	Measure M16: DCC will promote options for better travel planning amongst Dundee City Council employees	Promoting Travel Alternatives	<ul style="list-style-type: none"> ► Review DCC Travel Plan ► DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work 	DCC City Development (Transportation Division)	Funding being sought in 2017/18 to review Corporate Travel Plan and update it in line with CAFS actions	2011+	<ul style="list-style-type: none"> ► Implementation of DCC Travel Plan & review of progress with targets ► 10% reduction by 2013 in staff business travel ► % DCC employees walking/cycling to work 	Small	<p>See also Measure 3 ,17 & 22</p> <p>A Staff travel survey was completed in October 2019 in conjunction with Climate Week. Over 700 responses were received. Key figures included that while 55% of respondents drove a car to work, 16% travelled to work by bike or on foot. 40% travelled less than 5 miles to work.</p> <p>Work was then undertaken to create revised guidance to staff and to formalise staff travel policies. A draft Staff Travel Plan was created and is proposed to be launched in 2020.</p>	2015+ 2020	
17	Measure M17: DCC will continue to promote and encourage their employees to consider the use of bicycles in their daily duties by providing cycle usage mileage	Promoting Travel Alternatives	<ul style="list-style-type: none"> ► Continue to investigate and develop the use of various incentive schemes ► Develop cycling strategies ► DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work 	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> ► % DCC employees walking/cycling to work ► Incorporate cycling measures within DCC Travel Plan in line with the new DCC Cycling Strategy to be developed 	Small	<p>See also Measures 3,16 & 22</p> <p>There is an ongoing promotion of cycling through the provision of the Tax-Free Bikes scheme in partnership with Cyclescheme and also monthly cycling breakfasts offered to those who cycle in to the city centre. Both regular and electric bicycles are available for use by staff members.</p> <p>An updated Dundee Cycling Strategy was launched in September 2019. This refresh of the 2016 strategy sets out how Dundee City Council will deliver its duties, powers and policies to enable and encourage more people to cycle more often.</p>	2014+	
18	Measure M18: DCC will assess the Council's energy needs, make recommendations and implement	Policy Guidance And Development Control	► DCC to implement annual energy reduction action plan	DCC City Development (Property Division)			► 10% reduction by 2013	Small	The Council continues to invest in a range of energy management projects within its non-domestic building estate. Physical improvements to building fabric, installation of energy efficiency measures and behavioural change campaigns have led to year on year reductions in carbon emissions from the Council's buildings. A	On-going	

	reductions of carbon emissions which result in corresponding reductions of NO ₂ and PM ₁₀ .								17% reduction in CO ₂ e emissions from Council property was achieved between 2017/18 and 2018/19 and a cumulative reduction of almost 40% was achieved in the last 10 years. The Council also continues its substantial investment in decarbonising its own fleet of vehicles and business travel footprint. Through replacing its older diesel fleet with electric vehicles, the Council has seen a reduction in CO ₂ e of almost 25% in the last 10 years. This is expected to substantially increase in the near future as the organisation completes its fleet decarbonisation and invests in electric refuse collection vehicles and green hydrogen generation. It is anticipated that with the introduction of 85 new electric vehicles and especially HGV's there will be over 6,000 tonnes reduction in 2020		
					New annual aspirational reduction target of 5% until 2020	2013+					
19	Measure M19: DCC to promote and support localised energy generation that doesn't compromise Air Quality in private households	Promoting Low Emission Plant	► Determine strategy/advice note and annually review content	► DCC Housing Department ► Solar Cities		2011+	► List of any promotion campaigns planned/implemented	Small	The Non-Domestic Energy Efficiency Scheme (NDEES) Basket 2 is progressing to implementation. Basket 3 draft options being complied. The Regional Performance Centre for Sport Energy Centre went operational in Oct 2019.	ongoing	
20	Measure M20: DCC will provide the public with relevant air quality information.	Public Information	► Investigating the potential for uptake of an air pollution information system, such as Air Alert ► Improvements to AQ website information ► Make up to date air quality information available to the public through Councils digital website	► DCC Environment Department ► DCC City Development (Transportation Division)			► Investigate funding sources ► Implement Air Alert or similar service ► Improved rating of website in peer review ► Make AQ information available through Council's website ► Real Time Travel Information	Small	The 2019 Annual Progress Report was submitted in June 2019 following approval and is available for the public to view and download via the Dundee City Council website. Historical air quality monitoring data for the 2006 – 2015 period is available on the DCC website. Links to real-time and historical air pollutant data from Dundee's continuous automated monitors presented on the Scottish Air Quality (SAQ) website are also contained on the DCC website. NO ₂ Annual Mean diffusion tube data for 2012-2018 for sites across Dundee became available on the SAQ website during 2019. There is an increased level of air quality information becoming available on the Scottish Air Quality website which can be accessed through the DCC website	2012+	
20		Public Information			► Complete improvements to AQ website	2013/15			Improvements ongoing (see above)		

	Public Information			► Develop Database to enable DCC staff to better manage large volume of AQ data and make it more readily available to stakeholders	2013/15				See measure 30.		
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No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
21	Measure M21: DCC will continue its work to increase uptake and implementation of School and Workplace Travel Plans, particularly where likely to impact on the AQMA	Promoting Travel Alternatives	<ul style="list-style-type: none"> ► DCC to ensure all relevant commercial planning applications have travel plan conditions applied in accordance with current best practice. ► DCC to produce Travel Plan Strategy which: <ul style="list-style-type: none"> ► Details procedure for tracking & possible requirement for enforcement of planning conditions requiring travel plans. ► Details procedure for Travel Plan Information storage at DCC 	<ul style="list-style-type: none"> ► DCC City Development Department, (Planning Division, Transportation Division) ► DCC Education Department 			<ul style="list-style-type: none"> ► Develop Business Case for Travel Co-ordinator & identify potential funding streams. ► Number of new travel plans (need to show in terms of walking cycling - % of journeys saved). ► Identify & report on any Air Quality related Travel Plan targets from travel plan strategy and any relevant Travel Planning Team targets. ► Promotion of Travel Plan initiatives e.g. Sustrans' Travel Smart ► Implement & regularly review Travel Plan Strategy 	Small	School Travel Plans are discussed at the School Travel and Pupil Safety Working Group with commitment from Executive Director of Children & Families Service to support schools in developing their own travel plans.	2014+	
	Measure M22: DCC will continue working in partnerships with TACTRAN and local active travel networks to ensure that walking and cycling initiatives	Promoting Travel Alternatives	<ul style="list-style-type: none"> ► Identify walking & cycling schemes (such as Park & Cycle). ► Identify walking & cycling promotional 	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> ► Number of walking and/or cycling initiatives in operation. ► Establish the use of cycle monitoring counts at key points on cycle routes 	Small	See also Measures 3,16 & 17 A Sustrans Cycling Strategy Officer was embedded within Dundee City Council and supported the updating and renewing of Dundee's Cycling Strategy in October 2019 and has worked toward the publication of Bike Life report for Dundee. Further work is required in respect to cycle count	2014+	

22	are promoted and supported in Dundee		opportunities around Dundee City					<p>data. A new counter was installed on walk/cycle way on Tay Road Bridge in September 2019 to add to existing counters present at Arbroath Road, Douglas Terrace and Lochee.</p> <p>The Docks Way path opened in early 2019. Further improvements were carried out near to Dawson Park and Caird Park in 2019 and while the Kingsway crossings opened.</p> <p>Engagement work on Northern Links and Broughty Ferry active travel initiatives was carried out during 2019.</p>			
					Preliminary Works to achieve off-road cycle route around the Port of Dundee	2013/14			<p>Permission to commence on Nynas land to undertake preliminary works to achieve off-road route around Port of Dundee</p> <p>The work on upgrading the cycle path and to introduce lighting through the Dock which commenced in Oct 2018 was completed in early 2019, with the section known as the 'Docks Way Path'.</p>	2019	
					Provide Pedestrian Bridge over the railway at Riverside Drive / Seabraes	2013/14			<p>Transportation Division & City Engineers completed works at Riverside Drive / Seabraes Pedestrian Bridge, including pedestrian crossing improvements on Riverside Drive.</p>	Completed	
23	Measure M23: DCC will continue to work with transport providers to support and promote increased uptake of public transport modes	Transport planning and infrastructure	<ul style="list-style-type: none"> ► Promote schemes such as the SQUID card including Dundee and surrounding towns. ► Introduce smart and integrated ticketing 	► DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> ► % uptake schemes ► Passenger numbers 	Small	<p>Dundee City Council continued to help promote public transport as an attractive and affordable alternative to private car use. In 2019 Dundee City Council teamed up again with local bus operators to offer a 20p fare promotion (Holiday Hop) to children travelling with adults during the Easter, summer, and October school holiday periods. This initiative has seen a huge increase in the number of children travelling by bus during the holiday periods compared to before the promotion was introduced. Compared to baseline data collected in 2016, in 2019 there were 74% (Easter), 94% (2019) and 86% (October) increases</p>	ongoing	
		Transport planning and infrastructure			NEC SMART Ticketing to Go Live 2014	2014			Completed	July 2014	
24	Measure M24: DCC will continue to work in partnership with other organisations to promote and implement energy efficiency measures in Dundee	Policy Guidance and Development Control	► To implement an Annual Action Plan of energy efficiency measures.	► DCC City Development (Property Division)			<ul style="list-style-type: none"> ► Implementation of Annual Energy Efficiency Action Plan. ► Report reductions in energy use 	Small	<p>The Council has now completed its second phase of installation of energy conservation measures within its own estate. In total £4.4 million has been spent on 26 sites with guaranteed energy savings of around £500,000 per annum. This has resulted in annual savings of 1,800 tonnes of CO2.</p>	ongoing	
25	Measure M25: DCC Environment Department will comment upon planning	Policy Guidance and Development Control	► The Environment Department (Environmental Protection Division) will	► DCC City Development (Planning Division) ► DCC Environment			► Total number of planning applications consultations responded to in each calendar year	Small	<p>Officers from the pollution team within Community Safety and Protection check the weekly planning lists and provide comments to the Planning Officers on all applications that may adversely impact on local air quality. 41 planning applications were responded to for the</p>	n/a	Suggestions on best practice and mitigation measures advised accordingly.

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	applications to ensure that all relevant air quality issues are highlighted and mitigation measures are considered wherever possible		continue to work with City Development (Planning Division) as Statutory Consultees	Department			(changed from financial year) ▶ Percentage of the total planning applications responded to with air quality conditions/ assessments		2019 calendar year.		
					See Measure 10 regarding the introduction of Supplementary Planning Guidance						
26	Measure M26: DCC will enforce statutory legislation to control smoke, dust, fumes or gas emissions from commercial and domestic premises which are causing a nuisance or are prejudicial to health	N/A	▶ DCC will continue to monitor and enforce statutory legislation in this area	▶ DCC Environment Department.			▶ Number of relevant complaints in each financial year. ▶ % resolved	Small	For period up to 31st December 2019, officers investigated a total of 23 relevant complaints of which 91% had been resolved and two were still being investigated.	N/A	
27	Measure M27: DCC will enforce relevant legislation to reduce the burning of commercial and domestic waste	N/A	▶ DCC will continue to monitor and enforce legislation in this area	▶ DCC Environment Department			▶ Number of relevant complaints ▶ % resolved	Small	During 2019 officers investigated 10 complaints of smoke from commercial waste burning and 20 complaints of smoke from domestic waste burning (bonfires) under Environmental Protection and Clean Air legislation. 100% of these complaints have been resolved.	N/A	
28	Measure M28: DCC will promote composting in a bid to reduce pollution from domestic bonfires	Policy Guidance and Development Control	▶ Reinroduce discount/promotion campaign for compost bins	▶ DCC Environment Department		2011+	▶ % uptake composting bins	Small	DCC continue to promote composting as a means of sustainable management of garden waste within the City & as part of the green waste rollout we are offering compost bins at a competitive price to residents with free delivery if they opt to home-compost rather than purchase a permit for the chargeable garden waste collection service which comes into effect 2nd March 2020.	Ongoing	

No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction In the AQMA	Progress to Date	Estimated Completion Date	Comments relating to emission reductions
29	Measure M29: DCC will continue to monitor a range of air pollutants throughout	Public Information	▶ Continued support for Dundee Air Quality Monitoring Network	▶ DCC Environment Department.			▶ Number of monitoring sites ▶ Identification of sites in new hotspots ▶ Monitoring data	N/A	Dundee City Council has one background automated continuous monitoring site (Mains Loan), and automated continuous monitors located at Broughty Ferry Road, Meadowside, Logie Street, Lochee Road, Seagate, Whitehall St, Albert Street / Arbroath Road, Myrekirk	N/A	

	Dundee and make the monitoring information freely available to the public in an easily understandable form						via DCC website		<p>Terrace and Stannergate.</p> <p>The existing Particulate Monitors at the Seagate, Meadowside and Whitehall Street monitoring stations were upgraded in March 2019 using Scottish Government grant funding. This has expanded the pollutant monitoring capacity at these locations to include PM_{2.5} & PM₁₀.</p> <p>In 2019 there were 88 NO₂ diffusion tube sites across the city. These are located at receptor locations adjacent to busy roads and junctions, and also locations identified for collecting background levels. See Measure 20 re availability of air quality monitoring data on both the Dundee City Council and Scottish Air Quality websites.</p> <p>The 2019 Annual Progress Report was submitted to the statutory consultees following Committee approval in June 2019. This is available for the public to view and download via the Dundee City Council website.</p>		
30	<p>Measure M30: DCC will ensure that all air quality monitoring data reported to the public is both accurate and precise by implementing quality control measures</p>	Public Information	<p>►Regular calibrations and filter changing of continuous monitoring equipment in DCC's air quality stations</p> <p>►At least annual audit of air quality stations' equipment</p> <p>►Appropriate use and care of NO₂ diffusion tubes regularly deployed around the City Council area.</p>	► DCC Environment Department/ Tayside Scientific Services			<p>► QA/QC measures adopted</p> <p>► Auditing reports</p>	N/A	<p>External consultants undertake calibrations and filter changing of the continuous monitoring equipment in the air quality monitoring stations. Filter changes for the Osiris meters (indicative PM₁₀ meters) are undertaken on a quarterly basis and each receive an annual calibration. Two, six monthly audits of continuous monitoring stations and equipment are undertaken by external consultants with these auditing reports received. The Public Analyst used participates in the AIR NO₂ Proficiency Testing (AIR NO₂ PT) Scheme and field inter-comparison study for the NO₂ diffusion tubes. The NO_x analyser at the Mains Loan background automated continuous monitoring site became affiliated with the DEFRA AURN (automatic urban and rural network) monitoring group in 2017 and now is subject to an alternative auditing procedure. All of the above feeds in to the quality control and data ratification process.</p>	N/A	
					Develop Database to enable DCC staff to better manage large volume of AQ data and make it more readily available to stakeholders	2013/15			The database is now available for use.	completed	
31	<p>Measure M31: DCC will establish additional monitoring sites across the City in</p>	N/A	►DCC will continue to carry out and report on their statutory duties under	► DCC Environment Department			► Poor air quality sites identified monitored and dealt with through the process of Review & Assessment.	N/A	<p>► See Measure 29 regarding pollutant monitoring locations.</p> <p>New locations for diffusion tube monitoring that commenced in January 2019 included sites on Clepington Road, Dock Street / Trades Lane, lower Princes Street, Meadowside Halls, Princes</p>	N/A	See Section 3.1.2. , Table A.3 and Appendix B of the main report for monitoring results for the new tube locations in 2019.

	locations where poor air quality is suspected		the Review & Assessment process for LAQM				► Additional monitoring sites established as and when required		<p>Street, Seagate, and South Marketgait / Nethergate. These sites were chosen due to:</p> <p>(1) being at locations that have not been monitored previously with new receptors potentially being introduced due to recent planning applications or,</p> <p>(2) early results from the AQ City Model produced by SEPA through the NMF indicating possible exceedance at a location not previously measured.</p> <p>These sites replaced 7 sites at which monitoring was discontinued due to measured NO₂ annual mean concentrations being well below the AQO and were showing a decreasing trend, were no longer needed for AQ modelling verification, or unnecessary for long term trend analysis. The sites where monitoring was discontinued were at Commercial St (84), Gray's Lane (3), Muirton Road (2), Pitkerro Road (42), King Street (3), Dock Street (12), and Meadowside (28).</p> <p>The existing Particulate Monitors at the Seagate, Meadowside and Whitehall Street monitoring stations were upgraded in March 2019 using Scottish Government grant funding. This has expanded the pollutant monitoring capacity at these locations to include PM_{2.5} & PM₁₀.</p>		
32	Measure M32: DCC will implement road traffic counts to inform the review and assessment process.	Traffic Management	► Undertake classified traffic counts	► DCC Environment Department			► Classified traffic counts undertaken	N/A	<p>The updating and expansion of the Paramics Traffic model for Dundee continued throughout 2019. In May 2019, a number of additional traffic counts were undertaken to provide additional data for areas within the model not covered by the National Modelling Framework traffic counts undertaken in 2017.</p> <p>There were no traffic counts undertaken specifically for air quality purposes during 2019. The updated traffic model was nearing completion at the end of 2019 and will be used in conjunction with the SEPA AQ City model in 2020 to guide the design of the Dundee LEZ.</p>	Ongoing	

3. Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Section 3 sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

Dundee City Council undertook automatic (continuous) monitoring at 10 sites during 2019. **Table A.1** in **Appendix A** shows the details of the sites. There are currently three different PM₁₀ monitors (CM3, CM13, CM16) co-located at the Broughty Ferry Road site to help improve data accuracy and validity. During 2019 the particulate analysers (BAM) at the roadside sites of Whitehall Street, Seagate and Meadowside were replaced with new analysers (Palas Fidas 200) capable of monitoring both PM₁₀ and PM_{2.5}, on March 19th, 20th and 21st respectively.

National monitoring results are available at <http://www.scottishairquality.co.uk/>.

Maps showing the location of the monitoring sites are provided in **Appendix A**. Further details on how the monitors are calibrated and how the data has been adjusted are included in **Appendix C.1**.

3.1.2 Non-Automatic Monitoring Sites

Dundee City Council undertook non-automatic (passive) monitoring of NO₂ at 88 sites during 2019. **Table A.2** in **Appendix A** shows the details of the sites.

Maps showing the location of the monitoring sites are provided in **Appendix A**. Further details Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in **Appendix C.1**. Seven (7) new diffusion tube sites were added to the network at the start of 2019 at the following locations where new residential properties had been introduced, proposed or identified close to busy roads:

- Clepington Road (164) (DT 232)
- Dock St / Trades Lane (DT 233)
- Lower Princes Street (DT 237)
- Meadowside Halls (DT 238)
- Princes Street (185) (DT 239)
- Seagate (36-40) (DT 236)
- South Marketgait / Nethergate (DT 235)

The diffusion tube results for the entire network were reviewed in December 2019 (when only 10 months data was available) in order to identify those monitoring locations where concentrations were: well below the AQO; showing a decreasing trend; no longer needed for model verification; or, were unnecessary for long term trend analysis.

The following four tube locations were discontinued at the end of 2019:

- Albert Street (81) (DT 187)- well below the AQO
- Clepington Road (164) (DT 232) - well below the AQO
- Meadowside Halls (DT 238) – well below the AQO
- St Andrews Street (26) (DT 56) – well below the AQO

The above four diffusion tubes were redeployed at the beginning of 2020 in areas where new residential developments are planned (see **Section 4.1**) close to busy roads and junctions in Dundee.

- Clepington Road / Mains Loan
- Dock St (Customs House)
- Dock Street / Gellatly Street
- Victoria Street (Eagle Mill)

The annual concentrations from the new diffusion tubes deployed in 2020 will be reported in the Annual Progress Report 2021.

3.2 Individual pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for annualisation and bias. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO₂)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO₂ annual mean concentrations for the past 5 years with the air quality objective of 40µg/m³.

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in **Appendix B**. Locations marked in green were new in 2019.

The procedure specified in paragraphs 7.77 to 7.79 of statutory technical guidance LAQM.TG(16) was used to estimate the concentrations at the nearest receptor. The annual mean background concentration used in the calculation was 21.6 µg/m³ (from DT 185) for city centre sites, and 17.7 µg/m³, (the average of concentrations from five urban background locations (DT 7, DT 223, DT 155, DT 185, and DT 82) for the remainder. The above methodology has been shown in previous reports to under-estimate NO₂ concentrations at building façades in street canyon environments. Potential exceedances (> 36 µg/m³) of the NO₂ annual mean that were identified at relevant locations near the monitoring locations are shown in **Table 3.1**.

Table 3.1 Locations of Potential Exceedances of the NO₂ annual mean AQO in 2019

Site ID	Location	2019 Bias Adjusted NO ₂ Annual Mean (µg/m ³)	2019 Predicted annual mean NO ₂ concentration at Receptor (µg/m ³)
DT 205	West Marketgait/Old Mill (23)	47.1	46.9
DT 31	Lochee Rd (140) Traffic Lts	46.2	45.4
DT 37	Logie St (114)	47.1	45.4
DT 70	Victoria Rd/Hilltown	48.3	42.7
DT 190	Seagate (97)	41.0	41.0
CM 5	Seagate Romon	44.5	39.6
DT 156	Dock St (57)	44.2	39.6
DT 217	Seagate (99)	37.9	37.9
DT 30	Lochee Rd (138)	45.8	37.4
DT 149	Meadowside (Romon) Average	37.7	37.3
CM 4	Lochee Rd Romon	43.0	37.1
DT 224	Seagate (112)	37.1	37.1
DT 158	Lochee Rd (Romon) Average	41.5	36.8

The highest NO₂ annual mean concentrations predicted at relevant receptors were on the North West arterial route (Lochee Road and Logie Street); the West Marketgait, which is part of the inner ring road; the main bus corridor; and, part of the trunk road network close to the city centre (i.e. Dock Street 57). There are no specific measures within the AQAP currently targeting the inner ring road or trunk roads however these areas are included in air quality city model and scenario testing as a part of the LEZ process. All of these locations are within the AQMA.

Long term trends in NO₂ concentrations at automatic monitors with at least 5 years data capture are shown in **Figure A.3a**. All show an improving trend except the urban background

site at Mains Loan which shows a slight worsening trend. An analysis of apparent trends in the 75 monitoring locations with at least 5 years data is shown in **Figure A.3b**.

Concentrations at the majority of sites (72) show an improving trend or have remained stable. The greatest improvements have been in Meadowside where action plan measures, i.e. to increase the separation distance between the active carriageway and receptors, has been successful in reducing concentrations. Small worsening trends are evident on the main bus corridor (at Whitehall Crescent), the A92 trunk road (Broughty Ferry Road 129) and at the urban background site at Mains Loan.

An overview of how NO₂ annual mean concentrations are improving in different areas across the city can be seen in maps and graphs shown in **Appendix C.2**. In addition, **Figure C.30** compares the ranked annual mean NO₂ concentrations measured at fifty long-term monitoring sites for 2009, 2011 (the year of the action plan), and 2019. This shows an overall reduction in the highest monitored concentration and in the number of long-term sites which exceed the objective.

Table A.4 in **Appendix A** compares the ratified continuous monitored NO₂ hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m³, not to be exceeded more than 18 times per year. No exceedances of the hourly mean objective were identified at automatic monitoring locations in 2019. No exceedances of the hourly mean objective were indicated by the diffusion tube annual mean concentrations in 2019 as none exceeded 60µg/m³. The Lochee Road automatic monitor had two occasions when the concentration was over 200µg/m³. Analysis showed these occurred in the winter months, during peak traffic times. The pattern of these occurrences is similar to those in previous years.

Previously the only location where the hourly mean objective has been exceeded is at the Lochee Road automatic monitor. However there have been no exceedances of the objective there for the past 6 years. **Figure A.4** shows the long-term trend in the 99.8th percentile concentration of hourly means at Lochee Road. The trend line for the 14-year period that hourly levels have been monitored has been drawn using an Excel simple regression statistical program and shows a negative value for the first time since the AQMA for the hourly objective was declared in 2013. Diffusion tube monitoring and dispersion modelling show that the automatic monitor is not sited in the most polluted location. It is considered that there should be an established downward trend before revoking the AQMA for the hourly mean objective.

3.2.2 Particulate Matter (PM₁₀)

Table A.5 in **Appendix A** compares the ratified and adjusted monitored PM₁₀ annual mean concentrations for the past 5 years with the air quality objective of 18µg/m³.

Table A.6 in **Appendix A** compares the ratified continuous monitored PM₁₀ daily mean concentrations for the past 5 years with the air quality objective of 50µg/m³, not to be exceeded more than 7 times per year.

No exceedances of the PM₁₀ annual mean objective (18µg/m³) were predicted during 2019, within the current AQMA.

Annual mean PM₁₀ concentrations at monitoring sites with at least five years data are shown in **Figure A.5a** and **Figure A.5b**, with an analysis of the trends shown in **Figure A.5c**. An improving trend is evident at all current monitoring locations. The largest decreasing trend is evident at Stannergate (Osiris). Traffic is not the only source of PM₁₀ in the Stannergate area, and two nearby SEPA permitted processes surrendered their licences during 2017. The second largest decreasing trend has been in Meadowside where action plan measures to increase the separation distance between the active carriageway and receptors may have contributed to the decrease in concentrations.

The PM₁₀ daily mean objective (50µg/m³, not to be exceeded more than 7 times per year) was met at all current monitoring locations during 2019. Albert Street OSIRIS recorded 7 potential exceedances of the daily mean objective.

Dry, and relatively still conditions along with easterly winds, bringing pollutants from the rest of the UK and continental Europe appear to have contributed to some of these exceedances². Easterly winds and misty conditions have also been present during many of the other recorded exceedances of the daily mean in Dundee.

Figure A.6a shows the frequency of the daily mean PM₁₀ concentrations greater than 50µg/m³ recorded at the real-time monitors. Where the measured data capture is less than 85%, LAQM.TG(16) advises that, it is more appropriate to express short-term concentrations as percentile values for comparison with the objective. Expressing short-term concentrations as 98.08th percentile values provides easier inter-year comparison of data and examination of possible trends. **Figure A.6b** and **Figure A.6c** shows trends for those analysers with at least 5 years data capture. Trend lines have been drawn using an Excel simple regression statistical program.

The majority of automatic monitoring sites with at least 5 years data capture show an improving trend. The trend in concentrations at Mains Loan background site remains relatively stable with small increasing trends evident at Myrekirk Terrace, and Seagate. However, it is hard to draw conclusions from the analysis of trends in short-term PM₁₀ exceedances because apart from the influence of annual transboundary events (usually in March and April) most are caused by transient and sometimes unpredictable events such as road works, fires, road gritting and, demolition and construction activities.

² www.scottishairquality.scot/news/index?id=595

3.2.3 Particulate Matter (PM_{2.5})

Table A.7 in Appendix A compares the ratified and adjusted monitored PM_{2.5} annual mean concentrations for the past 5 years with the air quality objective of 10µg/m³.

As of the 1st of April 2016, the Scottish Government introduced the World Health Organisation guideline value for PM_{2.5} into Scottish legislation with an annual mean objective of 10µg/m³ to be achieved by 2020. Scottish local authorities are now required to include PM_{2.5} in the LAQM review and assessment process. Dundee City Council began monitoring for PM_{2.5} at the background site at Mains Loan on the 25th October 2017, a second PM_{2.5} analyser was installed at the Lochee Road monitoring station on the 23rd March 2018. Dundee City Council were successful in obtaining funding from the Scottish Government to establish a further three PM_{2.5} monitors in the city, (Whitehall Street, Seagate and Meadowside), which were installed on March 19th, 20th and 21st 2019 respectively.

Table A.7 in Appendix A compares the ratified and adjusted monitored PM_{2.5} annual mean concentrations for the past 5 years with the air quality objective of 10µg/m³. No exceedances of the annual mean objective were predicted.

The remaining roadside PM₁₀ monitoring locations represent relevant areas for PM_{2.5}, so the methodology described in LAQM.TG (16) (paragraph 7.109) has been used to estimate the PM_{2.5} annual mean concentrations. **Table 3.2** shows those monitoring locations where the PM_{2.5} objective has been estimated to be exceeded (highlighted in **bold**) since the new requirement was introduced.

Table 3.2 Estimated PM_{2.5} Annual Mean Concentrations 2015 to 2019

Year	2015	2016	2017	2018	2019
<i>Scottish Annual Mean Objective</i>	10	10	10	10	10
Logie St (Osiris)	10.9	9.7	10.2	13.2	10.8
Myrekirk Tce (Osiris)	12.9	10.9	8.4	9.5	8.6
Albert St (Osiris)	13.3	10.8	10.0	12.3	10.6
Stannergate (Osiris)	18.8	14.6	9.8	8.3	9.3

Potential exceedances were estimated at the following locations in 2019:

- Albert Street;
- Logie Street (Osiris);

Under section 83(1) of the Environment Act 1995, local authorities have a duty to designate any relevant areas where the air quality objectives are not (or are unlikely to be) met, as Air Quality Management Areas (AQMAs). No guidance is currently available on how to predict forward PM_{2.5} monitoring concentrations to 2020. The concentrations shown in **Table 3.2** are estimated concentrations at indicative analysers using the assumed ratio of PM_{2.5} to PM₁₀ of 0.7 as described in LAQM.TG (16) (paragraph 7.109). However, analysis of the actual ratio of PM_{2.5} to PM₁₀ at monitored roadside sites in Dundee in 2019 gives an average ratio of 0.51. Applying this ratio to the results in **Table 3.2** would bring all the estimated concentrations below 10µg/m³, which would indicate, along with actual monitored PM_{2.5} concentrations, that an AQMA for PM_{2.5} is not required.

3.2.4 Sulphur Dioxide (SO₂)

Dundee City Council does not currently monitor SO₂.

3.2.5 Carbon Monoxide, Lead and 1,3-Butadiene

Dundee City Council does not currently monitor any of these pollutants.

4 New Local Developments

4.1 Road Traffic Sources

As part of the Cleaner Air for Scotland Strategy 2015 discussed in **Section 2.2**, the Scottish Government, Scottish Environmental Protection Agency (SEPA) and Transport Scotland have developed a city air quality model of Dundee's road traffic emissions as part of the National Modelling Framework (NMF). The NMF is intended to include an air quality assessment tool, guidance documents, data requirements, best practice and 'web-based interactive data products' aimed at providing a standardised approach to modelling air quality at regional and local level. It is expected that the local NMF model will provide a significant proportion of the quantitative evidence required within the detailed options appraisal process for the National Low Emission Framework (NLEF). A comprehensive traffic data collection exercise was undertaken in 2017 in Dundee as shown in previous reports. This was updated in 2019 as part of the wider traffic survey to develop a city-wide traffic model, which will be used to test some of the low-emission zone options. Preliminary results from the updated city model using the 2019 traffic data are shown in **Figure C.31**. The model predicts some kerbside exceedances of the NO₂ annual mean objective at several locations on the north-east arterial route, where roadside monitoring by DCC does not show any exceedances. The model does not predict any kerbside exceedances on the West Marketgait or the Lochee Road / Logie Street sections of the north-west arterial route where some of the highest monitored roadside NO₂ concentrations have been recorded. The results shown in Figure C.31 are provisional and a full report on the modelling exercise is awaited from SEPA.

Under this section the Council is required to identify any of the following which are new:

- Narrow congested streets with residential properties close to the kerb;
- Busy streets where people may spend one hour or more close to traffic;
- Roads with a high flow of buses and/or HGVs;
- Junctions;
- New roads constructed or proposed;
- Roads with significantly changed traffic flows; and
- Bus or coach stations.

Since the last Annual Progress Report in 2019, there have been no new:

- Narrow congested streets with residential properties close to the kerb;
- Busy streets where people may spend one hour or more close to traffic;
- Roads with a high flow of buses and/or HGVs;
- New roads constructed or proposed; and
- Bus or coach stations.

Junctions (including busy roads and junctions in Scotland)

The APR 2017 identified locations (roads with greater than 10,000 vehicles per day (vpd) with relevant exposure within 10m) where although diffusion tube monitoring results are below the annual mean objective for NO₂ it has not been possible to assess whether the PM₁₀ objectives are at risk of being exceeded at these locations. These are:

- Hawkhill (Nr Blackness Primary School); and,
- Dock St close to the busy junction of the A92T and the A991.

It is not anticipated that the PM₁₀ or PM_{2.5} objectives would be breached in the Hawkhill area as none of the reference equivalent automatic monitors in Dundee recorded an exceedance of these objectives in 2019. For the area of Dock Street close to the A92T / A991, modelling

was carried out as part of a planning application for a proposed mixed use development (including flats from first floor)³, although exceedances of the NO₂ annual mean objective were predicted up to third floor, no exceedances of the objectives PM₁₀ or PM_{2.5} were predicted at receptors in the vicinity.

The APR 2016 reported the results of modelling studies which identified new exceedances of the annual mean objectives for NO₂ and/or PM₁₀ at relevant receptors at the following six locations, all except the Forfar Road / Clepington Road junction are part of the trunk road network.

- A92 (between Broughty Ferry Road and Greendykes Road (PM₁₀ & NO₂)(**Fig C.25**);
- Scott Fyfe roundabout (A92/A972/B961/B959/C223) (PM₁₀)(**Figure C.19**);
- Claypotts junction (A92/B978) (PM₁₀);
- A972T (Kingsway – Pitkerro Road roundabout) (NO₂) (**Figure C.19**);
- A90 (north of the Kingsway) (NO₂) (**Figure C.19**); and
- Forfar Road (A929) / Clepington Road (C244) junction (PM₁₀ & NO₂). (**Figure C.19**);

The NO₂ results were checked by diffusion tube monitoring (results shown in **Figure C.19** and **C.25** and **Table A.3**). The monitored concentrations at each of these locations did not breach the annual mean objective.

Each of the eight areas above are within the network of roads and junctions studied by the NMF for Dundee. **Figure C.31** shows no exceedances of the annual mean objective for NO₂ were predicted by the model at these locations. SEPA have indicated that PM₁₀ will be considered as part of the NMF process⁴. These areas are all within the boundary of the current AQMA. There are no specific AQAP actions, currently being pursued, that target trunk road traffic in these areas. The local authority intends to liaise with Transport Scotland as part of the NLEF process to discuss whether any additional actions are possible to reduce pollutant concentrations at relevant locations close to the trunk road network in Dundee.

Annual road count data (as AADT) from the council's long term Road Traffic Reduction Act (RTRA) Sites from 2005-2019 are presented in **Table C.6**. **Table C.7** shows the percentage growth at each of the sites since 2005. Only one site, Tay Bridge, has experienced a significant increase (>10%) in traffic flows over this time. There is currently no relevant exposure within 10m of this location. Consequently, updated assessments of NO₂ and PM₁₀ are not required for those RTRA Sites where there is relevant exposure. No 2019 data for the traffic monitoring site Broughty Ferry Road (east of Dalgleish Rd) was available at the time of writing. Generally, findings at these sites have been considered indicative of traffic growth for local roads in the city.

New roads constructed or proposed

New junctions and roads have been constructed as part of the Central Waterfront Development Masterplan 2001 - 2031, described previously in the Progress Report 2005. The closest receptors to these roads are currently located on Dock Street, which is already an identified exceedance area. New residential developments are proposed within the Central Waterfront Area and the need for review and assessments of the new roads and junctions will be examined in subsequent reports as necessary. Traffic counts of the main roads in the completed road network were undertaken in 2017 as part of the data collection exercise for the city air quality model. Planning applications were approved in 2017 for the 7 storey mixed use developments including new residential exposure at Site 2 (17/00337/FULM⁵) and Site 6 (17/00113/FULM⁶) within the waterfront area as shown in

³ http://idoxwam.dundeeccity.gov.uk/idoxpa-web/files/2F64D6E6C1FBD1605B559D04E3C9BB02/pdf/18_00988_FULL-09_-_AIR_QUALITY_ASSESSMENT-907467.pdf

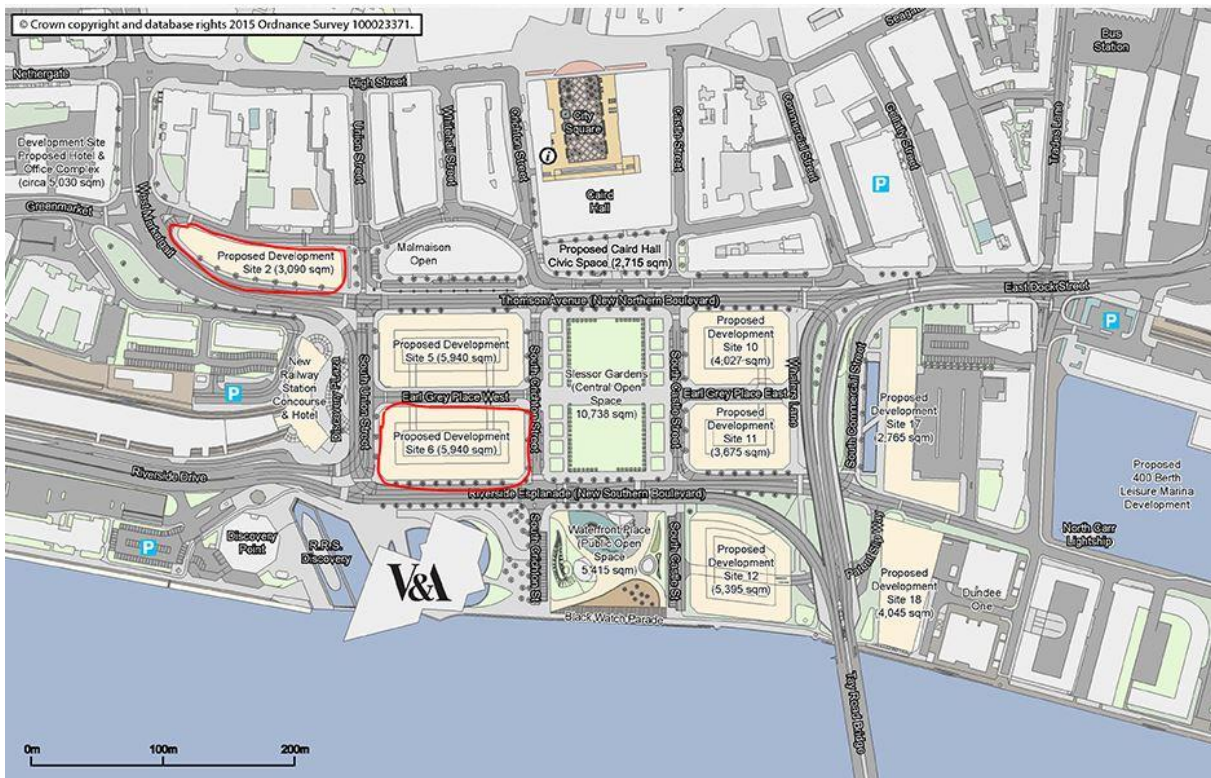
⁴ Personal Communication from Colin Gillespie SEPA and Jamie Landwehr DCC

⁵ http://idoxwam.dundeeccity.gov.uk/idoxpa-web/files/51E78CF29BF1FA7B11FA4846A09E8068/pdf/17_00337_FULM--807610.pdf

Figure 4.1. The planning consents for these developments included conditions requesting air quality assessments for new and existing residential receptors. The assessment of Site 6 was completed in 2018, using traffic count information from the city model, the results of the dispersion modelling indicated that NO₂, PM₁₀ and PM_{2.5} concentrations were predicted to be below the AQOs at all locations of relevant exposure across the development.⁷ The results of the air quality assessment of Site 2 will be included in future APR when they become available.

NO₂ diffusion tube monitoring close to Site 2 began in 2017 (DT 218) (see **Figure C.22**). The vacant site is currently being used as a ground level temporary carpark. The monitoring result for this site was below the objective in 2019 (29.3µg/m³). NO₂ diffusion tube monitoring close to Site 6 began in 2018 (DT 228). The monitoring result for this site was below the objective in 2019 (25.4µg/m³).

Figure 4.1 Central Waterfront Site Map



4.2 Other Transport Sources

None of the following transport sources have been identified as new since the Annual Progress Report 2019:

- Airports;
- Locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m;
- Locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m; and
- Ports for shipping.

⁶ http://idoxwam.dundee.gov.uk/idoxpa-web/files/FE1C82D9CFE9655FE288ACED2CC262BD/pdf/17_00113_FULM--780127.pdf

⁷ http://idoxwam.dundee.gov.uk/idoxpa-web/files/3C595B6A9A40C075CF512D927F9B0C9/pdf/17_00113_FULM-AIR_QUALITY_ASSESSMENT_-_DUNDEE_WATERFRONT-902402.pdf

4.3 Industrial Sources

Under this section the local authority is required to identify any of the following which are new:

- **Industrial installations:** new or proposed installations for which an air quality assessment has been carried out;
- **Industrial installations:** existing installations where emissions have increased substantially or new relevant exposure has been introduced;
- **Industrial installations:** new or significantly changed installations with no previous air quality assessment;
- Major fuel storage depots storing petrol;
- Petrol stations; and
- Poultry farms.

Industrial sources are regulated by the Scottish Environment Protection Agency (SEPA) under the Pollution Prevention and Control Regulations (PPC). Local authorities also have controls over smaller industrial and commercial sources, largely through the Clean Air Act and its associated control of stack heights. As a result of these controls, there should be few sources that may be relevant to local authorities under the Local Air Quality Management (LAQM) regime. The majority of these sources will have been addressed during previous rounds of Review and Assessment and the focus is, therefore, on new installations and those with significantly changed emissions or new exposure.

The technical guidance (LAQM.TG(16)) states that industrial sources are unlikely to make a significant contribution to annual mean concentrations, but may contribute to elevated short-term concentrations, which may lead to exceedances of the short-term air quality objectives (e.g. 15-minute mean for SO₂, 1-hour mean for NO₂ or 24-hour mean for PM₁₀). The assessment should consider the potential impact of specific industrial processes or chemical storage for all of the regulated pollutants. Generally, industrial sources most likely to require further assessment work are those that emit NO₂, PM₁₀ and potentially SO₂.

A list of industrial processes in the city which are regulated by the Scottish Environmental Protection Agency (SEPA) is provided in **Appendix C.4**. This Appendix also includes a screening assessment of all the SEPA regulated processes and contains updated information provided by SEPA.

▪ **New or Proposed Installations for which an Air Quality Assessment has been Carried Out**

SEPA were consulted regarding any changes that meet the above criteria at SEPA regulated sites. The consultation responses are summarised in **Appendix C.4**. In addition, the council approved planning applications for two proposed installations which were accompanied with air quality assessments during 2019.

[19/00188/FULL | Construction of Peak Power Generation and Energy Storage Facility with a generating output capacity of 16MW | Land To South Of Nobel Road Gourdie Industrial Estate Dundee.](#)⁸

[18/00766/FULL | Construction of a small-scale gas-fired energy reserve facility for the generation of up to 19.9MW of electricity. | Land At Track To North Of Jack Martin Way Claverhouse East Industrial Estate Dundee.](#)⁹

⁸ http://idoxwam.dundee.gov.uk/idoxpa-web/files/C7D4270923440B68C3F11B953C8E76A2/pdf/19_00188_FULL-05_-_AIR_QUALITY_REPORT-942838.pdf

⁹ http://idoxwam.dundee.gov.uk/idoxpa-web/files/51BB85186BDDFAED38A82B08251205AC/pdf/18_00766_FULL-10B_-_REVISED_AQIA-1009936.pdf

Both the above air quality assessments for these proposed gas-fired installations reflected the limited operating hours associated with these types of facilities, and did not predict any exceedances of the relevant air quality objectives. Conditions were attached to both planning consents restricting the type of fuel, emissions, exit velocity, stack height and annual operating hours.

- **Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced**

SEPA were also consulted regarding any changes that meet the above criteria at SEPA regulated sites. The consultation responses are summarised in **Appendix C.4**, and no existing installations with substantially increased emissions or new relevant exposure were identified.

- **New or Significantly Changed Installations with No Previous Air Quality Assessment**

SEPA were consulted regarding any changes that meet the above criteria at SEPA regulated sites. The consultation responses are summarised in **Appendix C.4**. The council was consulted on the permit below which did not have an air quality assessment.

PPC/B/1180866 - Dover Fueling Solutions UK Limited, Unit 3 Baker Road, West Pitkerro Industrial Estate, Dundee, DD5 3RT - Activity: Coating and Paint Process

The above process is located within an industrial estate with no relevant receptors nearby. Discussion with the local SEPA office established that this is an existing facility and the requirement for a permit was due to a threshold change. The only LAQM pollutants of concern associated with the activity were particulates. These are contained within the process and the building. No further assessment was requested.

- **Major Fuel (Petrol) Storage Depots**

The assessment considers benzene, with respect to the 2010 objective. There are no major fuel (petrol) storage depots within the Local Authority area.

- **Petrol Stations**

The assessment considers benzene with respect to the 2010 objective. Large petrol stations, where the annual throughput is more than 2000m³ of petrol (2 million litres per annum) and with a busy road nearby (i.e. >30,000 annual average daily traffic flows) require consideration where there is relevant exposure (e.g. residential properties) within 10m of the pumps. All existing petrol stations have been assessed previously and there are no residences within 10m of the pumps.

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

- **Poultry Farms**

Farms housing in excess of: 400,000 birds if mechanically ventilated; 200,000 birds if naturally ventilated; and, 100,000 birds for any turkey unit, require consideration if there is residential exposure within 100m of the poultry units. The assessment needs to consider only PM₁₀.

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

4.4 Commercial and Domestic Sources

Under this section the Council is required to identify any of the following which are new since the last Annual Progress Report:

- Biomass¹⁰ combustion plant – individual installations (50kW to 20MW);
- Areas where the combined impact of several biomass combustion sources may be relevant;
- Areas where domestic solid fuel burning may be relevant; and
- Combined Heat and Power (CHP) Plant.

Since the APR 2019, there have been no new biomass combustion installations nor areas identified where the combined impact of several biomass sources may be relevant. Smoke Control Orders cover most of the local authority area and there are currently no areas identified with significant solid fuel use, though enquiries/complaints to the Council about domestic solid fuel burning, and planning applications for the installation of wood/solid fuel burning stoves are on the increase.

The requirement to consider CHP Plant is a new requirement that local authorities have had to report since the APR 2016. No new CHP plants were identified during 2019.

4.5 New Developments with Fugitive or Uncontrolled Sources

Under this section the Council is required to identify any of the following potential sources of fugitive or uncontrolled particulate matter, which are new:

- Landfill sites;
- Quarries;
- Unmade haulage roads on industrial sites;
- Waste transfer stations etc.; and
- Other potential sources of fugitive particulate emissions.

APR 2018 Section 4.3, discussed sources of fugitive or uncontrolled particulate matter, proposed within the port area, associated with oil and gas decommissioning activities (PPC/A/1151594). SEPA have indicated in their responses contained in **Appendix C.4** that the application has been withdrawn by the applicant. It is possible that the proposed activities will still be carried out but potentially under the Waste Management Licensing Regime instead. The activities will still be regulated by SEPA, but there is the potential for other fugitive dusts to arise from uncontrolled sources across the licensed area, with increased movements of heavy vehicles over unmade ground.

The findings of a study into potential sources of elevated PM₁₀ concentrations at the Stannergate monitoring station (CM 18) to the east of the port, were reported in APR 2018. Road traffic, wind-blown dust from road surfaces, port activities, sea salt and secondary PM from the European continent were identified as potential sources influencing PM₁₀ concentrations at this location. Measured PM₁₀ concentrations at Stannergate (CM 18) reduced since 2017 and are now estimated to be below both the annual mean and daily mean objectives. Monitoring will continue around the port to determine whether further action plan measures are necessary.

¹⁰ Note (from Defra FAQ 2009): the term 'biomass' strictly applies to all solid fuels made from plants, i.e. coal, smokeless fuels, wood, straw etc... However, the term biomass is now frequently taken to be synonymous with renewable fuels such as wood and straw. For the purposes of air quality review and assessment the strict definition of biomass is applicable.

5 Planning Applications

Dundee City Council have been advised by the LAQM Helpdesk that this section is not mandatory.

6 Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

Potential exceedances of the NO₂ annual mean objective (40µg/m³) were predicted at the following receptor locations, within the AQMA:

- Lochee Road;
- Logie Street;
- Seagate;
- Victoria Road; and
- West Marketgait.

An analysis of trends in NO₂ annual mean concentrations at monitoring locations with at least 5 years data indicates that the majority of sites show an improving trend with the greatest improvement taking place in Meadowside where action plan measures have been successful in reducing concentrations. Small worsening trends are evident on the main bus corridor (at Whitehall Crescent), on the A92 trunk road (at Broughty Ferry Road (129)), and at the urban background site at Mains Loan.

No exceedances of the NO₂ hourly mean objective were identified by automatic monitors or indicated by diffusion tubes in 2019. Lochee Road is the only area of the city where the hourly AQO has been exceeded previously. Although exceedances of the hourly mean continue to be recorded here, for the past 6 years the objective has been achieved (18 exceedances are allowed). The trend line in the 99.8th percentile concentration showed at negative value for the first time since the AQMA for the hourly mean was declared in 2013. Until there is an established downward trend the AQMA for the hourly mean AQO should remain.

No exceedances of the PM₁₀ annual mean objective (18µg/m³) were predicted during 2019.

An improving trend is evident at all current monitoring locations. The largest decreasing trend is evident at Stannergate (Osiris). Traffic is not the only source of PM₁₀ in the Stannergate area, and two nearby SEPA permitted processes surrendered their licences during 2017. The second largest decreasing trend has been in Meadowside where action plan measures to increase the separation distance between the active carriageway and receptors may have contributed to the decrease in concentrations.

The PM₁₀ daily mean objective (50µg/m³, not to be exceeded more than 7 times per year) was met at all monitoring locations during 2019.

The majority of automatic monitoring sites with at least 5 years data capture show an improving trend. The trend in concentrations at Mains Loan background site remains relatively stable with small increasing trends evident at Myrekirk Terrace, and Seagate. However, it is hard to draw conclusions from the analysis of trends in short-term PM₁₀ exceedances because apart from the influence of annual transboundary events (usually in March and April) most are caused by transient and sometimes unpredictable events such as road works, fires, road gritting and, demolition and construction activities.

No monitored exceedances of the PM_{2.5} annual mean objective (10µg/m³) were recorded in Dundee during 2019. Potential exceedances of the PM_{2.5} annual mean objective (10µg/m³) have been estimated from the PM₁₀ annual mean concentrations using the methodology described in LAQM.TG(16). Potential exceedances were estimated at the following locations:

- Albert Street;
- Logie Street (Osiris);

However, applying a local PM_{2.5}/PM₁₀ ratio to the monitored results would bring each of the above estimated concentrations below the annual mean objective. This along with the actual monitored PM_{2.5} concentrations support the case that an AQMA is not required for this pollutant.

6.2 Conclusions relating to New Local Developments

The work being undertaken as part of CAFS to set up an air quality model of Dundee's road traffic sources was highlighted in **Section 4.1** and preliminary results from the model discussed. Areas of the city meeting the criteria for assessment for PM₁₀ are listed and these will be included in the city model in due course. An air quality assessment for a new flatted development close to Arbroath Road is discussed, no exceedances of the relevant Air Quality objectives were predicted. An air quality assessment is awaited for a proposed mixed use development (including residential and other receptors) within the Central Waterfront Area. This will be reviewed in subsequent reports when available. Traffic flows from the council's Road Traffic Reduction Act Sites from 2019 were reviewed, no new areas requiring assessment were identified. There were no new 'other transport' sources identified in 2019.

One new industrial source (Part B process) was identified in 2019. The council was consulted on the application for a coating and paint process as discussed **Section 4.3**: this is an existing facility and the requirement for a permit was due to a threshold change. The only LAQM pollutants of concern associated with the activity were particulates and these were contained within the process and the building. Planning applications were approved in 2019 for two gas-fired peaking plants. The air quality assessments for these installations reflected the limited operating hours associated with this type of facility and did not predict any exceedances of the relevant air quality objectives. Conditions were attached to the planning consent restricting the type of fuel, emissions, exit velocity, stack height and annual operating hours.

Commercial and domestic sources were reviewed in **Section 4.4**. No new areas or installations meeting the criteria were identified in 2019.

There is the potential for an increase in uncontrolled fugitive particulate matter as a consequence of additional movements of heavy vehicles over unmade ground associated with oil and gas decommissioning facilities proposed within the port. Activities within the port were previously identified as contributing to elevated PM₁₀ concentrations measured at the Stannergate monitoring station. There are ongoing changes within the port area, and although this location has seen a reduction in the measured concentrations of PM₁₀, monitoring will continue to determine if further action plan measures are needed.

6.3 Proposed Actions

The 2019 monitoring data did not identify the need to declare an AQMA for any additional pollutants or objectives. None of the new diffusion tubes deployed in 2019 identified a new area of exceedance outside of the known hotspots, although the monitored concentration at the new tube installed to the north of the North East Arterial Route, (DT 239 Princes Street (185)) was close to exceeding the annual mean objective (39.9 µg/m³). The following actions are proposed following the review and assessment of monitoring data and new developments:

- Continue monitoring of fugitive PM₁₀ sources around the port area;

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- Review the air quality assessment awaited for the mixed use development in the Central Waterfront Area;
- Report on any new or significantly changed SEPA prescribed process;
- Provide a further update on the progress of the NMF model for Dundee;
- Report on the new diffusion tubes installed in 2020. Four diffusion tubes were installed in areas where new residential developments are planned or have been identified close to busy roads and junctions in Dundee;
 - Clepington Road / Mains Loan
 - Dock St (Customs House)
 - Dock Street / Gellatly Street
 - Victoria Street (Eagle Mill)
- Monitor planning applications for new pollution sources, relevant exposure and creation of 'street canyons';
- Liaise with Transport Scotland as part of the NLEF process to discuss whether any additional actions are possible to reduce pollutant concentrations at relevant locations close to the trunk road network in Dundee;
- Consider whether specific action plan measures are possible to target the identified exceedance areas on the West Marketgait (part of the inner ring road);
- Implement the action plan measures being taken forward in 2020/21; and,
- Submit the next Annual Air Quality Progress Report in 2021.

Appendix A: Monitoring Results

Table A.1 Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? (Y/N)	Monitoring Technique	Distance to Relevant Exposure? (m) ⁽¹⁾	Distance to Kerb of Nearest Road (m) ⁽²⁾	Inlet Height (m)	
CM 3	Broughty Ferry Road Rollalong	Urban Industrial	341970	730977	PM ₁₀	Y	TEOM	0	6.88	2.93	
					NO ₂		Chemiluminescent ^g		6.63	2.97	
CM 13	Broughty Ferry Road Partisol	Urban Industrial	341971	730978	PM ₁₀	Y	Partisol	0	6.11	2.84	
CM 4	Lochee Road Romon	Roadside	338861	730773	NO ₂	Y	Chemiluminescent ^{b f}	2.15 (2.24)	1.00 (1.15)	1.95 (1.77)	
					PM ₁₀		Beta Attenuation (BAM) _f		2.24	1.15	2.06
					PM ₁₀ & PM _{2.5}		Fidas ^f		1.98	1.36	2.21
CM 9	Logie Street Osiris	Kerbside	338176	731298	PM ₁₀	Y	Osiris (nephthalometer)	1.65	0.57	3.31	
CM 12	Mains Loan	Urban Background	340972	731893	NO ₂	Y	Chemiluminescent ^c	0	n/a	1.80	
					PM ₁₀ & PM _{2.5}		Fidas ^e			2.43	
CM 5	Seagate Romon	Roadside	340487	730446	NO ₂	Y	Chemiluminescent ^b	2.00	1.10	1.70	
					PM ₁₀		Beta Attenuation (BAM)			2.06	
					PM ₁₀ & PM _{2.5}		Fidas ^h			1.81	1.37
CM 2	Union Street Rollalong ^g	Roadside	340235	730091	NO ₂	Y	Chemiluminescent ^b	3.55	1.64	2.92	
					PM ₁₀		Beta Attenuation (BAM) ^a		1.64	3.00	
CM 6	Whitehall Street Romon	Roadside	340278	730156	NO ₂	Y	Chemiluminescent ^b	1.86	3.26	1.80	
					PM ₁₀		Beta Attenuation (BAM)		1.79	3.33	2.06
					PM ₁₀ & PM _{2.5}		Fidas ^h		1.63	3.52	2.62

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Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? (Y/N)	Monitoring Technique	Distance to Relevant Exposure? (m) ⁽¹⁾	Distance to Kerb of Nearest Road (m) ⁽²⁾	Inlet Height (m)
CM 14	Meadowside Romon	Roadside	340243	730653	NO ₂	Y	Chemiluminescent ^d	0.42	3.59 (1.60) ⁱ	2.26
					PM ₁₀		Beta Attenuation (BAM)		3.65 (1.63) ⁱ	2.17
					PM ₁₀ & PM _{2.5}		Fidas ^h	0.79	3.53	2.63
CM 15	Albert Street Osiris	Kerbside	341090	731105	PM ₁₀	Y	Osiris (nephthalometer)	1.54	0.89	3.15
CM 16	Broughty Ferry Road Osiris	Urban Industrial	341970	730977	PM ₁₀	Y	Osiris (nephthalometer)	0	7.15	3.00
CM 17	Myrekirk Osiris	Roadside	335438	731740	PM ₁₀	Y	Osiris (nephthalometer)	0.4	14.00	3.11
CM 18	Stannergate Osiris	Roadside	343322	731073	PM ₁₀	Y	Osiris (nephthalometer)	1.93	1.16	3.11

Notes:

- (1) "0" if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property or representative of a residential area).
- (2) N/A if not applicable. 'Kerb' is taken as being the edge of the carriageway with flowing traffic
- ^a During 2013 equipment was updated from TEOM to BAM
- ^b During 2013 equipment was updated from model ML 9841A to model API T200
- ^c Equipment is model Thermo 42i
- ^d Equipment is model ML 2041
- ^e During 2017 equipment was updated from TEOM to Palas Fidas
- ^f On 23rd March 2018 monitoring station upgraded with new enclosure and Palas Fidas replaced BAM. NO_x inlet position changed slightly old measurements shown in brackets
- ^g API T200 NO_x analyser relocated from closed Union Street Station in January 2016
- ^h During March 2019 equipment was updated from BAM to Palais Fidas
- ⁱ Measurements amended to reflect change in pavement width, see Erratum in Appendix C.5 APR2020, old measurements shown in brackets
- ^g CM2 Union Street – was discontinued in January 2016

Figure A.1 Automatic Monitoring Sites 2019

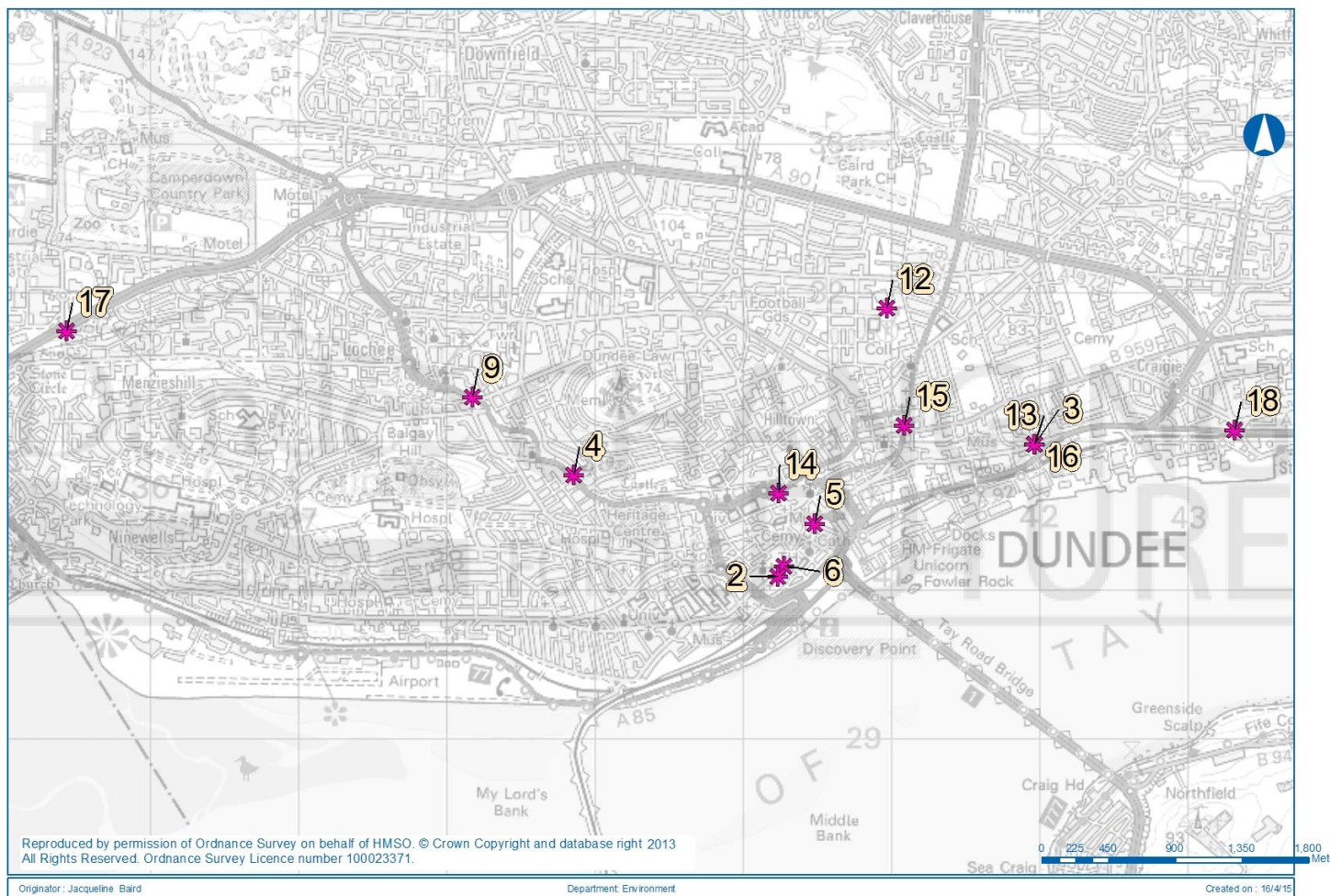


Table A.2 Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type ⁽¹⁾	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) ⁽²⁾	Distance to Kerb of Nearest Road (m) ⁽³⁾	Tube collocated with a Continuous Analyser ?
DT 92	Abertay 2	R	340019	730612	NO ₂	Y	PDT	2.01	1.95	N
DT 179	Albert St (15) (Facade)	R	341092	731121	NO ₂	Y	PDT	0.25	2.04	N
DT 180	Albert St (15) (Rdside)	K	341091	731121	NO ₂	Y	PDT	1.75	0.54	N
DT 167	Albert St (191)	K	341161	731535	NO ₂	Y	PDT	2.7	0.62	N
DT 187	Albert St (81)	K	341113	731265	NO ₂	Y	PDT	2.95	0.47	N
DT 5	Arbroath Rd (13)	K	341111	731070	NO ₂	Y	PDT	2.52	0.73	N
DT 223	Broughty Ferry Rd – Lower (Cyclesign)	UB	343530	730937	NO ₂	Y	PDT	n/a	2.84	N
DT 204	Broughty Ferry Rd (129)	R	342244	731066	NO ₂	Y	PDT	3.57	2.27	N
DT 139	Broughty Ferry Rd (141 Downpipe)	R	343317	731072	NO ₂	Y	PDT	0.2	4.32	N
DT 145	Broughty Ferry Rd (Greendykes)	R	342662	731112	NO ₂	Y	PDT	7.72	4.1	N
DT 7	Balgavies Place	UB	343082	731465	NO ₂	Y	PDT	n/a	n/a	N
DT 9	Birnam Place	UB	337531	730914	NO ₂	Y	PDT	n/a	n/a	N
DT 11	Broughty Ferry Rd (141)	R	343322	731073	NO ₂	Y	PDT	1.98	1.32	N
DT 155	Carolina Court LP6	UB	342353	731058	NO ₂	Y	PDT	n/a	n/a	N
DT 171	Claypotts / Arbroath Rd (502)	R	345347	732080	NO ₂	Y	PDT	5.3	11.2	N
DT 13	Cleington Rd/ Forfar Rd	K	341385	732121	NO ₂	Y	PDT	8.28	0.78	N
DT 232	Cleington Rd (164)	R	340013	732153	NO ₂	Y	PDT	0	1.94	N
DT 188	Commercial St (9)	R	340544	730291	NO ₂	Y	PDT	2.44	2.57	N
DT 84	Commercial St/Dock St (40)	R	340565	730263	NO ₂	Y	PDT	0.17	2.78	N

Site ID	Site Name	Site Type ⁽¹⁾	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) ⁽²⁾	Distance to Kerb of Nearest Road (m) ⁽³⁾	Tube collocated with a Continuous Analyser ?
DT 85	Dock St (21)	R	340524	730216	NO ₂	Y	PDT	0.34	5.13	N
DT 156	Dock St (57)	R	340656	730343	NO ₂	Y	PDT	3.25	2.53	N
DT 233	Dock St/Trades Lane	R	340690	730382	NO ₂	Y	PDT	-0.39	6.14	N
DT 227	Dudhope Crescent Road (40)	K	339830	730619	NO ₂	Y	PDT	1.99	0.83	N
DT 20	Dura St (100)	K	341150	731576	NO ₂	Y	PDT	1.65	0.57	N
DT 214	East Dock Street (26)	R	340725	730417	NO ₂	Y	PDT	0.2	3.7	N
DT 22	Eastport Roundabout	R	340651	730623	NO ₂	Y	PDT	1.56	1	N
DT 83	Forfar Rd (104)	K	341437	732360	NO ₂	Y	PDT	7.68	0.67	N
DT 26	Kingsway East Roundabout	R	343107	731740	NO ₂	Y	PDT	14.3	2.9	N
DT 27	Kingsway/ Mains Loan	R	341124	732468	NO ₂	Y	PDT	15.4	6.2	N
DT 177	Kingsway / Strathmartine Rd (279)	R	339179	732896	NO ₂	Y	PDT	3.63	3.14	N
DT 30	Lochee Rd (138)	K	338936	730680	NO ₂	Y	PDT	2.06	0.44	N
DT 31	Lochee Rd (140) Traffic Lts	R	338927	730685	NO ₂	Y	PDT	0.25	2.22	N
DT 32	Lochee Rd (184)	K	338767	730856	NO ₂	Y	PDT	3.19	0.73	N
DT 158	Lochee Rd (Romon) Average	R	338861	730773	NO ₂	Y	PDT	2.03	1.34	Y
DT 36	Lochee Rd/Polepark Rd	K	339016	730586	NO ₂	Y	PDT	9.21	0.95	N
DT 38	Logie St (98)	K	338252	731258	NO ₂	Y	PDT	n/a	0.84	N
DT 37	Logie St (114)	R	338184	731293	NO ₂	Y	PDT	0.53	1.73	N
DT 39	Loons Rd (1)	R	338211	731293	NO ₂	Y	PDT	0.5	1.9	N
DT 237	Lower Princess St	R	340964	730855	NO ₂	Y	PDT	0	2.44	N
DT 238	Meadowside Halls	R	340281	730586	NO ₂	Y	PDT	0	3.3	N

Site ID	Site Name	Site Type ⁽¹⁾	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) ⁽²⁾	Distance to Kerb of Nearest Road (m) ⁽³⁾	Tube collocated with a Continuous Analyser ?
DT 149	Meadowside (Romon) Average	R	340243	730653	NO ₂	Y	PDT	0.33	3.68 ⁽⁵⁾	Y
DT 42	Muirton Rd (6)	R	338156	731294	NO ₂	Y	PDT	0.3	1.11	N
DT 185	Murraygate (46)	UB	340409	730484	NO ₂	Y	PDT	n/a	n/a	N
DT 189	Myrekirk Rd (29)	R	335420	731726	NO ₂	Y	PDT	5.17	2	N
DT 45	Nethergate (6)	R	340274	730171	NO ₂	Y	PDT	2.51	1.25	N
DT 47	Nethergate (40)	R	340230	730124	NO ₂	Y	PDT	2.72	1.26	N
DT 213	Nethergate (64)	R	340196	730089	NO ₂	Y	PDT	2.4	4.15	N
DT 44	Nethergate (88)	K	340163	730061	NO ₂	Y	PDT	5	0.86	N
DT 46	Nethergate (95)	K	340033	729957	NO ₂	Y	PDT	1.84	0.86	N
DT 48	Nethergate(132) / Marketgait	R	340074	729984	NO ₂	Y	PDT	3.6	1.33	N
DT 239	Princes St (185)	K	341077	731031	NO ₂	Y	PDT	2.4	0.6	N
DT 49	Rankine St (2)	R	338768	730900	NO ₂	Y	PDT	0.4	1.76	N
DT 228	Riverside Esplanade / S. Crichton St.	R	340516	729991	NO ₂	Y	PDT	1.17	2.74	N
DT 54	Seagate (9)	R	340467	730388	NO ₂	Y	PDT	0.9	1.7	N
DT 236	Seagate (36-40)	R	340463	730420	NO ₂	Y	PDT	0.2	2.76	N
DT 190	Seagate (97)	R	340516	730499	NO ₂	Y	PDT	0	2.26	N
DT 217	Seagate (99)	R	340535	730522	NO ₂	Y	PDT	0	2.35	N
DT 224	Seagate (112)	R	340528	730537	NO ₂	Y	PDT	0	2.64	N
DT 159	Seagate(Romon) Average	R	340487	730446	NO ₂	Y	PDT	1.81	1.29	Y
DT 55	Soapwork Lane	R	340099	730650	NO ₂	Y	PDT	0	3.51	N
DT 218	South Marketgait (Lampost 18)	R	340291	729979	NO ₂	Y	PDT	n/a	2.58	N

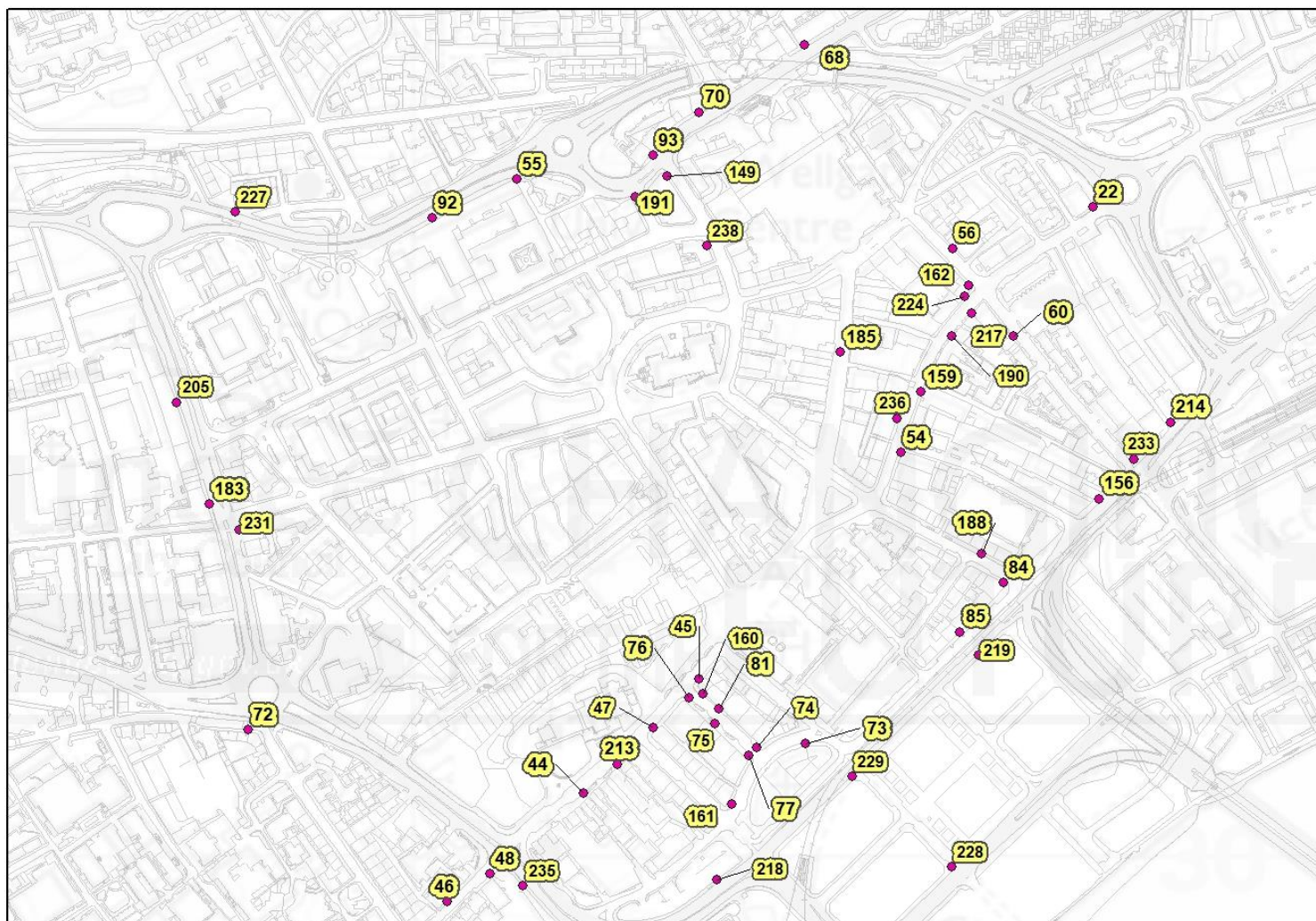
Site ID	Site Name	Site Type ⁽¹⁾	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) ⁽²⁾	Distance to Kerb of Nearest Road (m) ⁽³⁾	Tube collocated with a Continuous Analyser ?
DT 235	South Marketgait/Nethergate	R	340516	730584	NO ₂	Y	PDT	0.15	2.88	N
DT 151	South Rd (1 Denbank)	R	335188	731528	NO ₂	Y	PDT	0.28	1.79	N
DT 162	St Andrews St / Seagate (116)	R	340532	730548	NO ₂	Y	PDT	0.18	2.53	N
DT 56	St Andrews St (26)	K	340516	730584	NO ₂	Y	PDT	1.77	0.71	N
DT 59	Strathmore Avenue (353)	K	339609	731871	NO ₂	Y	PDT	1.45	0.67	N
DT 219	Thomson Avenue (Street Sign)	R	340542	730194	NO ₂	Y	PDT	1.8	2.2	N
DT 229	Thomson Avenue / S. Crichton St.	K	340421	730078	NO ₂	Y	PDT	3.05	0.86	N
DT 60	Trades Lane (31)	K	340575	730500	NO ₂	Y	PDT	1.82	0.44	N
DT 191	Victoria Rd (4) - India Buildings	R	340213	730633	NO ₂	Y	PDT	0	2.77	N
DT 93	Victoria Rd (10b)	K	340230	730673	NO ₂	Y	PDT	2.7	0.3	N
DT 68	Victoria Rd (60)	R	340375	730779	NO ₂	Y	PDT	0.56	2.18	N
DT 184	Victoria Rd (104) / William St	R	340697	730950	NO ₂	Y	PDT	1.5	1.36	N
DT 70	Victoria Rd/Hilltown	R	340274	730714	NO ₂	Y	PDT	2.01	1.15	N
DT 71	Victoria St/Albert St	K	341071	731072	NO ₂	Y	PDT	1.7	0.75	N
DT 205	West Marketgait/ Old Mill (23)	R	339773	730436	NO ₂	Y	PDT	0.05	2.8	N
DT 183	West Marketgait / Guthrie St	R	339805	730338	NO ₂	Y	PDT	2.02	1.16	N
DT 72	Westport (2)	R	339842	730122	NO ₂	Y	PDT	2.5	0.46	N
DT 231	West Marketgait/ Ward Road	R	339834	730314	NO ₂	Y	PDT	0	2.7	N
DT 73	Whitehall Cr (4)	K	340376	730109	NO ₂	Y	PDT	3	0.88	N
DT 161	Whitehall Cr /Union St (50)	K	340305	730051	NO ₂	Y	PDT	4.78	0.64	N
DT 76	Whitehall St (1)	K	340265	730153	NO ₂	Y	PDT	5.57	0.88	N

Site ID	Site Name	Site Type ⁽¹⁾	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA ? (Y/N)	Monitoring Technique	Distance to Relevant Exposure ? (m) ⁽²⁾	Distance to Kerb of Nearest Road (m) ⁽³⁾	Tube collocated with a Continuous Analyser ?
DT 75	Whitehall St (5)	R	340289	730128	NO ₂	Y	PDT	3.17	2.51	N
DT 81	Whitehall St (12)	R	340293	730142	NO ₂	Y	PDT	2.67	3	N
DT 77	Whitehall St (15)	K	340322	730098	NO ₂	Y	PDT	4.55	0.75	N
DT 74	Whitehall St (40)	K	340330	730106	NO ₂	Y	PDT	3.57	0.78	N
DT 160	Whitehall St (Romon) Average	R	340278	730156	NO ₂	Y	PDT	1.66	3.49	Y
DT 82	Woodside Ave	UB	340776	732307	NO ₂	Y	PDT	n/a	0.55	N

Notes:

- (1) R=Roadside, K=Kerbside, UB=Urban Background, 'Kerb' is taken as being the edge of the carriageway with flowing traffic
- (2) 0 if the monitoring site is at a location of exposure (e.g. installed on, adjacent to or equivalent to the façade of a residential property, or representative of a residential area).
- (3) n/a if not applicable (e.g.at background).
- (4) New sites are highlighted in green
- (5) Measurements amended to reflect change in pavement width. See Erratum in Appendix C.5 in APR 2020.

Figure A.2a NO₂ Diffusion Tube Locations (City Centre)



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Figure A.2b NO₂ Diffusion Tube Locations (East)

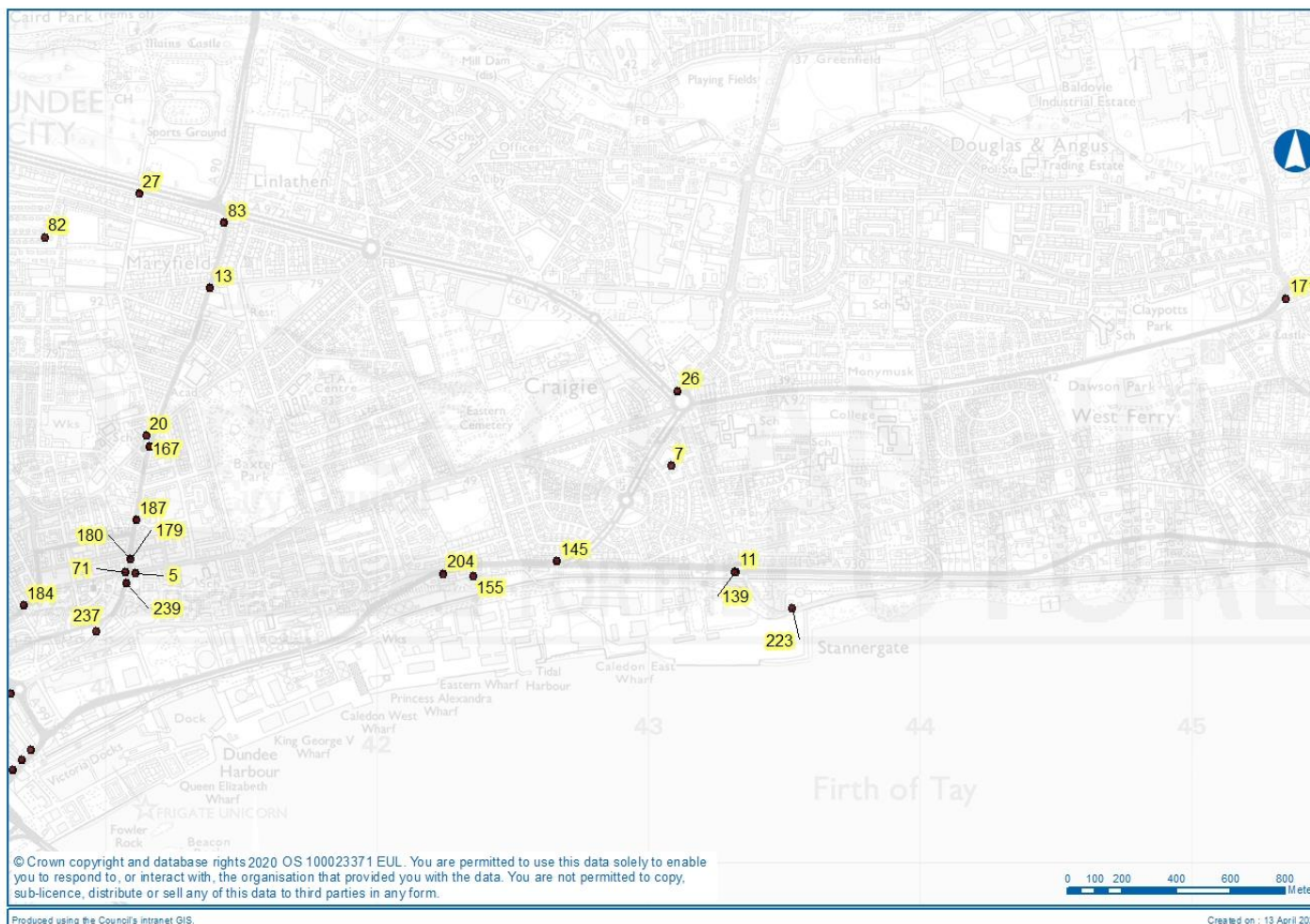


Figure A.2c NO₂ Diffusion Tube Locations (West)

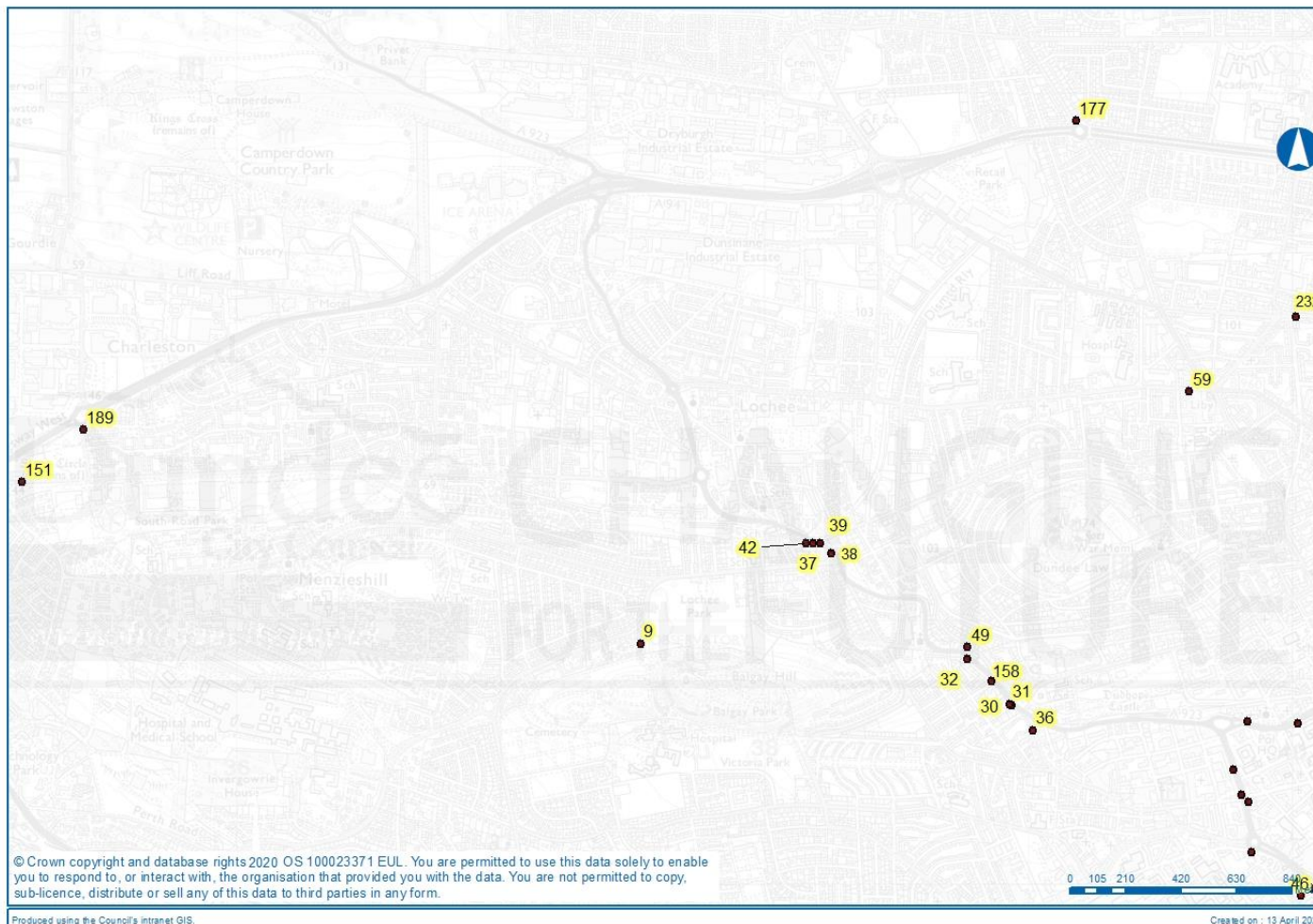


Table A.3 – Annual Mean NO₂ Monitoring Results

Site ID.	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2015	2016	2017	2018	2019
DT 92	Abertay 2	R	PDT	91.7	36.3	38.5	35.9	37.9	36.5
DT 179	Albert St (15) (Facade)	R	PDT	100.0	33.4	33.7	31.5	33.2	30.3
DT 180	Albert St (15) (Rdside)	K	PDT	100.0	35.5	35.5	33.0	35.1	31.7
DT 167	Albert St (191)	K	PDT	100.0	31.2	33.5	30.1	32.5	30.6
DT 187	Albert St (81)	K	PDT	100.0	30.3	31.3	27.9	29.7	27.1
DT 5	Arbroath Rd (13)	K	PDT	100.0	34.4	36.5	33.7	35.0	32.1
DT 168	Arbroath Rd (27)	R	PDT		29.5				
DT 147	Arbroath Rd (38)	K	PDT		33.7	35.0	34.3		
DT 212	Arbroath Rd (89)	R	PDT			29.4			
DT 7	Balgavies Place	UB	PDT	100.0	15.0	16.3	16.7	15.2	14.3
DT 9	Birnam Place	UB	PDT	91.7	8.7	9.5	9.9	9.3	8.5
DT 140	Broughty Ferry Rd (L/P 66)	R	PDT		32.0	33.1	33.5		
DT 164	Broughty Ferry Rd - Lower	UB	PDT		14.9	14.9	18.6		
DT 204	Broughty Ferry Rd (129)	R	PDT	100.0	38.3	36.0	38.2	40.1	37.0
DT 139	Broughty Ferry Rd (141 Downpipe)	R	PDT	100.0	32.3	33.3	34.0	31.1	30.1
DT 11	Broughty Ferry Rd (141)	R	PDT	100.0	35.4	40.4	40.0	36.4	36.3
DT 142	Broughty Ferry Rd (141) (St.Sign)	R	PDT		27.6				
DT 145	Broughty Ferry Rd (Greendykes)	R	PDT	100.0	31.8	35.0	34.1	33.6	32.2
DT 166	Broughty Ferry Rd LP 59(2)	R	PDT		21.1				
CM 3	Broughty Ferry Road	UI	Automatic	93.3		12.7	19.7	23.3	22.9
DT 223	Broughty Ferry Road Lower (Cyclesign)	UB	PDT	100.0			24.4	20.2	22.0

Site ID.	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2015	2016	2017	2018	2019
DT 155	Carolina Court LP6	UB	PDT	100.0	18.6	19.1	20.4	19.7	19.4
DT 171	Claypotts / Arbroath Rd (502)	R	PDT	100.0		26.6	29.1	25.9	24.8
DT 210	Cleghorn Street (57)	R	PDT			27.1			
DT 232	Clepington Rd (164)	R	PDT	100.0					24.2
DT 13	Clepington Rd/ Forfar Rd	K	PDT	100.0	36.5	31.8	30.6	30.6	29.4
DT 226	Commercial St (84)	R	PDT					26.2	
DT 188	Commercial St (9)	R	PDT	100.0	35.6	37.4	34.2	35.1	33.8
DT 84	Commercial St/Dock St (40)	R	PDT	100.0	36.4	34.8	34.3	33.1	31.6
DT 203	Coupar Angus Rd/Sinclair St	R	PDT		23.1				
DT 192	Dock St (12)	R	PDT		25.9	26.1	25.8	25.9	
DT 85	Dock St (21)	R	PDT	100.0	37.4	37.6	36.7	33.7	33.1
DT 156	Dock St (57)	R	PDT	100.0	51.4	49.3	49.4	46.4	44.2
DT 233	Dock St/Trades Lane	R	PDT	83.3					33.5
DT 206	Drumgeith Road (2)	R	PDT			18.4	19.6		
DT 227	Dudhope Crescent Road (40)	K	PDT	100.0				39.3	38.8
DT 20	Dura St (100)	K	PDT	100.0	34.9	37.5	33.5	33.2	32.7
DT 214	East Dock Street (26)	R	PDT	100.0		34.7	31.8	31.6	32.9
DT 22	Eastport Roundabout	R	PDT	100.0	30.7	31.7	30.0	31.1	30.0
DT 83	Forfar Rd (104)	K	PDT	100.0	45.1	46.3	40.6	41.0	38.1
DT 211	Forfar Rd (83a)	R	PDT			31.3			
DT 225	Grays Lane (3)	R	PDT					21.4	
DT 221	Harcourt Street (CCTV)	R	PDT				17.8		
DT 209	Hawkhill (251)	R	PDT			21.4			
DT 202	High St Lochee (22-24)	R	PDT		31.6	30.2			

Site ID.	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2015	2016	2017	2018	2019
DT 216	King Street (3)	K	PDT			30.9	28.5	32.8	
DT 177	Kingsway / Strathmartine Rd (279)	R	PDT	100.0	36.2	34.8	32.0	33.7	28.7
DT 26	Kingsway East Roundabout	R	PDT	100.0	36.1	37.2	37.9	38.3	34.1
DT 27	Kingsway/ Mains Loan	R	PDT	100.0	29.3	31.5	27.6	28.4	27.5
DT 30	Lochee Rd (138)	K	PDT	100.0	49.6	48.9	47.3	48.4	45.8
DT 31	Lochee Rd (140) Traffic Lts	R	PDT	100.0	50.3	53.0	48.1	48.8	46.2
DT 32	Lochee Rd (184)	K	PDT	100.0	36.2	35.1	34.5	33.7	32.4
DT 158	Lochee Rd (Romon) Average	K	PDT	100.0	44.8	43.8	42.6	43.1	41.5
CM 4	Lochee Rd Romon	R	Automatic	94.3	47.8	44.6	43.6	43.4	43
DT 36	Lochee Rd/Polepark Rd	K	PDT	100.0	28.1	27.6	26.7	25.4	25.7
DT 37	Logie St (114)	R	PDT	100.0	51.0	53.8	47.9	48.2	47.1
DT 38	Logie St (98)	K	PDT	100.0	32.3	34.3	32.9	31.5	30.2
DT 39	Loons Rd (1)	R	PDT	91.7	35.6	38.6	35.6	35.5	35.1
DT 237	Lower Princess St	R	PDT	91.7					29.8
CM 12	Mains Loan	UB	Automatic	95.9	10.3	11.4	12.1	12.3	11
DT 182	Meadowside (28)	K	PDT		37.1	35.9	34.8	35.0	
DT 149	Meadowside (Romon) Average	R	PDT	100.0	41.2	41.0	39.3	40.4	37.7
DT 238	Meadowside Halls	R	PDT	91.7					28.4
CM 14	Meadowside Romon	R	Automatic	86.6	38.2	35.9	34.8	34.3	33.9
DT 42	Muirton Rd (6)	R	PDT	100.0	25.0	26.6	23.4	25.0	24.1
DT 222	Muirton Road (2)	R	PDT				24.3	26.1	
DT 185	Murraygate (46)	UB	PDT	75.0	21.4	21.2	20.0	21.0	21.6
DT 189	Myrekirk Rd (29)	R	PDT	100.0	32.2	33.7	30.7	29.4	28.3

Site ID.	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2015	2016	2017	2018	2019
DT 181	Myrekirk Terrace (8)	R	PDT						
DT 47	Nethergate (40)	R	PDT	100.0	37.4	35.4	33.8	36.7	33.3
DT 45	Nethergate (6)	R	PDT	100.0	38.2	36.8	35.7	37.2	32.2
DT 213	Nethergate (64)	R	PDT	91.7		38.4	34.6	37.6	34.6
DT 44	Nethergate (88)	K	PDT	100.0	42.7	41.9	39.1	41.3	39.0
DT 46	Nethergate (95)	K	PDT	100.0	31.0	30.5	29.0	30.2	30.7
DT 48	Nethergate(132) / Marketgait	R	PDT	100.0	28.6	29.9	27.8	28.4	27.2
DT 91	Perth Rd (320)	K	PDT		34.0				
DT 207	Pitkerro Road (42)	R	PDT			32.6	32.5	33.0	
DT 239	Princes St (185)	K	PDT	83.3					39.9
DT 49	Rankine St (2)	R	PDT	100.0	40.2	36.5	39.3	38.5	36.7
DT 228	Riverside Esplanade/ S.Crichton St	R	PDT	100.0				29.1	25.4
CM 5	Seagate	R	Automatic	99.7	49.9	47.0	44.3	45.9	44.5
DT 50	Seagate (101)	R	PDT		39.6	38.7	35.5	38.3	
DT 224	Seagate (112)	R	PDT	100.0			34.1	37.6	37.1
DT 236	Seagate (36-40)	R	PDT	100.0					35.1
DT 54	Seagate (9)	R	PDT	100.0	32.8	33.2	30.3	29.5	28.8
DT 190	Seagate (97)	R	PDT	100.0	44.6	41.8	38.7	41.7	41.0
DT 217	Seagate (99)	R	PDT	91.7			42.5	41.3	37.9
DT 159	Seagate(Romon) Average	K	PDT	100.0	42.3	41.3	38.4	40.0	39.1
DT 55	Soapwork Lane	R	PDT	100.0	32.0	35.4	33.9	34.2	33.7
DT 218	South Marketgait (Lampost 18)	R	PDT	100.0			30.0	32.4	29.3
DT 235	South Marketgait/Nethergate	R	PDT	100.0					23.7

Site ID.	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2015	2016	2017	2018	2019
DT 151	South Rd (1 Denbank)	R	PDT	100.0	32.5	33.4	33.6	32.5	30.6
DT 56	St Andrews St (26)	K	PDT	58.3	28.9	30.9	29.0		26.2
DT 162	St Andrews St PB (façade)	R	PDT	100.0	34.9	35.1	32.8	33.7	32.4
DT 208	St Ann Street (2)	R	PDT			18.3			
DT 220	Strathmartine Road (15)	R	PDT				17.7		
DT 59	Strathmore Avenue (353)	K	PDT	91.7	35.9	39.4	33.2	32.4	31.6
DT 219	Thomson Avenue (Street Sign)	R	PDT	100.0			31.1	31.6	30.3
DT 229	Thomson Avenue/ S. Crichton St	K	PDT	100.0				28.9	27.9
DT 60	Trades Lane (31)	K	PDT	100.0	27.7	27.4	26.3	25.3	23.8
DT 61	Union St (Rollalong) Average	R	PDT		32.4				
CM 2	Union St Rollalong	R	Automatic		28.0				
DT 184	Victoria Rd (104) / William St	R	PDT	100.0	27.3	29.7	27.4	28.4	27.2
DT 93	Victoria Rd (10b)	K	PDT	100.0	29.3	31.7	29.8	31.5	31.3
DT 191	Victoria Rd (4) - India Buildings	R	PDT	100.0	29.7	30.2	28.6	29.3	28.9
DT 68	Victoria Rd (60)	R	PDT	100.0	34.9	34.7	33.0	33.4	33.0
DT 70	Victoria Rd/Hilltown	R	PDT	100.0	54.1	50.8	51.5	49.2	48.3
DT 71	Victoria St/Albert St	K	PDT	100.0	27.6	30.9	28.0	28.0	26.8
DT 183	West Marketgait / Guthrie St	R	PDT	91.7	46.8	46.1	44.1	41.4	38.3
DT 231	West Marketgait/ Ward Road	R	PDT	91.7				31.2	33.5
DT 205	West Marketgait/Old Mill (23)	R	PDT	100.0	54.0	51.6	45.1	47.0	47.1
DT 72	Westport (2)	R	PDT	91.7	33.0	31.2	33.1	31.5	28.4
DT 73	Whitehall Cr (4)	K	PDT	91.7	35.6	33.7	33.2	32.3	30.7
DT 161	Whitehall Cr /Union St (50)	K	PDT	100.0	25.0	24.9	24.4	24.1	23.2
DT 76	Whitehall St (1)	K	PDT	100.0	44.1	43.0	40.9	42.5	40.3

Site ID.	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2015	2016	2017	2018	2019
DT 81	Whitehall St (12)	R	PDT	100.0	34.5	35.0	34.5	38.4	35.4
DT 77	Whitehall St (15)	K	PDT	100.0	32.5	32.3	31.8	32.9	31.0
DT 74	Whitehall St (40)	K	PDT	100.0	35.6	35.2	33.7	36.8	33.4
DT 75	Whitehall St (5)	R	PDT	100.0	44.2	40.1	39.5	39.3	35.8
DT 160	Whitehall St (Romon) Average	R	PDT	100.0	36.5	36.6	35.0	38.3	34.6
CM 6	Whitehall St Romon	R	Automatic	99.7	36.3	37.2	35.3	37.5	33.4
DT 82	Woodside Ave	UB	PDT	100.0	13.2	13.7	13.3	13.4	11.4

Notes: Exceedances of the NO₂ annual mean objective of 40µg/m³ are shown in **bold**. Borderline values are shown in **orange**.
 NO₂ annual means exceeding 60µg/m³, indicating a potential exceedence of the NO₂ 1-hour mean objective are shown in **bold and underlined**.

(1) R=Roadside, K=Kerbside, UB=Urban Background

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias.

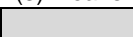
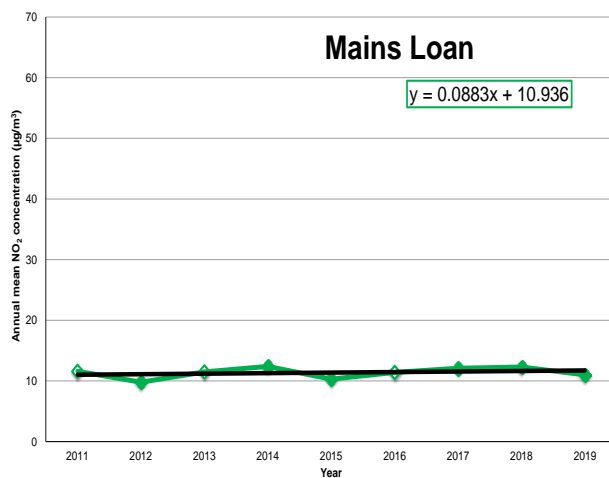
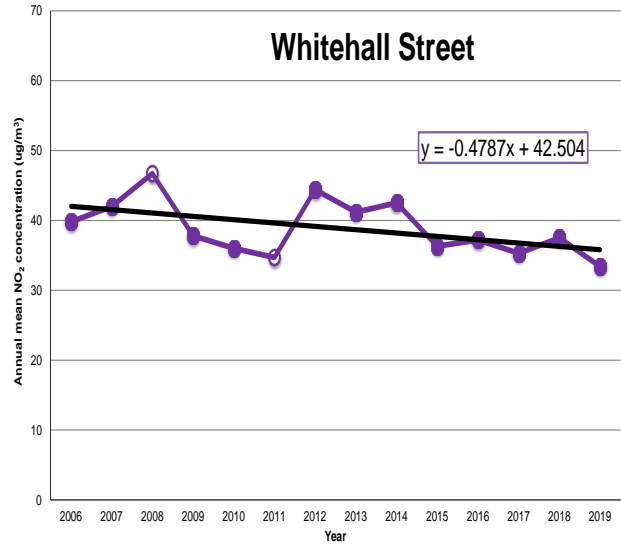
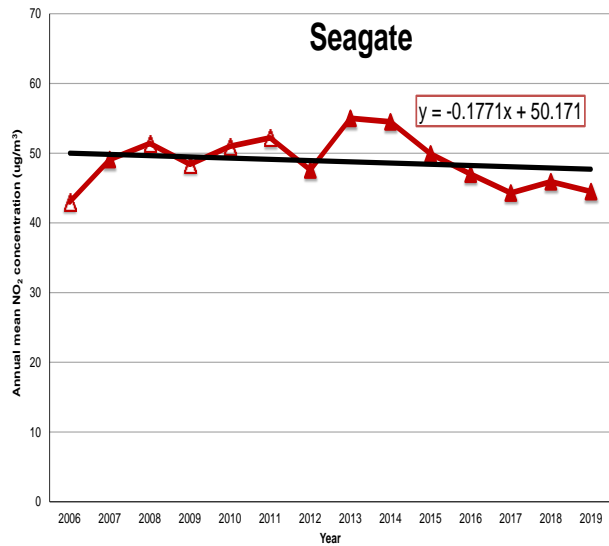
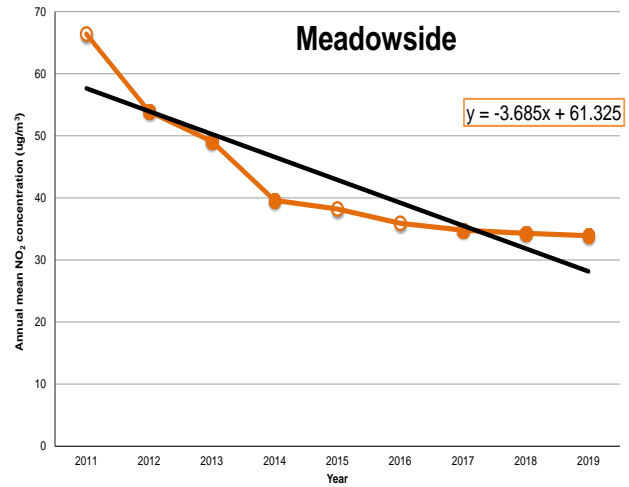
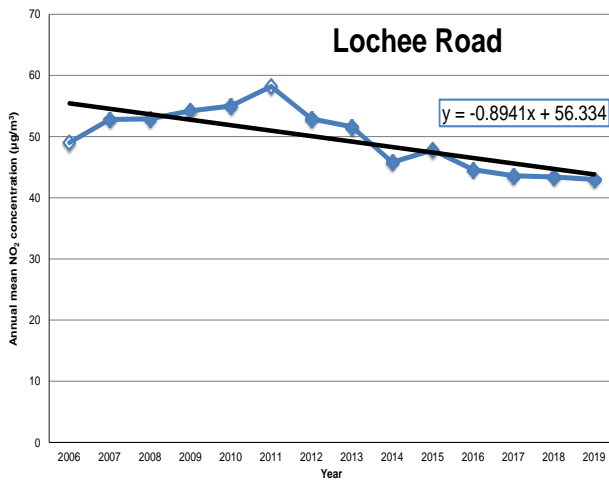
 All means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75% (highlighted by shading). See **Appendix C** for details.

Figure A.3a Trends in NO₂ at Automatic monitors



Notes:

- 1) Graphs show the trends in the NO₂ annual mean concentrations measured at the continuous monitors (other locations nearby may have higher concentrations.)
- 2) A minimum of five years data is required to show a valid trend. More years (data points) give greater certainty in the trend.
- 3) For strict comparison with the annual mean objective of 40µg/m³, data capture should be greater than 85%. Annual means where data capture were below are shown by a 'hollow' marker.
- 4) Means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.3b Trend Analysis at Long-term NO₂ Monitoring Locations

Site Id.	Location	Site Type	No. of years for trend	Trend	Site Id.	Location	Site Type	No. of years for trend	Trend
CM 14	Meadowside	R	9	-3.69	DT 20	Dura St (100)	K	14	-0.52
DT 190	Seagate (97)	R	7	-2.52	DT 83	Forfar Rd (104)	K	14	-0.52
DT 149	Meadowside (Romon) Average	R	9	-2.46	DT 70	Victoria Rd/Hilltown	R	14	-0.52
DT 205	West Marketgait/Old Mill (23)	R	5	-1.85	DT 39	Loons Rd (1)	R	14	-0.49
DT 183	West Marketgait / Guthrie St	R	7	-1.76	CM 6	Whitehall Street	R	14	-0.48
DT 177	Kingsway / Strathmartine Rd (279)	R	7	-1.40	DT 156	Dock St (57)	R	9	-0.48
DT 188	Commercial St (9)	R	7	-1.34	DT 158	Lochee Rd (Romon) Average	K	14	-0.47
DT 161	Whitehall Cr /Union St (50)	K	8	-1.14	DT 59	Strathmore Avenue (353)	K	14	-0.46
DT 180	Albert St (15) (Rdside)	K	7	-0.98	DT 82	Woodside Ave	UB	14	-0.45
DT 179	Albert St (15) (Facade)	R	7	-0.97	DT 36	Lochee Rd/Polepark Rd	K	14	-0.44
DT 189	Myrekirk Rd (29)	R	7	-0.91	DT 11	Broughty Ferry Rd (141)	R	14	-0.43
CM 4	Lochee Road	R	14	-0.90	DT 37	Logie St (114)	R	14	-0.42
DT 162	St Andrews St PB (façade)	R	8	-0.87	DT 31	Lochee Rd (140) Traffic Lts	R	14	-0.42
DT 92	Abertay 2	R	11	-0.86	DT 77	Whitehall St (15)	K	14	-0.41
DT 167	Albert St (191)	K	7	-0.85	DT 47	Nethergate (40)	R	14	-0.40
DT 184	Victoria Rd (104) / William St	R	7	-0.82	DT 44	Nethergate (88)	K	14	-0.40
DT 75	Whitehall St (5)	R	14	-0.80	DT 42	Muirton Rd (6)	R	14	-0.35
DT 54	Seagate (9)	R	14	-0.80	DT 155	Carolina Court LP6	UB	8	-0.34
DT 93	Victoria Rd (10b)	K	11	-0.78	DT 22	Eastport Roundabout	R	14	-0.33
DT 159	Seagate(Romon) Average	K	14	-0.75	DT 45	Nethergate (6)	R	14	-0.32
DT 46	Nethergate (95)	K	14	-0.71	DT 32	Lochee Rd (184)	K	14	-0.32
DT 60	Trades Lane (31)	K	14	-0.71	DT 26	Kingsway East Roundabout	R	14	-0.31
DT 56	St Andrews St (26)	K	13	-0.71	DT 145	Broughty Ferry Rd (Greendykes)	R	9	-0.23
DT 72	Westport (2)	R	14	-0.71	DT 7	Balgavies Place	UB	14	-0.22
DT 185	Murraygate (46)	UB	7	-0.70	DT 81	Whitehall St (12)	R	14	-0.22
DT 187	Albert St (81)	K	7	-0.69	DT 38	Logie St (98)	K	14	-0.20
DT 68	Victoria Rd (60)	R	14	-0.68	DT 85	Dock St (21)	R	14	-0.20
DT 139	Broughty Ferry Rd (141 Downpipe)	R	9	-0.64	CM 5	Seagate	R	14	-0.18
DT 71	Victoria St/Albert St	K	14	-0.63	DT 49	Rankine St (2)	R	14	-0.17
DT 191	Victoria Rd (4) - India Buildings	R	7	-0.62	DT 76	Whitehall St (1)	K	14	-0.16
DT 13	Cleington Rd/ Forfar Rd	K	14	-0.61	DT 9	Bimam Place	UB	14	-0.15
DT 84	Commercial St/Dock St (40)	R	14	-0.58	DT 160	Whitehall St (Romon) Average	R	14	-0.11
DT 5	Arbroath Rd (13)	K	14	-0.57	DT 55	Soapwork Lane	R	14	-0.01
DT 48	Nethergate(132) / Marketgait	R	14	-0.55	DT 74	Whitehall St (40)	K	14	0.00
DT 27	Kingsway/ Mains Loan	R	14	-0.54	CM 12	Mains Loan	UB	9	0.09
DT 171	Claypotts / Arbroath Rd (502)	R	5	-0.54	DT 204	Broughty Ferry Rd (129)	R	5	0.15
DT 151	South Rd (1 Denbank)	R	9	-0.52	DT 73	Whitehall Cr (4)	K	14	0.39
DT 30	Lochee Rd (138)	K	14	-0.52					

- Note:** (1) Locations where the 2019 NO₂ annual mean is exceeded at the monitor are shown in **bold**, borderline locations are **orange**
(2) Blue is an improving trend, red is a worsening trend
(3) Methodology explained after **Figure A.5c**

Table A.4 – 1-Hour Mean NO₂ Monitoring Results

Site ID.	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	NO ₂ 1-Hour Means > 200µg/m ³ ⁽³⁾				
					2015	2016	2017	2018	2019
CM3	Broughty Ferry Rd	UI	Automatic	93.3	n/a	0	0	0	0
CM4	Lochee Rd Romon	R	Automatic	94.3	0	4	6	6	2
CM12	Mains Loan	UB	Automatic	95.9	0	0 (77.2)	1	0	0
CM14	Meadowside Romon	R	Automatic	86.6	0 (109.5)	0 (102.4)	0	0	0
CM5	Seagate	R	Automatic	99.7	0	0	0	0	0
CM2	Union St Rollalong	R	Automatic	n/a	0	n/a	n/a	n/a	n/a
CM6	Whitehall St Romon	R	Automatic	99.7	0	0	0	0	0

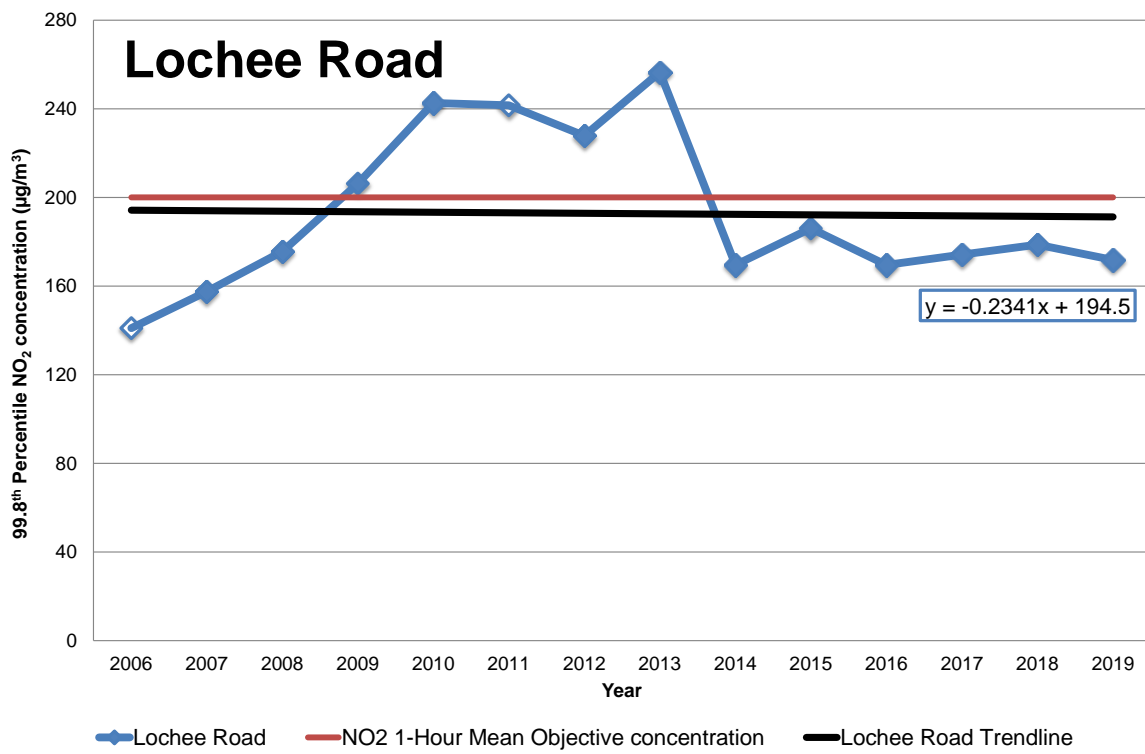
Notes: Exceedences of the NO₂ 1-hour mean objective (200µg/m³ not to be exceeded more than 18 times/year) are shown in **bold**.

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI=Urban Industrial

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets (and shaded grey).

Figure A.4 Trend in 99.8th percentile of hourly mean NO₂ concentrations at Lochee Road



Note: Hollow data points indicate those years when the valid data capture was less than 85%

Table A.5 – Annual Mean PM₁₀ Monitoring Results

Site ID	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	PM ₁₀ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2015	2016	2017	2018	2019
CM 4	Lochee Rd (BAM/Fidas)	R	Automatic	99.8	19.8	18.9	17.5	12.6	11.8
CM 5	Seagate (BAM/Fidas)	R	Automatic	99.6	14.5	13.7	15.8	15.6	13.7
CM 14	Meadowside (BAM/Fidas)	R	Automatic	85.6	16.1	16.4	14.7	15.3	14.1
CM 6	Whitehall Street (BAM/Fidas)	R	Automatic	99.3	n/a	15.1	14.7	15.7	11.9
CM 12	Mains Loan (TEOM/Fidas)	UB	Automatic	99.2	11.9	10.0	9.5	9.1	9.2
CM 3	Broughty Ferry Rd (TEOM)	UI	Automatic	86.8	12.6	12.1	11.4	12.3*	13.6
CM 13	Broughty Ferry Rd (Partisol)	UI	Automatic	99.5	12.6	11.5	11.1	11.2	11.3
CM 16	Broughty Ferry Rd (Osiris)	UI	Automatic	89.4	12.1	11.5	11.1	11.3*	11.2
CM 9	Logie St (Osiris)	K	Automatic	77.3	15.5	13.8	14.5	18.9	15.4*
CM 17	Myrekirk Tce (Osiris)	R	Automatic	62.5	18.4	15.6	12.0	13.5	12.3*
CM 15	Albert St (Osiris)	K	Automatic	93.5	19.0	15.4	14.3	17.5*	15.1
CM 18	Stannergate (Osiris)	R	Automatic	76.0	26.9	20.8	14.0	11.9*	13.3*
CM 2	Union St (TEOM/BAM)	R	Automatic	n/a	16.8	n/a	n/a	n/a	n/a

Notes: Exceedences of the PM₁₀ annual mean objective of 18µg/m³ are shown in **bold** (borderline values are orange).

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI=Urban Industrial

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%). * indicates data capture less than 85%

(3) All means have been “annualised” as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75% (highlighted by shading). See Appendix C for details.

Figure A.5a Trends in Annual Mean PM₁₀ concentrations at Automatic monitors

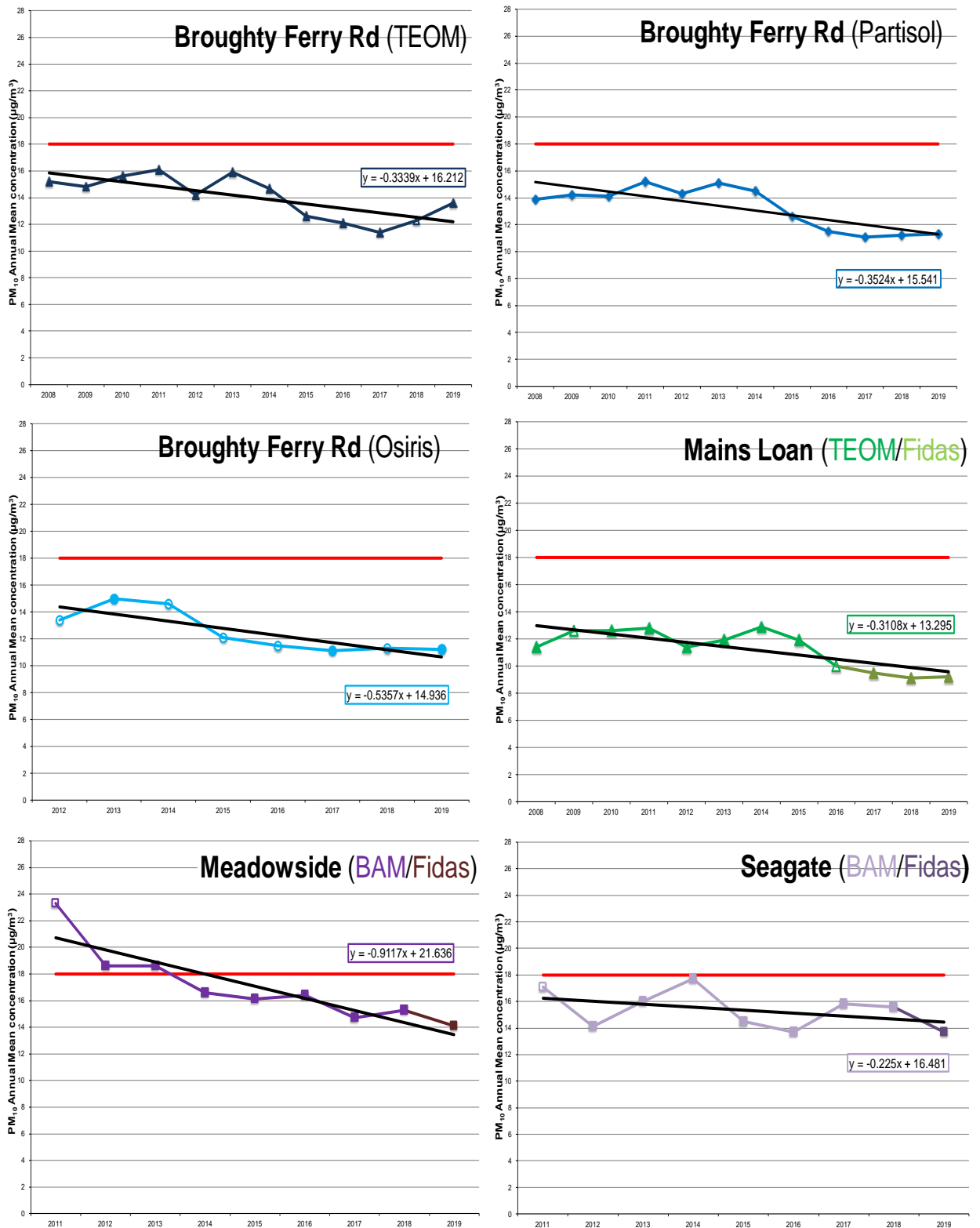
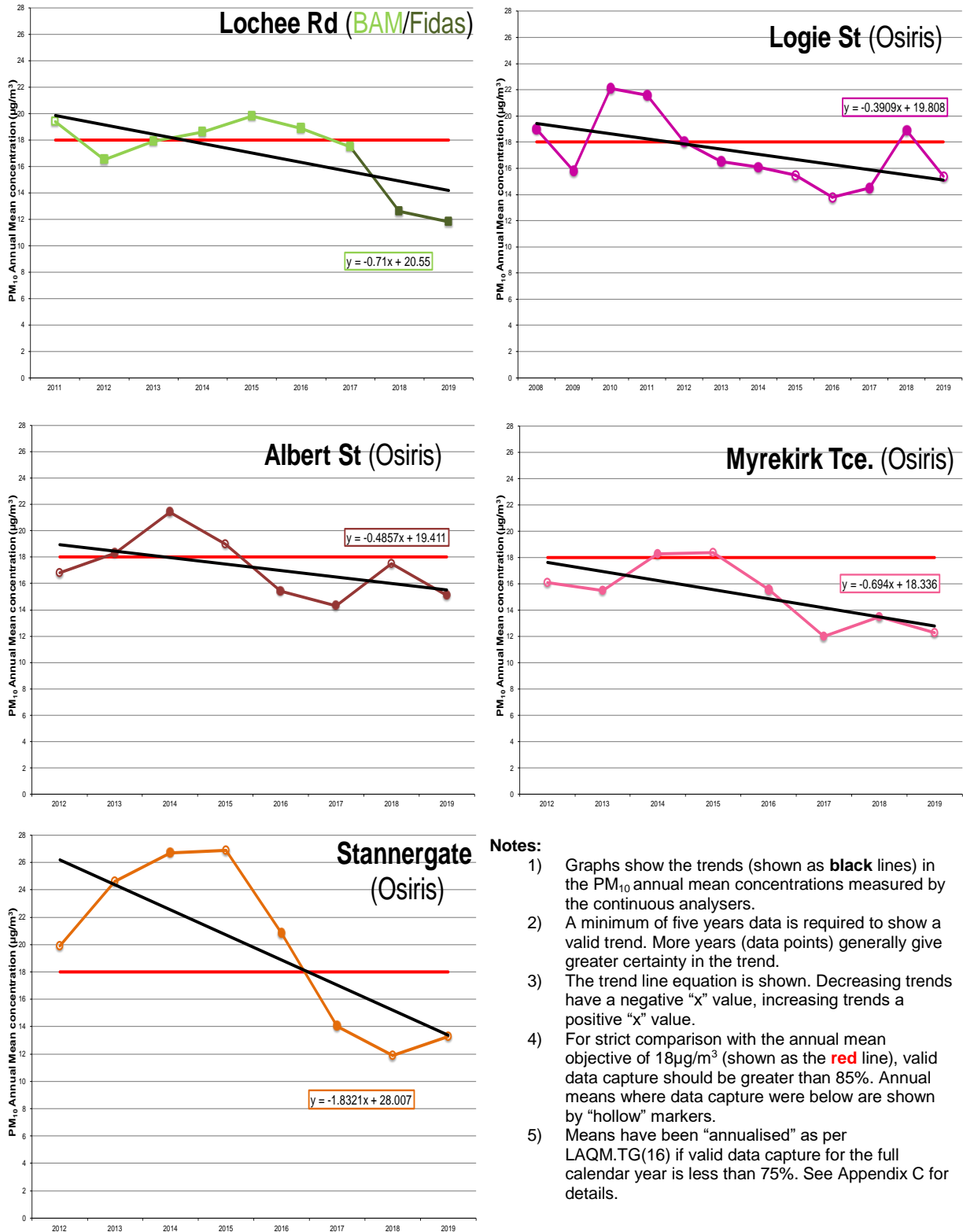


Figure A5.b Trends in Annual Mean PM₁₀ concentrations at Automatic monitors



- Notes:
- 1) Graphs show the trends (shown as **black lines**) in the PM₁₀ annual mean concentrations measured by the continuous analysers.
 - 2) A minimum of five years data is required to show a valid trend. More years (data points) generally give greater certainty in the trend.
 - 3) The trend line equation is shown. Decreasing trends have a negative "x" value, increasing trends a positive "x" value.
 - 4) For strict comparison with the annual mean objective of 18µg/m³ (shown as the **red line**), valid data capture should be greater than 85%. Annual means where data capture were below are shown by "hollow" markers.
 - 5) Means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A5.c Trend analysis of PM₁₀ annual means at long term monitoring sites

Site Id.	Location ^(1,2)	No. of years for trend	Trend ⁽³⁾
CM 18	Stannergate (Osiris)	8	-1.832
CM 14	Meadowside (BAM/Fidas)	9	-0.912
CM 4	Lochee Rd (BAM/Fidas)	9	-0.710
CM 17	Myrekirk Tce (Osiris)	8	-0.694
CM 16	Broughty Ferry Rd (Osiris)	8	-0.536
CM 15	Albert St (Osiris)	8	-0.486
CM 9	Logie St (Osiris)	12	-0.391
CM 13	Broughty Ferry Rd (Partisol)	12	-0.352
CM 3	Broughty Ferry Rd (TEOM)	12	-0.334
CM 12	Mains Loan (TEOM/Fidas)	12	-0.311
CM 5	Seagate (BAM)	9	-0.225

Notes: (1) Locations where the 2019 PM₁₀ annual mean is exceeded are shown in **bold**, borderline locations are **orange**
 (2) Locations shaded grey had less than 75% data capture in 2019, so the Annual mean was "annualised"
 (3) **Blue** is an improving trend, **red** a worsening trend.

Explanation of Methodology for **Figures A.3b** and **A.5c** have been generated using the LINEST function in Microsoft Excel. This function can be used to return a value that describes the slope of a best fit straight line for a number of points (in this case 5 or more values) i.e. simple linear regression. A negative value denotes a downwards slope hence an improving trend and, a positive value denotes an upwards slope or worsening trend. The magnitude of the number generated by the LINEST function can be used to compare the magnitude of the (improving or worsening) trend.

Table A.6 – 24-Hour Mean PM₁₀ Monitoring Results

Site ID	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	PM ₁₀ 24-Hour Means > 50µg/m ³ ⁽³⁾				
					2015	2016	2017	2018	2019
CM 4	Lochee Rd (BAM/Fidas)	R	Automatic	100.0	5	2	4	1	1
CM 5	Seagate (BAM/Fidas)	R	Automatic	99.7	3	0	3	1	1
CM 14	Meadowside (BAM/Fidas)	R	Automatic	84.7	4	3	1	4	3 (43.4)
CM 6	Whitehall Street (BAM/Fidas)	R	Automatic	99.2	n/a	1	1	4 (39.8)	1
CM 12	Mains Loan (TEOM/Fidas)	UB	Automatic	98.9	1	0 (27.5)	0	0	1
CM 3	Broughty Ferry Rd (TEOM)	UI	Automatic	86.3	2	0	0	0 (25.6)	1
CM 13	Broughty Ferry Rd (Partisol)	UI	Automatic	99.5	0	0	0	0	0
CM 16	Broughty Ferry Rd (Osiris)	UI	Automatic	88.8	2 (35.4)	1 (26.2)	0	1 (34.2)	1
CM 9	Logie St (Osiris)	K	Automatic	76.7	4 (39.2)	0 (28.6)	2	11	3 (41.1)
CM 17	Myrekirk Tce (Osiris)	R	Automatic	62.2	7 (54.2)	1	0	2	1 (39.7)
CM 15	Albert St (Osiris)	K	Automatic	93.4	8 (63.9)	2	3	5 (46.0)	7
CM 18	Stannergate (Osiris)	R	Automatic	75.3	15 (72.3)	4	2	0 (25.7)	1 (32.9)
CM 2	Union St (TEOM/BAM)	R	Automatic	n/a	7	n/a	n/a	n/a	n/a

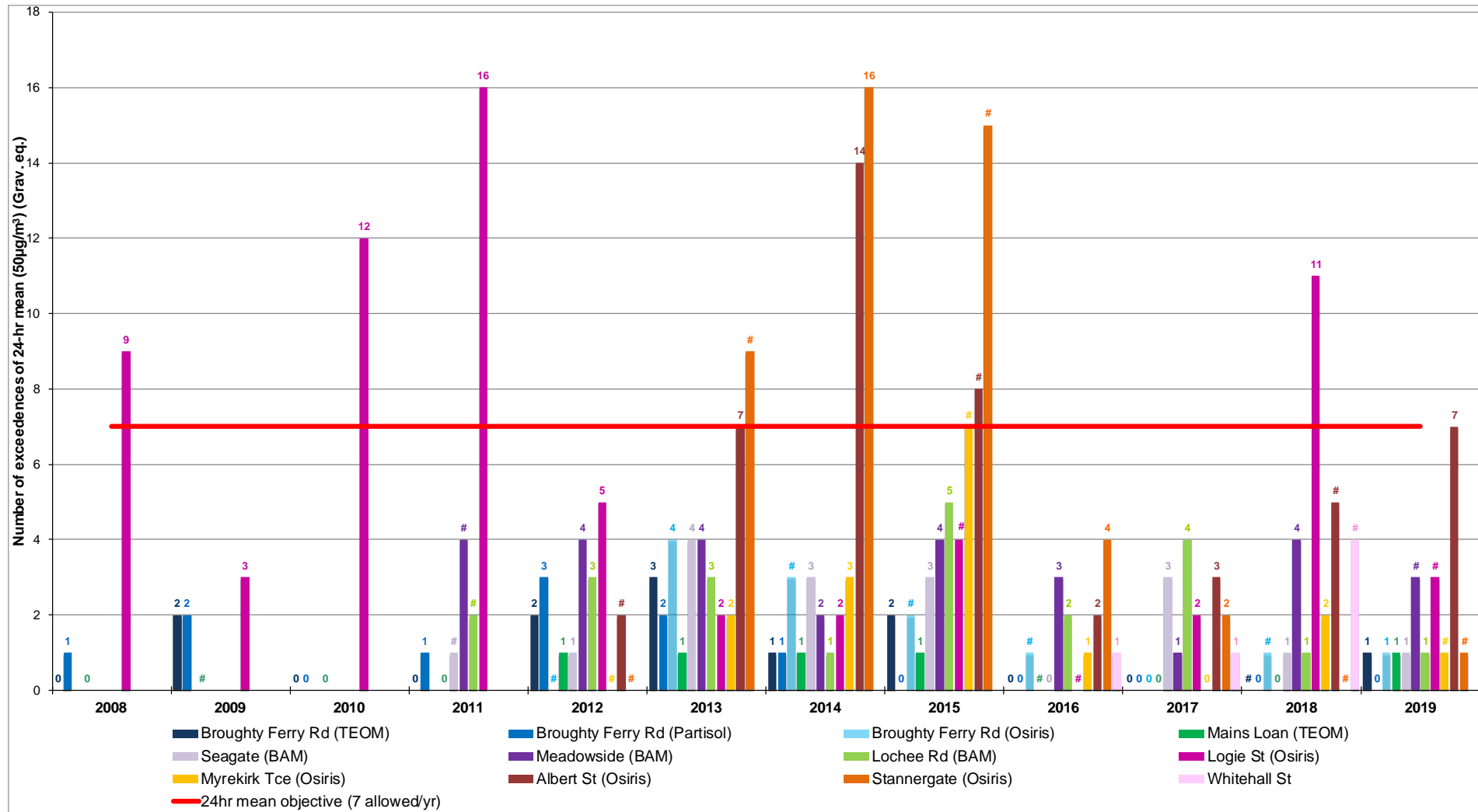
Notes: Exceedences of the PM₁₀ 24-hour mean objective (50µg/m³ not to be exceeded more than 7 times/year) are shown in **bold**.

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI= Urban Industrial

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 98.08th percentile of 24-hour means is provided in brackets (and shaded grey).

Figure A.6a Frequency of Exceedances of PM₁₀ 24 hour Mean Objective (50µg/m³, 7 allowed) 2008-2019



Note: # denotes that the actual number of exceedances is unknown as the data capture was less than 85%

Figure A6.b Trends in 98.08th percentile PM₁₀ concentrations at Automatic monitors

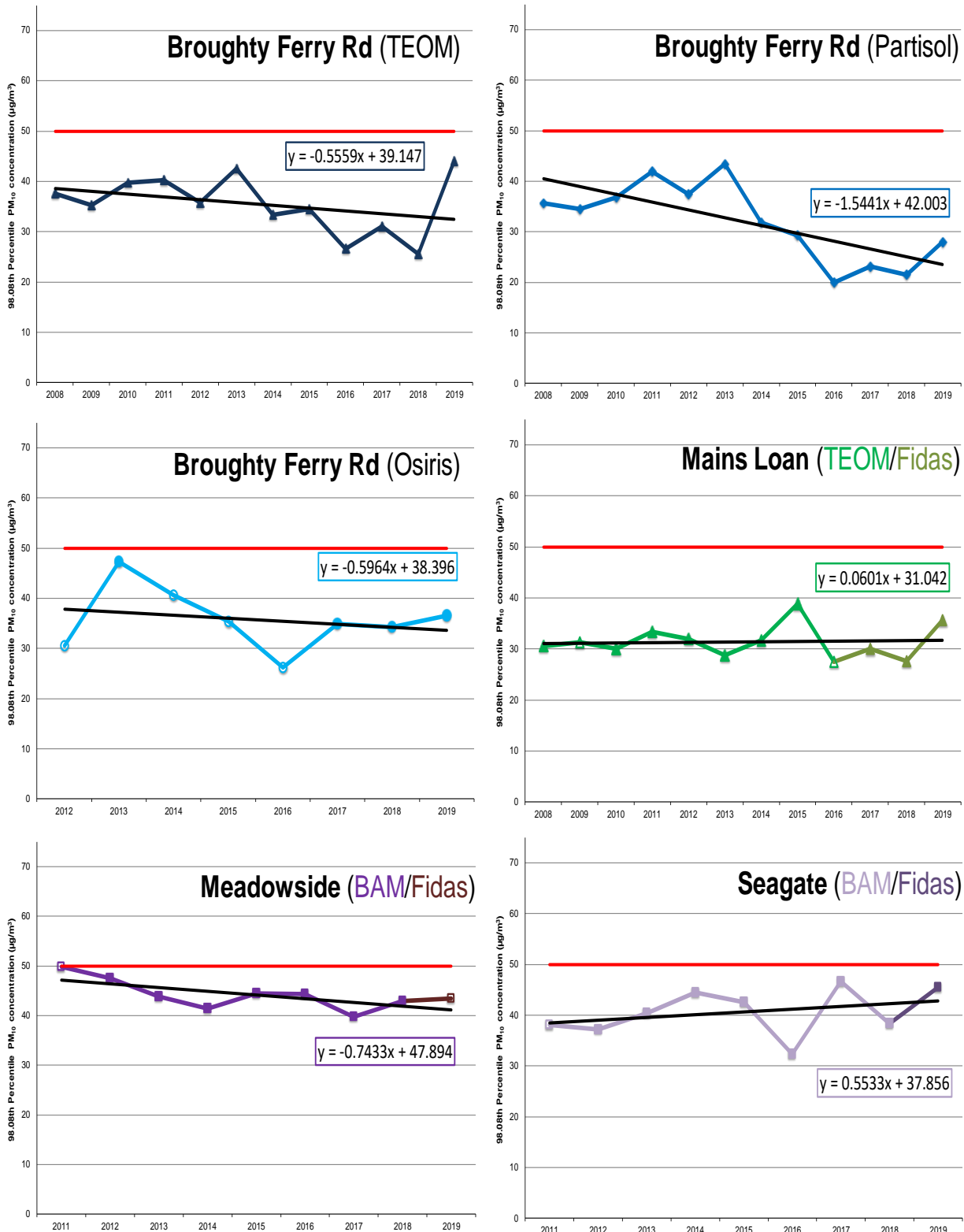
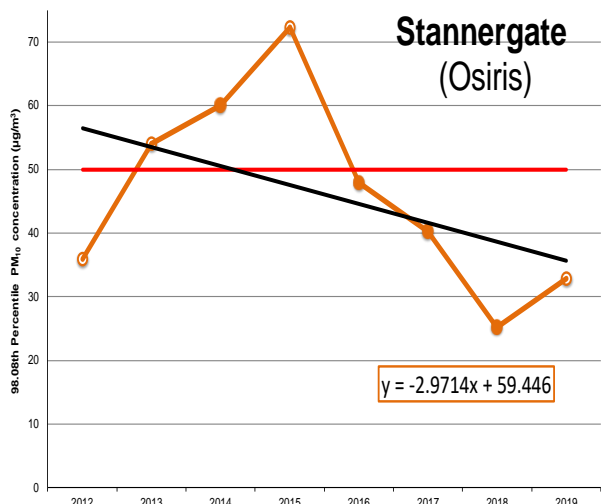
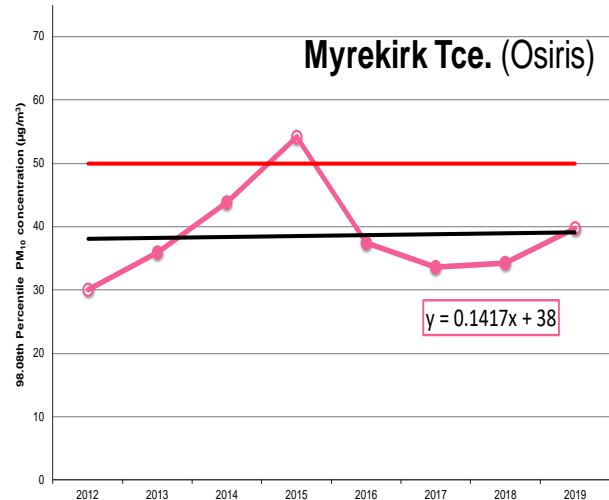
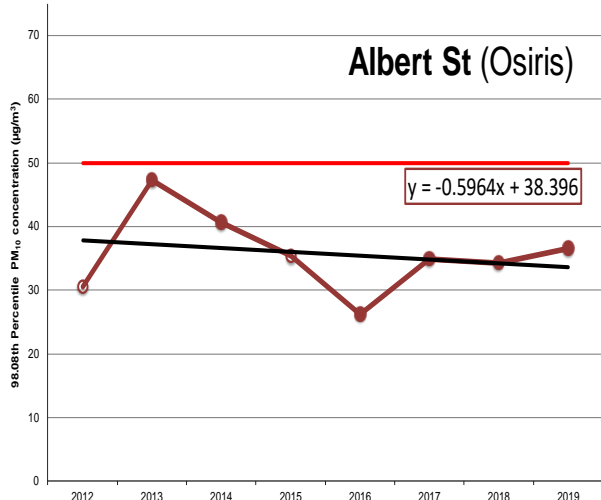
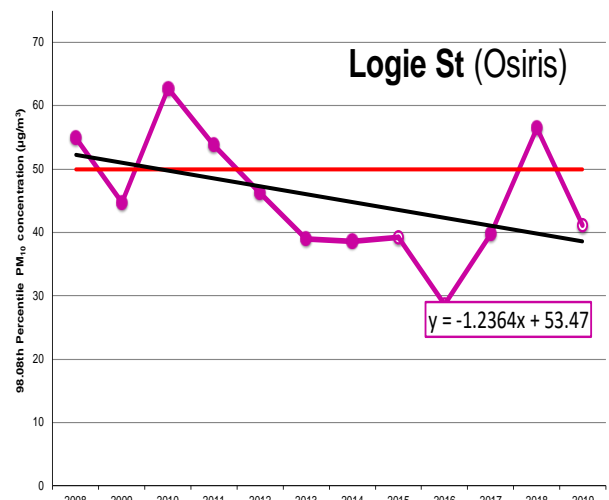
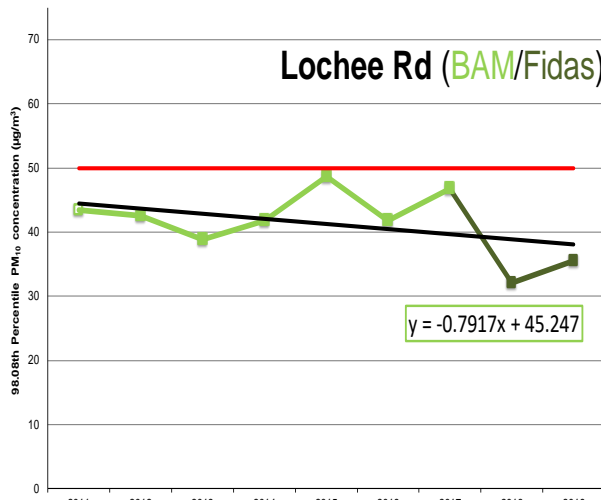


Figure A6.c Trends in 98.08th percentile PM₁₀ concentrations at Automatic monitors



Notes:

- 1) Graphs show the trends (shown as **black** lines) in the PM₁₀ 98.08th percentile concentrations measured by the continuous analysers.
- 2) A 98.08th percentile concentration greater than 50µg/m³ (shown by the **red** line) is taken to represent an exceedance of the Scottish short term PM₁₀ objective.
- 3) The 98.08th percentile is normally used when valid data capture for the year is less than 85% (shown by "hollow" markers).
- 4) A minimum of five years data is required to show a valid trend. More years (data points) give greater certainty in the trend.
- 5) The trend line equation is shown. Decreasing trends have a negative "x" value, increasing trends a positive "x" value.

Table A.7 – Annual Mean PM_{2.5} Monitoring Results

Site ID	Site Name	Site Type ⁽¹⁾	Monitoring Type	Valid Data Capture 2019 (%) ⁽²⁾	PM _{2.5} Annual Mean Concentration (µg/m ³) ⁽³⁾⁽⁴⁾				
					2015	2016	2017	2018	2019
CM 4	Lochee Rd (Fidas)	R	Automatic	99.8	n/a	n/a	n/a	5.7	6.4
CM 5	Seagate (Fidas)	R	Automatic	78.3	n/a	n/a	n/a	5.5	6.9*
CM 14	Meadowside (Fidas)	R	Automatic	65.1	n/a	n/a	n/a	n/a	6.6
CM 6	Whitehall Street (Fidas)	R	Automatic	78.5	n/a	n/a	n/a	n/a	6.3*
CM 12	Mains Loan (Fidas)	UB	Automatic	99.2	n/a	n/a	n/a	5.5	5.5

Notes: Exceedences of the PM_{2.5} annual mean objective of 10µg/m³ are shown in **bold** (borderline values are orange).

(1) R=Roadside, K=Kerbside, UB=Urban Background, UI=Urban Industrial

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been “annualised” as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75% (highlighted by shading). See Appendix C for details.

(4) * indicates data capture less than 85%

Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 – NO₂ Monthly Diffusion Tube Results for 2019

Site Id. (DT)	Location	x	y	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Mean	% Data	Period Adj' Factor	Annual Mean	Annual mean Bias (0.85)
92	Abertay 2	340019	730612	54.9	57.0	M	54.5	41.5	37.7	38.9	30.0	34.6	39.6	47.7	35.7	42.9	91.7	1.0	42.9	36.5
179	Albert St (15)(Façade)	341092	731121	46.8	42.8	27.8	49.0	38.6	34.3	27.9	26.1	29.3	38.1	40.8	26.5	35.7	100.0	1.0	35.7	30.3
180	Albert St (15)(Roadside)	341091	731121	48.8	45.2	28.6	50.3	38.0	32.7	29.4	27.7	30.4	37.7	46.9	31.7	37.3	100.0	1.0	37.3	31.7
167	Albert St (191)	341161	731535	42.0	41.2	23.7	56.9	36.1	33.1	25.6	21.8	30.1	39.9	49.8	31.2	36.0	100.0	1.0	36.0	30.6
187	Albert St (81)	341113	731265	44.2	44.7	24.5	41.4	29.4	29.2	23.4	24.5	25.4	35.8	35.2	25.1	31.9	100.0	1.0	31.9	27.1
5	Arbroath Rd (13)	341111	731070	52.4	52.7	32.0	35.3	33.7	32.5	33.1	32.7	30.9	35.9	40.5	42.1	37.8	100.0	1.0	37.8	32.1
223	B/ Ferry Rd Lower (Cyclesign)	343530	730937	44.0	41.1	43.0	9.3	16.7	17.2	16.7	20.7	18.7	22.1	23.9	37.1	25.9	100.0	1.0	25.9	22.0
204	B/Ferry Rd (129)	342244	731066	62.3	52.1	36.7	50.6	36.5	35.8	35.2	32.1	31.6	46.3	59.0	43.9	43.5	100.0	1.0	43.5	37.0
139	B/Ferry Rd (141) Downpipe	343317	731072	54.0	50.1	42.9	27.0	27.6	28.3	26.7	29.8	28.5	35.6	36.7	38.4	35.5	100.0	1.0	35.5	30.1
145	B/Ferry Rd Greendykes	342662	731112	54.2	50.4	36.6	37.4	32.3	29.8	32.6	30.0	31.8	35.6	41.7	41.9	37.9	100.0	1.0	37.9	32.2
7	Balgavies PI	343082	731465	31.5	27.9	13.8	11.9	10.6	11.1	11.3	11.2	12.0	18.2	21.2	21.4	16.8	100.0	1.0	16.8	14.3
9	Birnham PI	337531	730914	18.9	14.2	7.7	9.5	3.0	M	7.1	6.5	7.7	10.1	13.7	12.2	10.1	91.7	1.0	10.1	8.5
11	Broughty Ferry Rd (141)	343322	731073	55.2	59.4	48.2	37.3	34.5	34.6	32.8	38.9	35.9	41.6	45.0	48.4	42.7	100.0	1.0	42.7	36.3
155	Carolina Court Lp6	342353	731058	37.3	29.8	18.3	19.3	15.8	15.5	15.6	16.3	17.7	24.3	32.3	31.0	22.8	100.0	1.0	22.8	19.4
171	Claypotts / Arbroath Rd (502)	345347	732080	50.8	46.4	35.7	15.2	17.4	18.3	19.4	20.8	26.0	28.7	36.4	34.9	29.2	100.0	1.0	29.2	24.8
13	Clelington Rd/ Forfar Rd	341385	732121	52.5	46.5	28.4	32.6	28.6	25.6	25.8	25.2	29.0	39.1	44.2	37.0	34.5	100.0	1.0	34.5	29.4
232	Clelington Rd (164)	340013	732153	44.4	43.7	27.9	25.8	22.2	19.9	25.4	26.5	23.6	27.7	27.8	27.3	28.5	100.0	1.0	28.5	24.2
188	Commercial St (9)	340544	730291	49.3	46.5	35.1	46.8	36.4	34.1	35.6	30.2	35.7	42.2	46.7	38.9	39.8	100.0	1.0	39.8	33.8
84	Commercial St /Dock St (40)	340565	730263	51.0	47.8	38.5	35.5	32.5	32.0	32.7	29.4	29.6	33.2	42.5	41.7	37.2	100.0	1.0	37.2	31.6

Site Id. (DT)	Location	x	y	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Mean	% Data	Period Adj' Factor	Annual Mean	Annual mean Bias (0.85)
85	Dock St (21)	340524	730216	56.5	41.2	38.9	35.5	34.2	32.5	33.6	34.0	35.2	41.6	45.2	38.5	38.9	100.0	1.0	38.9	33.1
156	Dock St (57)	340656	730343	75.0	72.5	51.1	43.2	37.7	43.9	42.0	43.9	45.7	53.8	58.4	56.5	52.0	100.0	1.0	52.0	44.2
233	Dock St/Trades Lane	340690	730382	51.4	49.0	33.1	44.7	32.0	31.9	M	M	33.0	35.6	42.6	40.6	39.4	83.3	1.0	39.4	33.5
227	Dudhope Crescent Road (40)	339830	730619	73.6	63.9	42.4	39.0	34.9	35.4	32.4	40.3	40.1	42.2	54.3	49.4	45.7	100.0	1.0	45.7	38.8
20	Dura St (100)	341150	731576	56.0	47.7	36.2	40.2	36.6	32.1	30.8	32.0	33.3	39.5	40.9	37.0	38.5	100.0	1.0	38.5	32.7
214	East Dock St (26)	340725	730417	50.3	49.5	35.2	41.1	36.7	31.9	35.6	30.7	32.6	39.1	44.6	36.8	38.7	100.0	1.0	38.7	32.9
22	Eastport Roundabout	340651	730623	46.8	45.5	30.3	40.3	32.3	29.2	31.4	25.2	31.7	30.5	42.7	37.8	35.3	100.0	1.0	35.3	30.0
83	Forfar Rd (104)	341437	732360	61.6	62.3	46.4	41.0	38.4	38.3	36.3	38.8	37.9	41.6	48.9	46.8	44.9	100.0	1.0	44.9	38.1
26	Kingsway East Roundabout	343107	731740	53.5	54.7	40.0	41.1	35.7	32.3	38.3	34.3	35.2	32.3	37.5	46.6	40.1	100.0	1.0	40.1	34.1
27	Kingsway/ Mains Loan	341124	732468	41.3	35.1	21.5	51.6	33.5	28.3	28.9	21.4	28.4	33.7	41.2	23.3	32.4	100.0	1.0	32.4	27.5
177	Kingsway/Strathmartine Rd (N)	339179	732896	56.4	48.2	34.7	33.6	24.7	23.3	28.6	26.4	26.1	29.8	40.1	33.9	33.8	100.0	1.0	33.8	28.7
30	Lochee Rd (138)	338936	730680	82.2	68.8	56.7	47.7	47.6	44.0	43.0	44.4	46.7	48.6	58.4	58.8	53.9	100.0	1.0	53.9	45.8
31	Lochee Rd (140)(Traffic Lts)	338927	730685	77.9	69.9	57.4	46.3	49.6	49.3	49.7	41.7	49.4	54.6	52.6	53.3	54.3	100.0	1.0	54.3	46.2
32	Lochee Rd (184)	338767	730856	62.5	54.0	37.8	33.4	29.6	27.9	29.6	30.8	29.3	35.7	41.1	46.1	38.2	100.0	1.0	38.2	32.4
	Lochee Rd (Romon 1)			74.0	67.4	52.4	38.7	39.0	39.9	39.6	39.2	43.0	49.2	53.3	50.1	48.8	100.0	1.0	48.8	41.5
	Lochee Rd (Romon 2)			73.7	66.8	51.9	37.6	40.1	37.6	39.3	41.1	41.5	48.1	53.8	55.7	48.9	100.0	1.0	48.9	41.6
	Lochee Rd (Romon 3)			69.8	65.4	51.9	42.2	40.0	39.3	38.3	42.5	41.5	48.8	47.1	55.9	48.6	100.0	1.0	48.6	41.3
158	Lochee Rd (Romon) Average	338861	730773	72.5	66.5	52.1	39.5	39.7	38.9	39.1	41.8	42.0	48.7	51.4	53.9	48.8	100.0	1.0	48.8	41.5
36	Lochee Rd/Polepark Rd	339016	730586	52.4	43.5	28.9	28.1	24.4	19.8	21.4	20.7	24.4	26.8	38.3	34.5	30.3	100.0	1.0	30.3	25.7
37	Logie St (114)	338184	731293	79.0	74.6	52.7	57.0	44.0	48.8	46.3	47.3	48.0	57.1	60.2	50.6	55.5	100.0	1.0	55.5	47.1
38	Logie St (98)	338252	731258	48.5	49.7	35.9	31.6	27.5	27.1	26.1	28.7	30.9	36.3	43.5	40.0	35.5	100.0	1.0	35.5	30.2
39	Loons Rd (1)	338211	731293	56.7	49.3	31.6	50.5	M	36.2	34.9	30.5	36.5	39.8	48.3	39.6	41.3	91.7	1.0	41.3	35.1
237	Lower Princess St	340964	730855	42.9	45.3	25.7	42.6	28.1	25.1	M	24.8	25.0	30.8	58.2	36.6	35.0	91.7	1.0	35.0	29.8

Site Id. (DT)	Location	x	y	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Mean	% Data	Period Adj' Factor	Annual Mean	Annual mean Bias (0.85)
238	Meadowside Halls	340281	730586	45.7	46.7	32.0	31.0	M	24.7	23.8	26.1	25.4	33.1	38.4	40.4	33.4	91.7	1.0	33.4	28.4
	Meadowside (Romon 1)			60.2	61.6	40.5	46.8	41.9	36.3	39.3	39.1	38.8	41.5	49.0	38.2	44.4	100.0	1.0	44.4	37.8
	Meadowside (Romon 2)			58.6	60.1	43.9	43.0	40.0	37.3	40.3	38.7	39.4	44.1	43.6	48.3	44.8	100.0	1.0	44.8	38.1
	Meadowside (Romon 3)			56.4	60.1	44.3	44.1	32.1	37.6	40.4	40.1	37.0	43.6	53.2	37.9	43.9	100.0	1.0	43.9	37.3
149	Meadowside (Romon) Average	340243	730653	58.4	60.6	42.9	44.6	38.0	37.1	40.0	39.3	38.4	43.1	48.6	41.5	44.4	100.0	1.0	44.4	37.7
42	Muirton Rd (6)	338156	731294	34.3	35.2	18.3	42.3	26.4	23.8	25.8	20.5	23.0	29.9	34.0	27.1	28.4	100.0	1.0	28.4	24.1
185	Murraygate (46)	340409	730484	35.6	32.6	18.2	26.0	17.1	M	18.7	M	M	23.1	30.0	27.9	25.5	75.0	1.0	25.5	21.6
189	Myrekirk Rd (29)	335420	731726	55.5	43.4	34.5	25.3	24.6	28.6	25.9	24.1	29.4	35.2	44.8	28.3	33.3	100.0	1.0	33.3	28.3
48	Nethergate (132)/Marketgait	340074	729984	43.3	41.0	28.8	33.5	29.6	27.2	22.9	25.4	29.8	36.7	37.0	29.2	32.0	100.0	1.0	32.0	27.2
47	Nethergate (40)	340230	730124	47.5	48.0	31.2	50.4	35.9	34.7	38.2	31.5	33.6	38.8	40.8	39.8	39.2	100.0	1.0	39.2	33.3
45	Nethergate (6)	340274	730171	53.5	52.9	38.7	34.3	32.4	29.9	34.7	35.5	35.0	32.8	40.0	35.2	37.9	100.0	1.0	37.9	32.2
213	Nethergate (64)	340196	730089	M	55.4	37.5	45.0	36.3	37.6	38.4	36.5	34.7	42.5	36.2	48.3	40.8	91.7	1.0	40.8	34.6
44	Nethergate (88)	340163	730061	46.9	52.1	39.3	66.2	45.5	45.8	46.2	38.6	41.3	43.3	41.0	44.0	45.9	100.0	1.0	45.9	39.0
46	Nethergate (95)	340033	729957	48.0	44.2	34.3	38.7	32.4	31.8	26.0	26.9	32.6	39.9	40.7	38.6	36.2	100.0	1.0	36.2	30.7
239	Princes St (185)	341077	731031	55.9	M	31.8	65.6	49.3	42.3	44.5	M	37.3	44.1	55.4	42.8	46.9	83.3	1.0	46.9	39.9
49	Rankine St (2)	338768	730900	72.2	58.6	41.6	37.1	35.8	32.7	30.8	33.8	34.1	44.8	51.0	45.4	43.2	100.0	1.0	43.2	36.7
228	Riverside Esplanade/S. Crichton St.	340516	729991	34.5	44.1	26.7	32.2	25.1	28.1	25.4	24.0	23.9	27.9	37.6	29.3	29.9	100.0	1.0	29.9	25.4
224	Seagate (112)	340528	730537	57.9	58.0	46.9	41.2	36.7	36.1	37.9	38.5	38.6	41.2	43.5	47.6	43.7	100.0	1.0	43.7	37.1
236	Seagate (36-40)	340463	730420	55.8	53.8	47.4	34.6	37.6	33.8	31.5	34.8	37.9	41.9	44.0	42.6	41.3	100.0	1.0	41.3	35.1
54	Seagate (9)	340467	730388	41.8	43.2	27.7	37.6	31.7	30.7	30.2	25.8	28.8	35.4	41.9	31.7	33.9	100.0	1.0	33.9	28.8
190	Seagate (97)	340516	730499	53.0	56.6	42.4	66.2	50.9	45.2	46.8	38.4	38.8	46.9	46.6	47.1	48.2	100.0	1.0	48.2	41.0
217	Seagate (99)	340535	730522	43.7	57.8	M	42.7	35.2	42.2	46.8	41.4	39.7	46.9	47.3	47.1	44.6	91.7	1.0	44.6	37.9
	Seagate (Romon 1)			51.6	55.5	45.3	58.8	44.0	43.9	43.9	38.5	39.8	44.8	48.3	47.4	46.8	100.0	1.0	46.8	39.8

Site Id. (DT)	Location	x	y	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Mean	% Data	Period Adj' Factor	Annual Mean	Annual mean Bias (0.85)
	Seagate (Romon 2)			51.5	54.0	44.3	57.0	43.7	42.9	42.1	37.3	34.8	46.2	47.1	47.5	45.7	100.0	1.0	45.7	38.8
	Seagate (Romon 3)			50.9	48.1	42.7	55.6	44.7	43.1	43.1	37.9	40.9	45.2	48.3	44.8	45.4	100.0	1.0	45.4	38.6
159	Seagate (Romon) Average	340487	730446	51.3	52.5	44.1	57.1	44.1	43.3	43.0	37.6	38.5	45.7	47.9	46.6	46.0	100.0	1.0	46.0	39.1
55	Soapwork Lane	340099	730650	59.7	50.3	35.8	43.6	32.0	31.3	32.2	31.8	32.8	38.6	48.0	39.2	39.6	100.0	1.0	39.6	33.7
218	South Marketgait (Lampost 18)	340291	729979	39.8	43.1	24.6	42.4	32.6	31.5	31.8	27.0	29.9	34.1	44.5	33.0	34.5	100.0	1.0	34.5	29.3
235	South Marketgait/Nethergate	340106	729972	39.3	36.4	22.1	30.5	24.8	20.1	22.2	18.4	25.1	29.4	40.0	25.9	27.9	100.0	1.0	27.9	23.7
151	South Road (1 Denbank)	335188	731528	54.7	47.5	34.0	32.3	30.7	29.8	32.4	26.3	30.8	37.6	36.8	38.9	36.0	100.0	1.0	36.0	30.6
56	St Andrews St (26)	340516	730584	40.8	M	23.3	46.1	M	M	M	23.8	M	31.3	39.9	32.9	34.0	58.3	0.905	30.8	26.2
162	St Andrews St/Seagate(116)	340532	730548	50.7	50.6	36.0	41.5	32.9	32.9	35.3	32.6	33.1	32.0	40.6	39.0	38.1	100.0	1.0	38.1	32.4
59	Strathmore Ave (353)	339609	731871	54.0	46.0	27.1	45.8	32.5	25.2	35.5	30.7	33.3	M	42.8	36.0	37.2	91.7	1.0	37.2	31.6
219	Thomson Avenue (Street Sign)	340542	730194	46.5	45.5	30.0	37.7	28.2	30.1	30.7	29.2	31.9	37.9	41.8	38.5	35.7	100.0	1.0	35.7	30.3
229	Thomson Avenue/S.Crichton St	340421	730078	46.1	47.0	31.6	26.8	27.2	25.6	28.6	29.8	22.3	36.0	41.5	31.9	32.9	100.0	1.0	32.9	27.9
60	Trades Lane (31)	340575	730500	42.0	38.2	25.3	28.8	22.3	19.9	23.6	20.8	30.0	21.6	32.8	30.0	27.9	100.0	1.0	27.9	23.8
93	Victoria Rd (10)	340230	730673	48.2	47.0	31.6	43.4	33.0	30.0	31.1	29.2	31.1	35.8	44.1	37.1	36.8	100.0	1.0	36.8	31.3
184	Victoria Rd (104)/William St)	340697	730950	37.7	39.5	24.2	41.0	30.6	26.8	30.2	25.9	25.5	35.5	37.5	29.9	32.0	100.0	1.0	32.0	27.2
191	Victoria Rd (4 India Buildings)	340213	730633	46.2	44.4	22.4	40.1	31.8	25.1	28.3	25.1	30.0	34.5	44.1	35.8	34.0	100.0	1.0	34.0	28.9
68	Victoria Rd (60)	340375	730779	49.3	47.8	33.1	45.7	37.6	34.4	36.4	31.4	33.4	40.7	38.6	37.0	38.8	100.0	1.0	38.8	33.0
70	Victoria Rd/Hilltown	340274	730714	89.2	78.4	67.5	45.2	47.7	41.7	48.1	51.2	48.0	54.7	51.7	58.5	56.8	100.0	1.0	56.8	48.3
71	Victoria St / Albert St	341071	731072	41.1	37.4	26.9	36.4	29.5	28.8	23.2	23.0	26.0	34.6	40.4	31.1	31.5	100.0	1.0	31.5	26.8
205	West Marketgait/ Old Mill (23)	339773	730436	76.3	79.7	61.5	42.8	44.4	41.5	43.8	49.7	53.9	49.9	63.5	57.5	55.4	100.0	1.0	55.4	47.1
231	West Marketgait/ Ward Road	339834	730314	54.1	53.0	35.8	35.8	M	31.4	29.6	30.9	33.6	38.5	45.8	45.3	39.4	91.7	1.0	39.4	33.5
183	West Marketgait/Guthrie St	339805	730338	M	66.2	53.0	43.4	42.4	41.7	41.2	43.5	43.6	48.5	46.8	25.2	45.0	91.7	1.0	45.0	38.3
72	Westport (2)	339842	730122	45.4	46.2	36.9	M	25.5	27.4	27.2	26.2	27.6	33.9	34.7	36.3	33.4	91.7	1.0	33.4	28.4

Site Id. (DT)	Location	x	y	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Mean	% Data	Period Adj' Factor	Annual Mean	Annual mean Bias (0.85)
73	Whitehall Cr (4)	340376	730109	41.6	49.1	32.4	34.2	30.3	M	32.0	31.4	32.8	34.5	42.9	35.6	36.1	91.7	1.0	36.1	30.7
161	Whitehall Cr/Union St (50)	340305	730051	39.8	37.1	22.1	27.2	24.0	21.1	22.4	21.0	22.3	29.1	33.1	27.9	27.3	100.0	1.0	27.3	23.2
76	Whitehall St (1)	340265	730153	58.5	59.4	45.8	53.6	44.9	42.7	44.1	40.4	42.5	44.7	43.0	49.2	47.4	100.0	1.0	47.4	40.3
81	Whitehall St (12)	340293	730142	48.8	51.5	36.3	58.5	43.5	34.2	42.9	33.6	38.4	37.8	39.9	35.0	41.7	100.0	1.0	41.7	35.4
77	Whitehall St (15)	340322	730098	47.3	45.9	32.7	36.5	31.2	32.7	31.8	29.2	31.5	36.6	42.1	40.0	36.5	100.0	1.0	36.5	31.0
74	Whitehall St (40)	340330	730106	42.7	45.5	36.6	47.6	38.2	38.1	34.7	31.8	31.7	36.4	49.3	38.9	39.3	100.0	1.0	39.3	33.4
75	Whitehall St (5)	340289	730128	53.7	57.0	44.3	39.3	39.9	36.6	39.1	38.1	38.2	39.8	34.7	44.8	42.1	100.0	1.0	42.1	35.8
	Whitehall St (Romon 1)			47.5	48.5	35.9	56.3	38.8	38.6	37.9	33.5	35.9	40.9	M	36.2	40.9	91.7	1.0	40.9	34.8
	Whitehall St (Romon 2)			48.1	49.8	35.2	50.2	38.4	37.8	39.8	32.6	34.3	41.6	38.1	38.3	40.4	100.0	1.0	40.4	34.3
	Whitehall St (Romon 3)			46.9	48.5	35.2	57.4	36.7	35.2	39.7	32.0	34.1	41.0	43.5	39.0	40.8	100.0	1.0	40.8	34.7
160	Whitehall St (Romon) Average	340278	730156	47.5	48.9	35.4	54.6	38.0	37.2	39.1	32.7	34.8	41.2	40.8	37.8	40.7	100.0	1.0	40.7	34.6
82	Woodside Ave	340776	732307	23.3	20.9	9.9	12.9	9.0	7.9	9.4	7.9	10.9	16.2	18.7	14.0	13.4	100.0	1.0	13.4	11.4

Notes

- (1) Exceedences of the NO₂ annual mean objective are shown in **bold**. (Borderline values are coloured **orange**).
- (2) NO₂ annual means greater than 60µg/m³ are shown in **bold & underlined**, indicating a potential exceedence of the NO₂ 1-hr mean obj'.
- (3) Sites shaded green were monitoring locations installed in 2019.
- (4) M' means that the diffusion tube was either missing or else interference meant that the results were considered invalid.

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

Appendix C.1 Air Quality Monitoring Data QA/QC

QA/QC of Automatic Monitoring

All automatic analysers (excluding Osiris units) are audited twice yearly by an external consultant, Ricardo. The gas analysers do not have on-site gases and are manually calibrated every 3 weeks by Ricardo using National Physical Laboratory (NPL) traceable gas.

Dundee City Council secured funding from the Scottish Executive to commission Ricardo to assist with data management and ratification procedures. Dundee joined the 'Calibration Club' run by Ricardo at the end of 2006. Ricardo have ratified all the real-time monitoring data reported on the Scottish Air Quality Website from 2006 onwards under contract from the Scottish Government.

All instruments (excluding Osiris units) are serviced and calibrated every 6 months by the equipment supplier. Osiris units undergo quarterly flow checks and filter changes as well as annual service and calibration by the manufacturer (Turnkey Instruments).

The Partisol is a semi-automatic reference equivalent PM₁₀ analyser. It contains 16 'Emfab' filters, each is exposed for 24 hours allowing for 2 weeks continuous operation (usually with two blanks). The filters are supplied by the equipment manufacturer and conditioned and weighed before and after the sampling period by Tayside Scientific Services using in-house procedures.

The Fidas 200 is a nephelometer, which is calibrated using a HEPA filter and 'CalDust' by Ricardo (Local Site Operator) every 3 weeks for the first 6 months following installation, thereafter it is calibrated during the twice yearly service and audits.

QA/QC of Diffusion Tube Monitoring

Monitoring of NO₂ concentrations using passive diffusion tubes (PDT) is widely used throughout the UK. Provided that care is taken with the storage, handling and analysis of the tubes, and an appropriate "bias-adjustment" factor is applied, the overall uncertainty of the annual mean is expected to be about +/-20%. The key issues to be considered are the performance of the laboratory, the precision of the diffusion tubes, and the application of a suitable bias adjustment factor. These issues are considered in turn below.

Laboratory Performance

The diffusion tubes used by Dundee City Council are supplied by Gradko and analysed by Tayside Scientific Services utilising the 20% Triethanolamine (TEA) in water preparation method. Diffusion tubes are exposed for 4 to 5 weeks in accordance with the recommended dates supplied by Defra. The method for preparing and analysing tubes has remained unchanged since 2001. Two diffusion tubes from each monthly batch are used as blanks. These tubes are not exposed but are taken round during the monthly deployment and collection and stored in the refrigerator during the exposure period. They are analysed along with the appropriate batch of exposed tubes. The purpose of the blanks is to determine whether contamination occurred during the preparation or deployment.

Defra and the Devolved Administrations advise that diffusion tubes used for Local Air Quality Management should be obtained from laboratories that have demonstrated satisfactory performance in the AIR Proficiency Testing (PT) scheme. Laboratory performance in AIR PT

is also assessed, by the National Physical Laboratory (NPL), alongside laboratory data from the monthly NPL Field Intercomparison Exercise carried out at Marylebone Road, central London.

AIR is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme. AIR NO₂ PT forms an integral part of the UK NO₂ Network's QA/QC, and is a useful tool in assessing the analytical performance of those laboratories supplying diffusion tubes to Local Authorities for use in the context of Local Air Quality Management (LAQM). With consent from the participating laboratories, LGC Standards provides summary proficiency testing data to the LAQM Helpdesk for hosting on the webpages at <http://laqm.defra.gov.uk/diffusion-tubes/ga-qc-framework.html> . This information is updated on a quarterly basis following completion of each AIR PT round.

Tayside Scientific Services has demonstrated satisfactory performance in the latest report.¹¹

Tube Precision

For the purposes of Local Air Quality Management, tube precision is separated into two categories, "Good" or "Poor", as follows: tubes are considered to have "good" precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than 10%. Tubes are considered to have "poor" precision where the CV of four or more periods is greater than 20% and/or the average CV is greater than 10%.

A spreadsheet tool has been developed to calculate the overall precision of a particular co-location study or any sets of duplicate or triplicate results. The tube precision of each study calculated using this spreadsheet¹² is summarised in **Table C.1**. The distinction between "good" and "poor" precision is an indicator of how well the same measurement can be reproduced. This precision reflects the laboratory's performance/consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Any laboratory can show "poor" precision for a particular period/co-location study, if this is due to poor handling of the tubes in the field.

Suitable Bias Adjustment Factor

The discussion and calculation of a suitable bias adjustment factor is detailed below:

The diffusion tubes are supplied by Gradko and analysed by Tayside Scientific Services utilising the 20% Triethanolamine (TEA) in water preparation method. The bias adjustment factor available on the LAQM Support Website¹³ for Tayside Scientific Services is **0.80** (Spreadsheet version 06/20_final). This is based the kerbside National inter-comparison site at Marylebone Road (0.80).

Factor from Local Co-location Studies

Dundee City Council co-locates three nitrogen dioxide diffusion tubes with each of the roadside automatic nitrogen dioxide analysers. Co-location studies were carried out at 4 automatic monitoring locations in 2019. The factor for each study is shown in **Table C.1** along with the factor for the national inter-comparison site at Marylebone Road in London. A minimum of 9 months is required to make a valid bias calculation. All the Dundee City

¹¹ <https://laqm.defra.gov.uk/assets/laqmno2performancedatauptonovember2019v1.pdf>

¹² <http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html>

¹³ <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

Council co-location studies met the criteria in 2019. The QA/QC procedures for all the Dundee City Council automatic analysers used in the bias-calculation is equivalent to the Automatic Urban and Rural Network (AURN), which is run by the national government. Tayside Scientific Services have demonstrated satisfactory performance for the analysis of diffusion tubes over the quarterly AIR-PT/WASP rounds up to November 2019. The automatic analyser period means are calculated from mid-day on tube changeover days.

Table C.1 Bias Factors from 2019 Co-location Studies and National Bias Adjustment Spreadsheet (Version 03/20_final)

Site Name	Site Type ¹	Length of Study (months)	PDT ² Mean Conc. (Dm) (µg/m ³)	Analyser Mean Conc. (Cm) (µg/m ³)	% DC ³	Bias (B)	Tube Precision & average CV ⁴	Bias Adjustment Factor (A) (Cm/Dm)
Lochee Road	R	12	49	43	99	15%	G (3%)	0.87
Meadowside	R	10	44	34	95	31%	G (5%)	0.77
Seagate	R	12	46	44	100	4%	G (3%)	0.97
Whitehall Street	R	12	41	33	100	22%	G (3%)	0.82
Marylebone Road Intercomparison	K	12	82	65	n/a	25.3 %	G	0.80

1 - R= Roadside, K= Kerbside

2 - PDT = Passive Diffusion Tube for NO₂

3 - %DC = Percentage Data Capture on the automatic analyser for the periods used

4 - Tube precision is determined as follows: **G** = Good precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; **P** = Poor precision - CV of four or more periods >20% and/or average CV >10%; **S** = Single tube, therefore not applicable; **na** = not available.

Discussion of Choice of Factor to Use

The majority of nitrogen dioxide diffusion tubes operated by Dundee City Council are located at roadside or kerbside locations. In view of this it is normally considered appropriate to use an overall factor derived from roadside and kerbside sites. A manual approximate orthogonal regression calculation using Bias B figures (obtained from the precision and accuracy spreadsheets¹⁴) was carried out for the local roadside sites separately and incorporating the national inter-comparison kerbside site at Marylebone Road. The calculation was carried out in accordance with the guidance available on the Defra website prepared by Air Quality Consultants¹⁵ (AQC) (see **Table C.2**). The factor obtained using only local roadside sites was **0.83**, and **0.84** when the kerbside site at Marylebone Road was included. The **0.84** bias correction factor represents a more conservative approach and has been used to bias correct the diffusion tube data presented in this report.

¹⁴ <http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html>

¹⁵ <http://laqm.defra.gov.uk/documents/NO2-Diffusion-Tube-Collocation-Methodology.pdf>

Table C.2 Manual Approximate Orthogonal Regression Calculation 2019

Co-location Sites 2017	Site Type ¹	Bias Factor A	Bias B			
Lochee Road	R	0.87	15%			
Meadowside	R	0.77	31%			
Seagate	R	0.97	4%			
Whitehall St	R	0.82	22%			
Mean Local		0.86	18.0%			
				Manual orthogonal regression Calculation as para 2.4 AQC doc²		
				Express as a factor	Add 1	Inverse
				0.18	1.18	0.85
National: Marylebone Road Intercomparison	K	0.80	25.3%			
Combined Local & National: Mean Combined		0.85	19.5%	0.195	1.195	0.84

Notes:

1 - R= Roadside, K= Kerbside

2 - Paragraph 2.4 of AQC's report states, "For most purposes, a reasonable approximation of our method can be derived by averaging the bias values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 equals 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression, but will be reasonably close). IT IS IMPORTANT NOT TO AVERAGE THE ADJUSTMENT FACTORS."

PM Monitoring Adjustment

Dundee utilise several methods for monitoring particulate matter (PM₁₀) within the city. TEOM and Osiris monitors have heated inlets. These tend to drive off volatile organic particulate matter and in consequence the measured concentrations tend to be lower than those measured by gravimetric reference standard monitors. The Partisol is a reference equivalent method and had been used historically to determine a local correction factor for the TEOMs, which were designated as non-equivalent in 2006. TEOM PM₁₀ data presented in this report have been corrected using the Volatile Correction Methodology (VCM) since 2008.

DCC have five Osiris analysers which have been in their current locations since at least 2012. These are also non-equivalent but their measurements are considered indicative of particulate concentrations. Dundee commenced a yearly study in 2005 to compare the PM₁₀ data measured using an Osiris analyser with that from a TEOM. This study determined that the Osiris generally exaggerates peak values compared to the TEOM. Annually, post service, all 5 Osiris monitors are co-located in-house and their data is compared with that of the designated "master" to derive, if necessary, individual adjustment factors. The factors used to adjust the 2019 data can be made available on request¹⁶. The "master" Osiris unit has been co-located with the Partisol at the urban industrial site at Broughty Ferry Road since September 2012, thus allowing the Osiris results presented in this report to be gravimetrically corrected prior to reporting. The gravimetric factor applied to 2019 data was **1.303**. This methodology although reasonable for annual mean data, has a tendency to

¹⁶ T:\Pollution\Air Quality\Progress Reports\Progress Report 2018\PM10

over-estimate the number of daily mean exceedances. Consequently, these results should be treated with some caution.

In addition, DCC have four unheated Beta-Attenuation Monitors (BAM), which are gravimetric equivalent monitors. The PM₁₀ data from these have been corrected for slope by Ricardo using the factor (0.8333) determined by the UK Equivalence Testing Programme¹⁷. For comparison with the NAQS objectives annual mean concentrations are calculated from an hourly time base. PM₁₀ data from the Fidas does not require to be adjusted, but the PM_{2.5} data is adjusted for slope by the following factor (1/1.06).

Short-term to Long-term Data adjustment

Annualisation of data was required for one diffusion tube site and two realtime monitors with less than 75% data capture in 2019. The methodology outlined in Box 7.9 of LAQM.TG(16) was used. The urban background sites used are shown in the tables below along with the annualisation factors applied to the data.

Table C.3 Period Adjustment Calculation St Andrews Street (26) (DT 56) Jan, Mar-Apr, Aug, Oct-Dec 2019

Urban Background Locations	Annual Mean, A _m (µg/m ³)	Period Mean, P _m (µg/m ³)	Ratio, A _m /P _m	Average Ratio, R _a
Balgavies PI	25.88	28.59	0.905	0.905
Carolina Court Lp6	16.84	18.46	0.912	
Woodside Ave	22.77	25.54	0.891	
B/ Ferry Rd Lower (Cyclesign)	13.42	14.70	0.913	
Site to be annualised				
St Andrews St (26) (DT56)	30.8	34.00		

Note: annualised mean shown in red this is not bias corrected for diffusion tubes

Table C.4 Period Adjustment Calculation Meadowside PM 2.5 2019

Urban Background Locations	Annual Mean, A _m (µg/m ³)	Period Mean, P _m (µg/m ³)	Ratio, A _m /P _m	Average Ratio, R _a
Edinburgh St.Leonards	6.34	6.02	1.054	1.03
Dundee Mains Loan	5.51	5.38	1.024	
Aberdeen -Errol Place	7.26	7.15	1.015	
Perth Muirton	5.13	4.99	1.027	
Site to be annualised				
Meadowside PM2.5	6.6	6.38		

¹⁷ <http://laqm.defra.gov.uk/laqm-faqs/faq104.html>

Table C.5 Period Adjustment Calculation Myrekirk PM 10 2019

Urban Background Locations	Annual Mean, A_m ($\mu\text{g}/\text{m}^3$)	Period Mean, P_m ($\mu\text{g}/\text{m}^3$)	Ratio, A_m/P_m	Average Ratio, R_a
Edinburgh St.Leonards	10.95	12.31	0.890	0.917
Dundee Mains Loan	9.17	10.13	0.905	
Aberdeen -Errol Place	13.70	14.40	0.951	
Perth Muirton	8.52	9.23	0.923	
Site to be annualised				
Myrekirk PM10	12.3	13.39		

Appendix C.2 Overview of NO₂ Annual Mean Concentrations across the City

Union Street & Whitehall Street

Figure C.1 NO₂ Monitoring Locations in Union Street and Whitehall Street

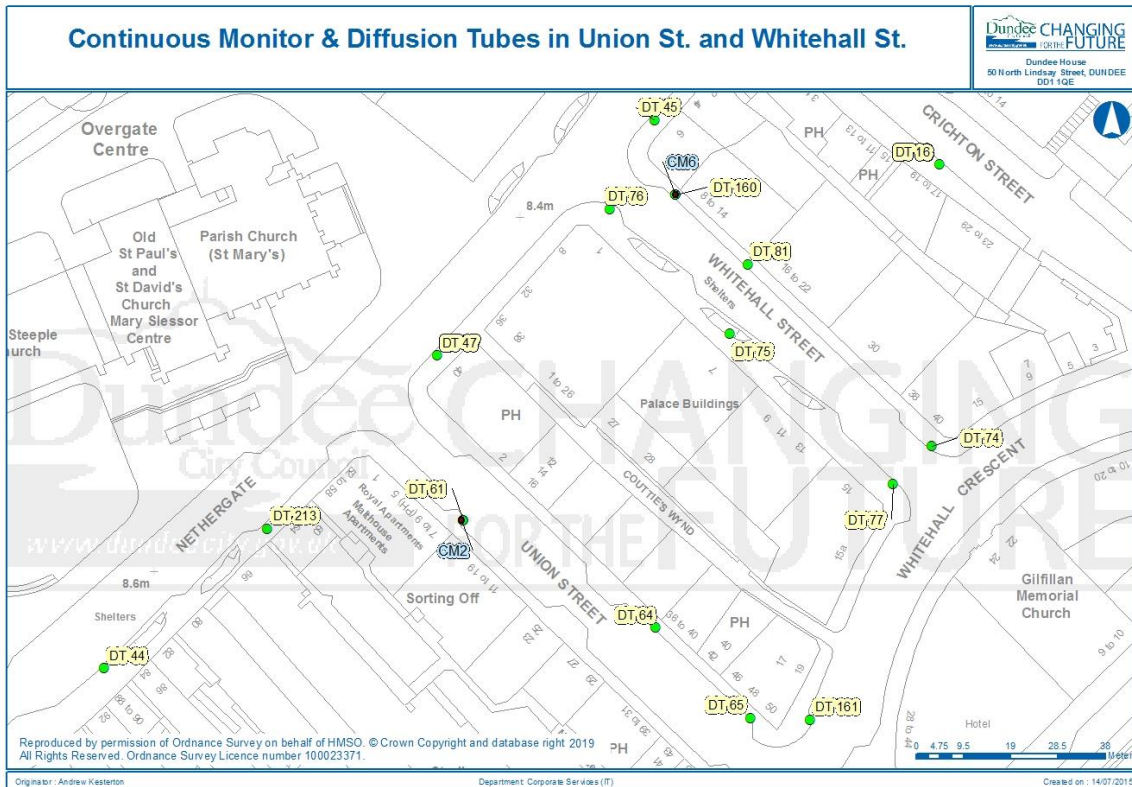


Figure C.2 Overview of NO₂ Concentrations in Union St and Nethergate (east of Marketgait)

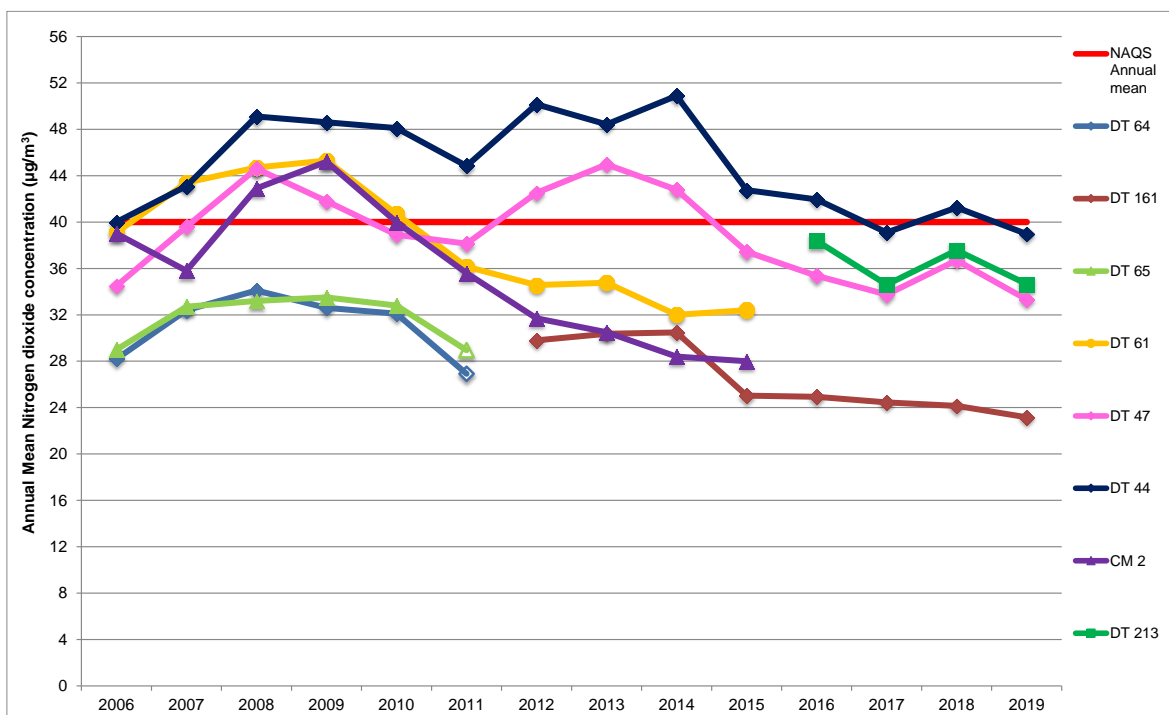
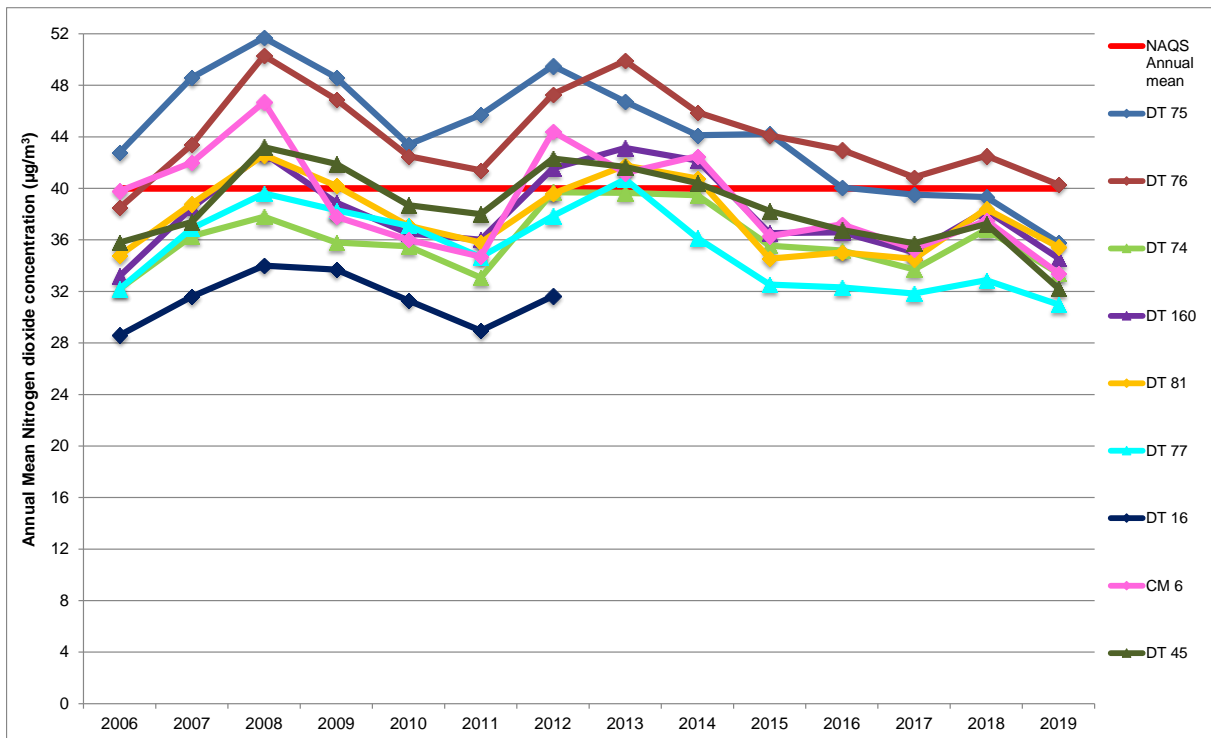


Figure C.3 Overview of NO₂ Concentrations in Whitehall St and Crichton St.



Seagate

Figure C.4 NO₂ Monitoring Locations in Seagate

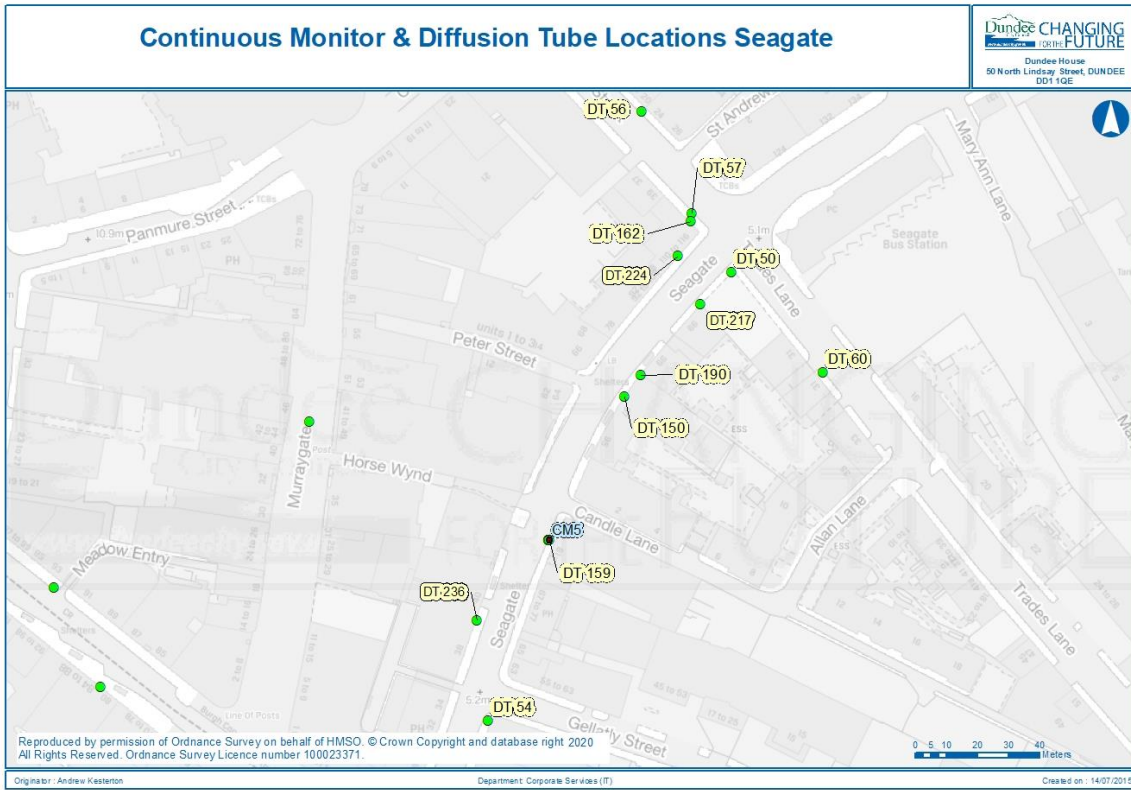
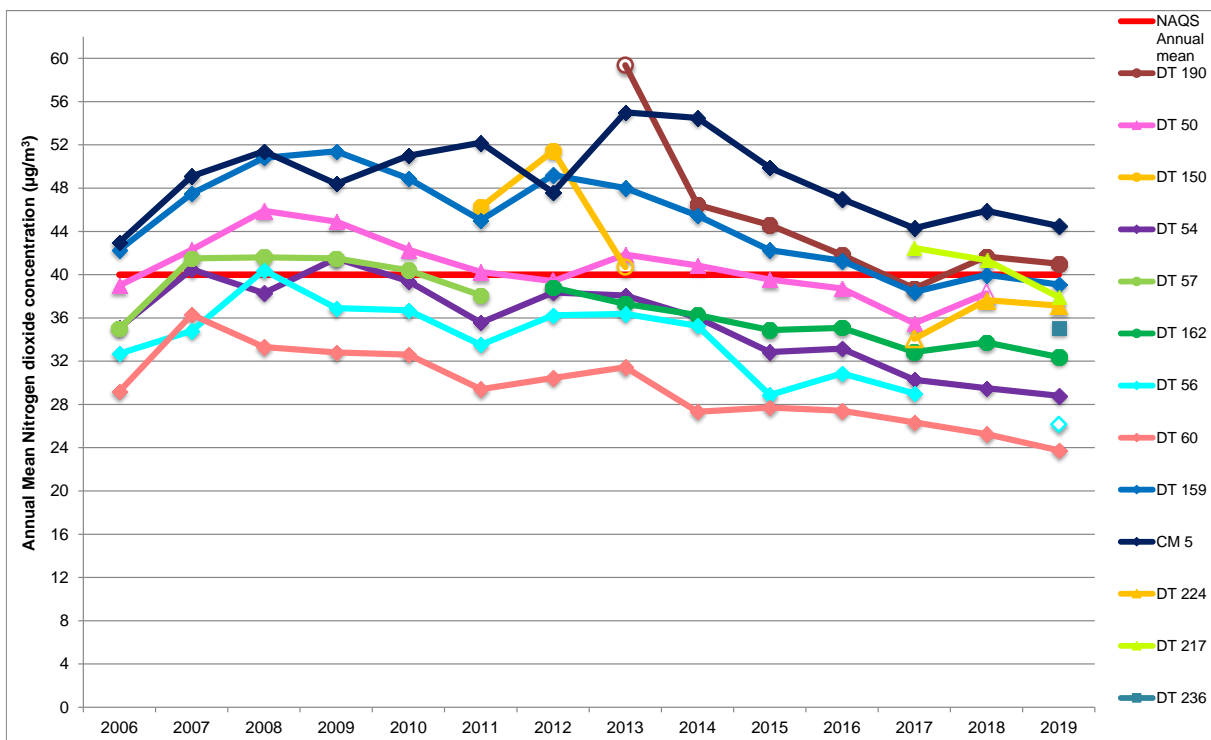


Figure C.5 Overview of NO₂ Concentrations in Seagate.



Nethergate

Figure C.6 NO₂ Diffusion Tube Locations in Nethergate

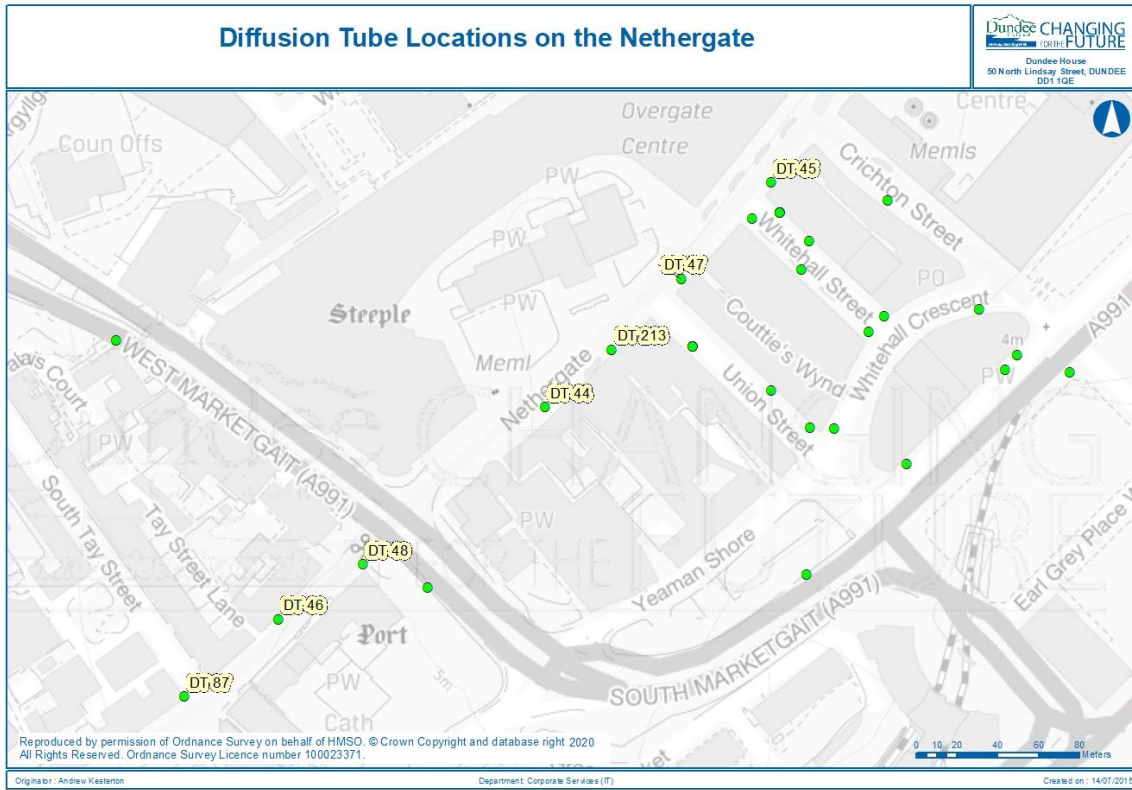
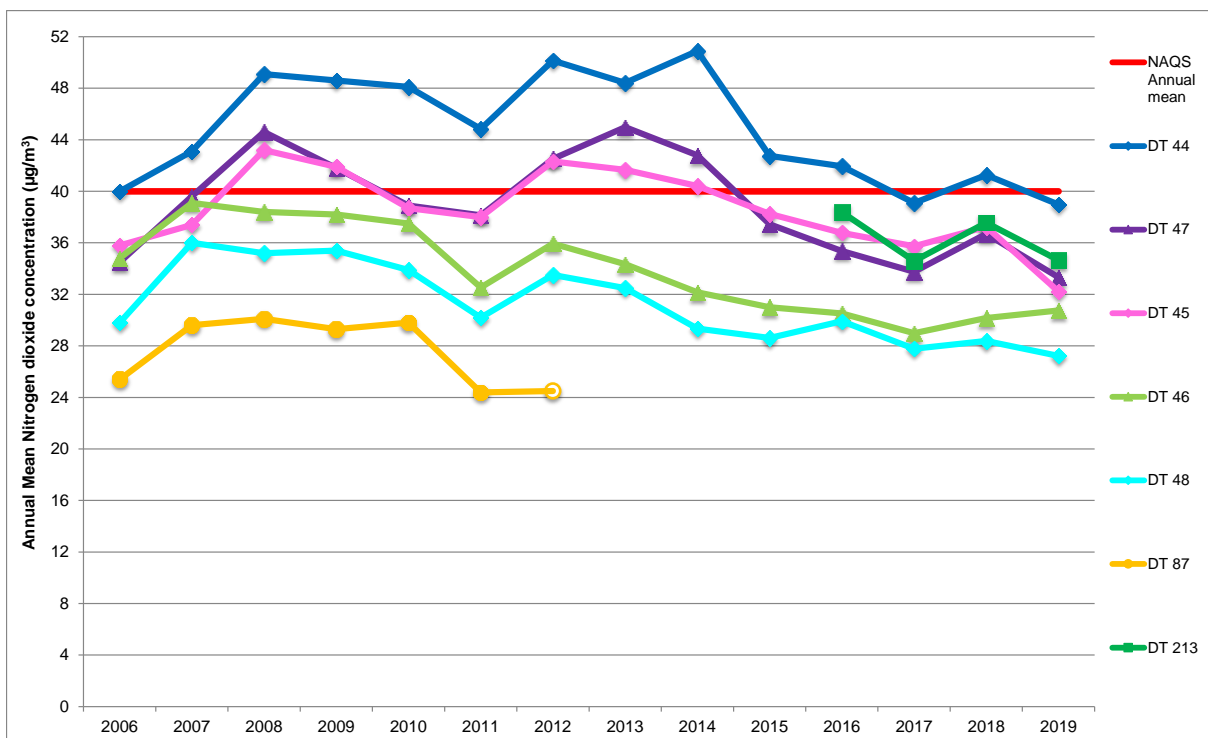


Figure C.7 Overview of NO₂ Diffusion Tube Concentrations in Nethergate.



Victoria Road / Meadowside

Figure C.8 NO₂ Diffusion Tube Locations in Victoria Road / Meadowside

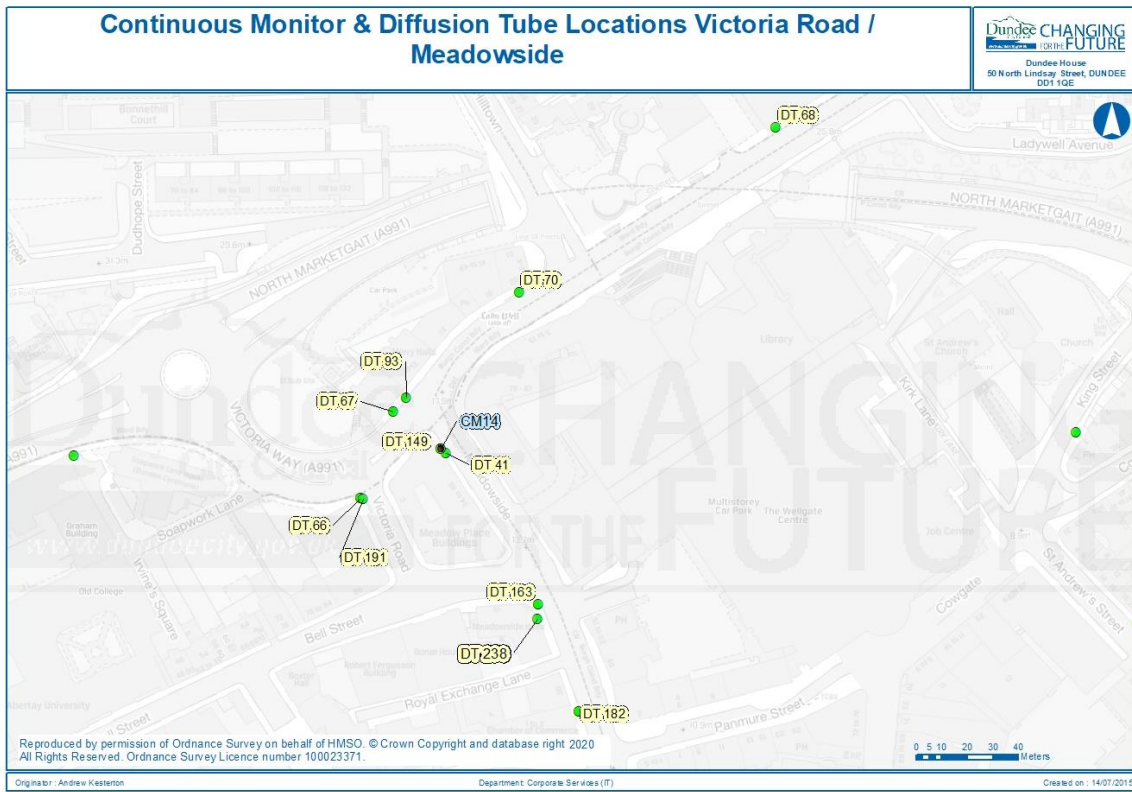
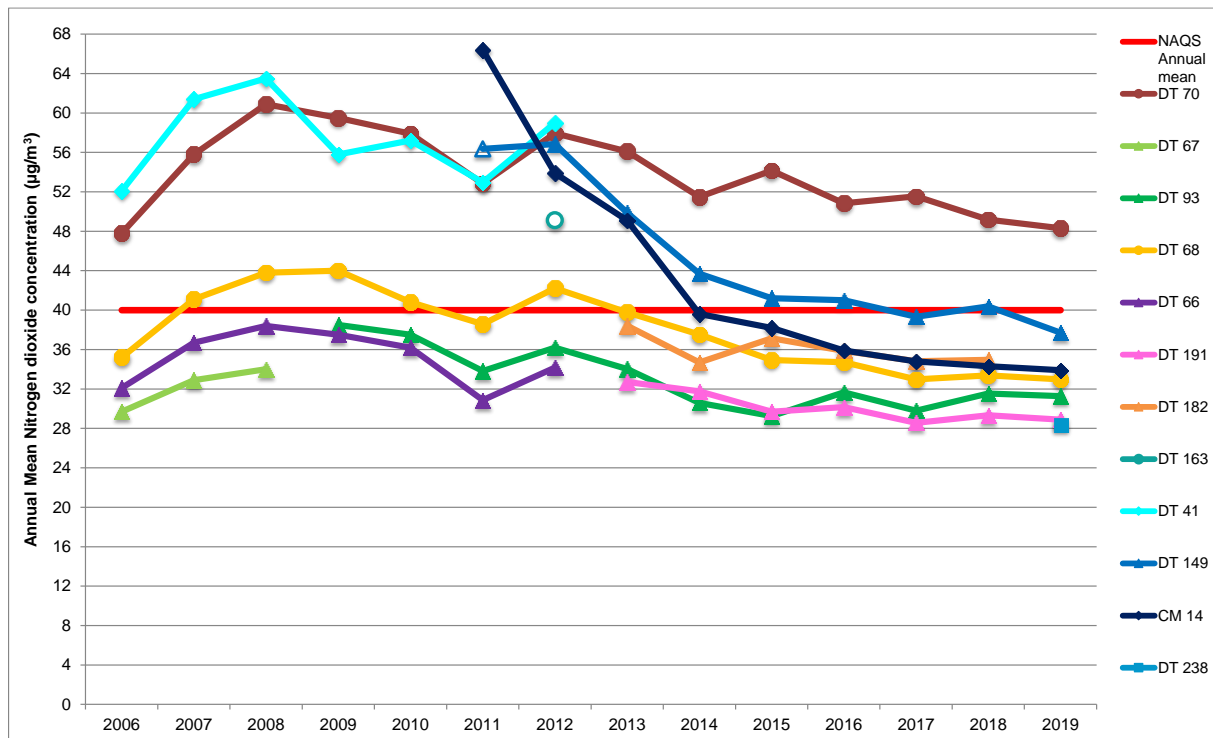


Figure C.9 Overview of NO₂ Diffusion Tube Concentrations in Victoria Road / Meadowside



Albert Street / Dura Street

Figure C.10 NO₂ Diffusion Tube Locations in Albert Street / Dura Street

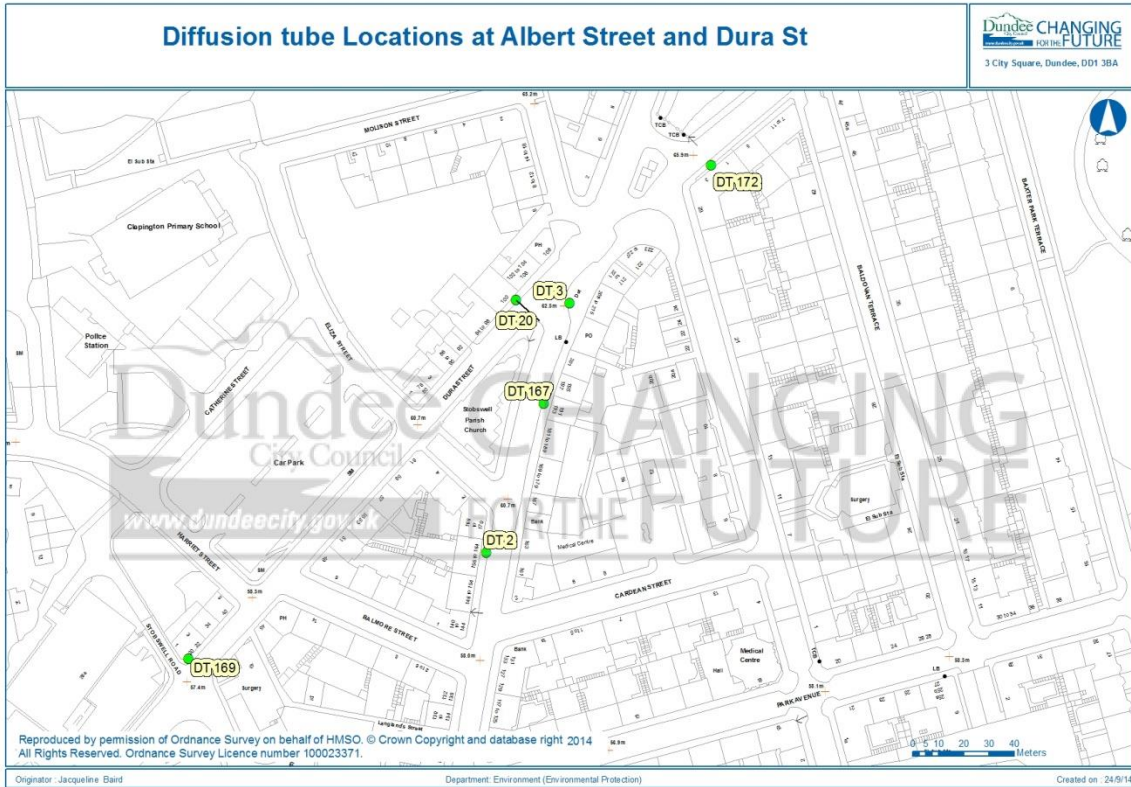
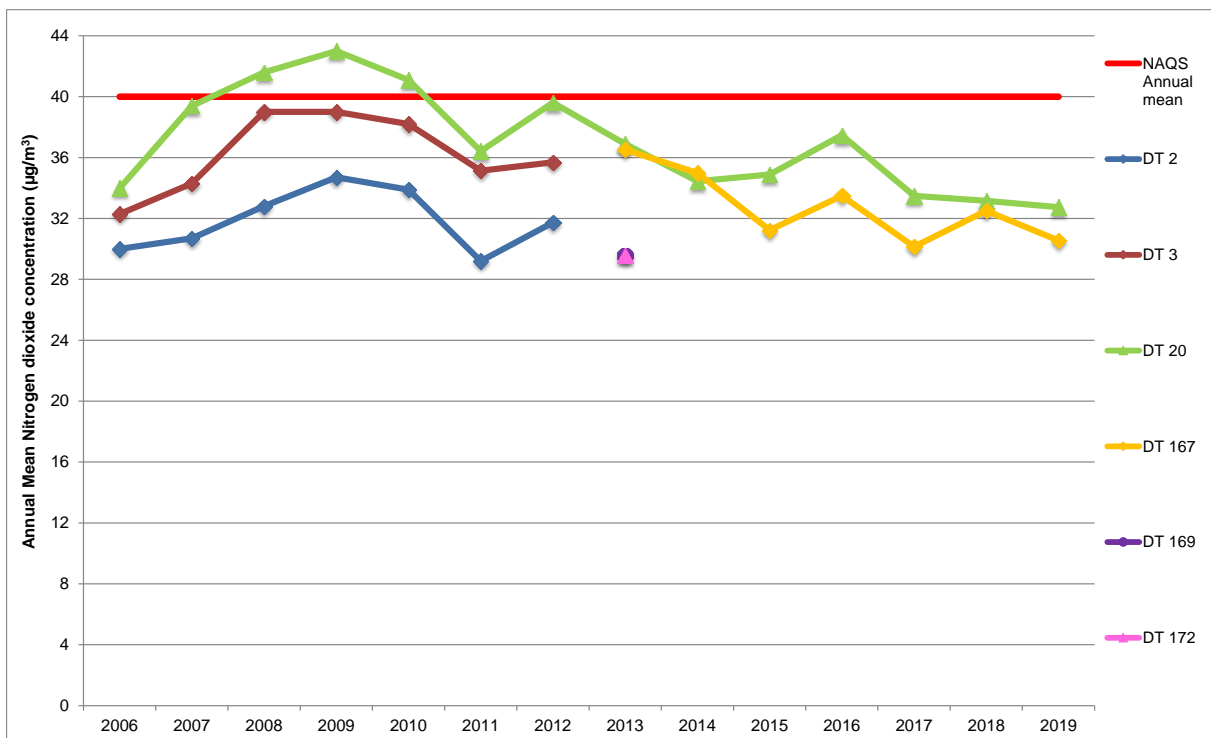


Figure C.11 Overview of NO₂ Diffusion Tube Concentrations in Albert Street / Dura Street.



Lochee Road

Figure C.12 NO₂ Monitoring Locations in Lochee Road

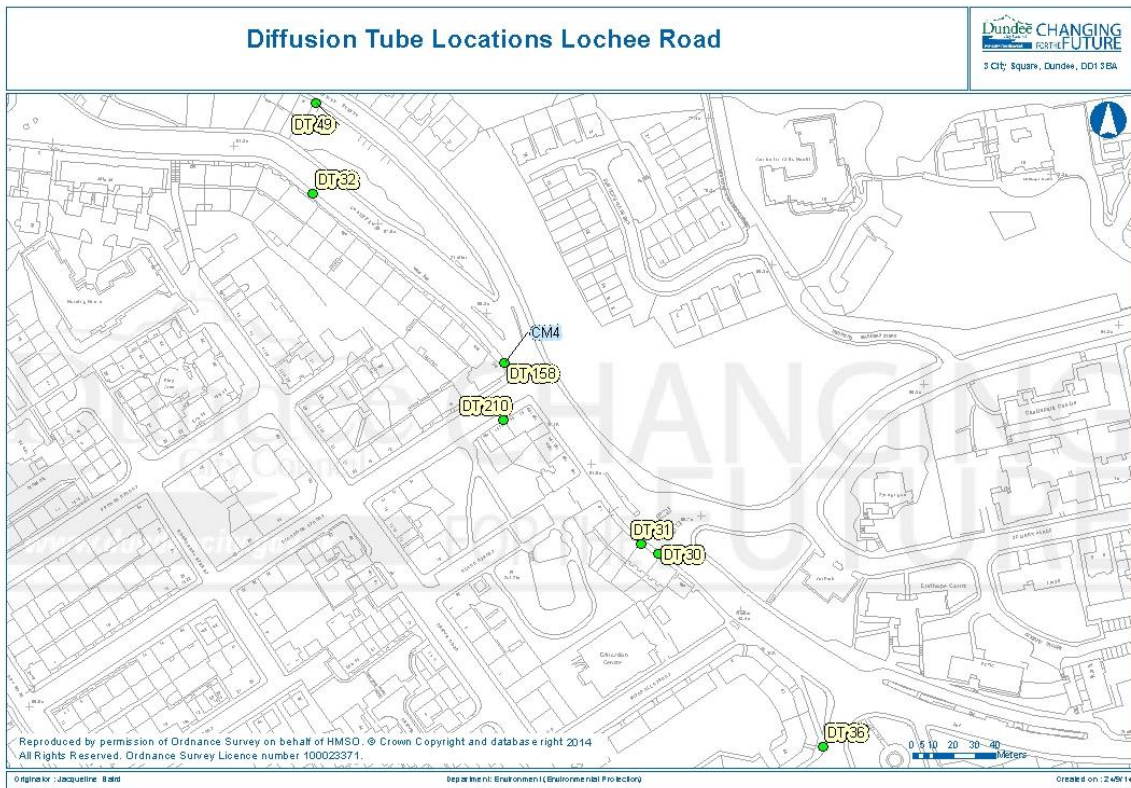
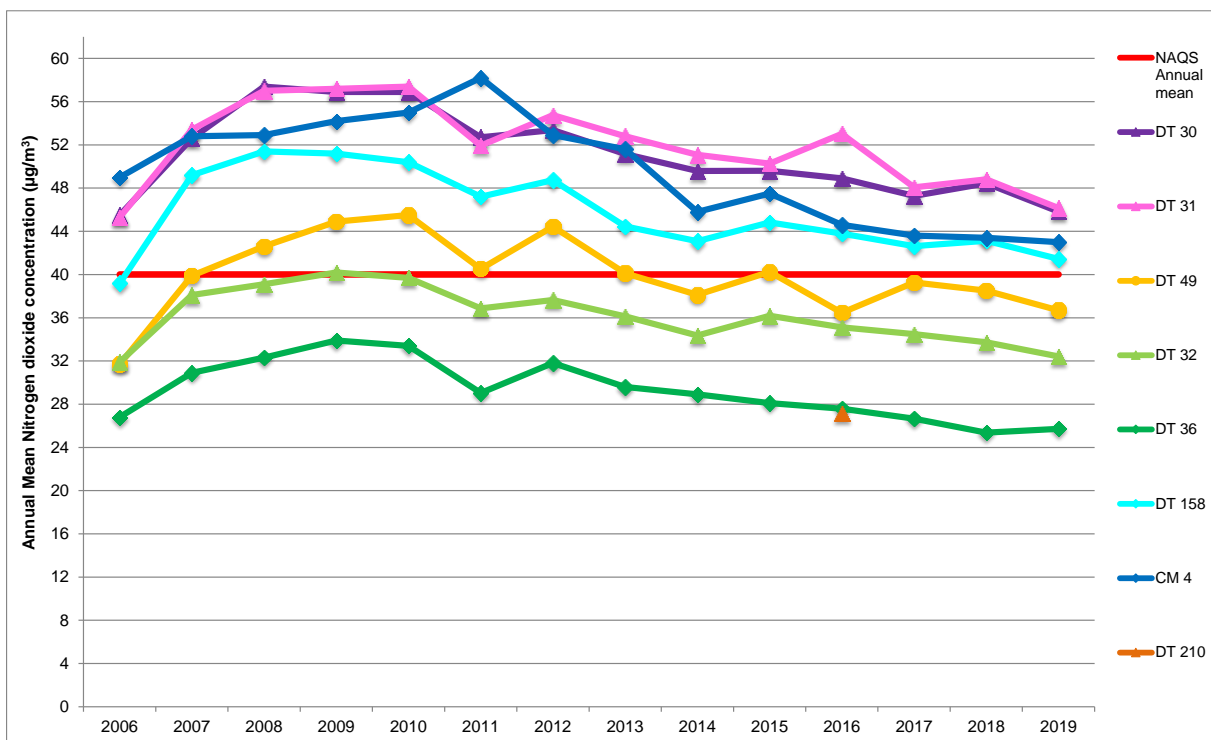


Figure C.13 Overview of NO₂ Concentrations in Lochee Road



Logie Street

Figure C.14 NO₂ Diffusion Tube Locations in Logie Street

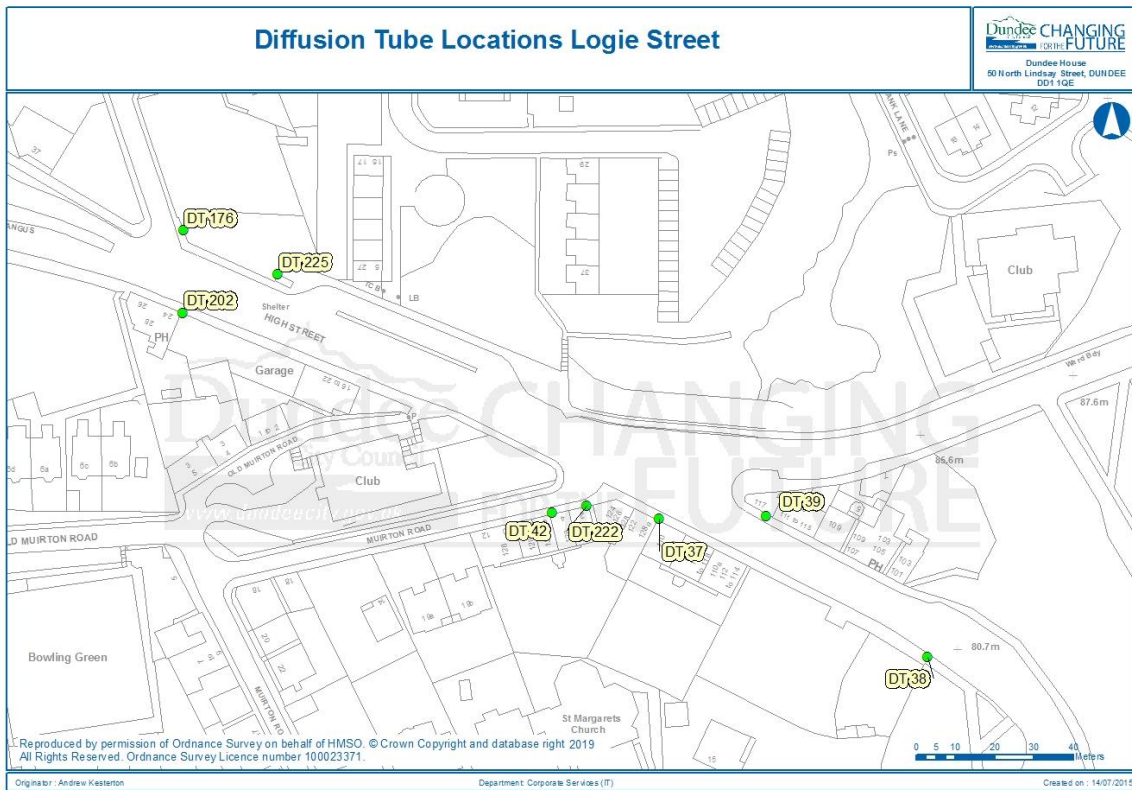
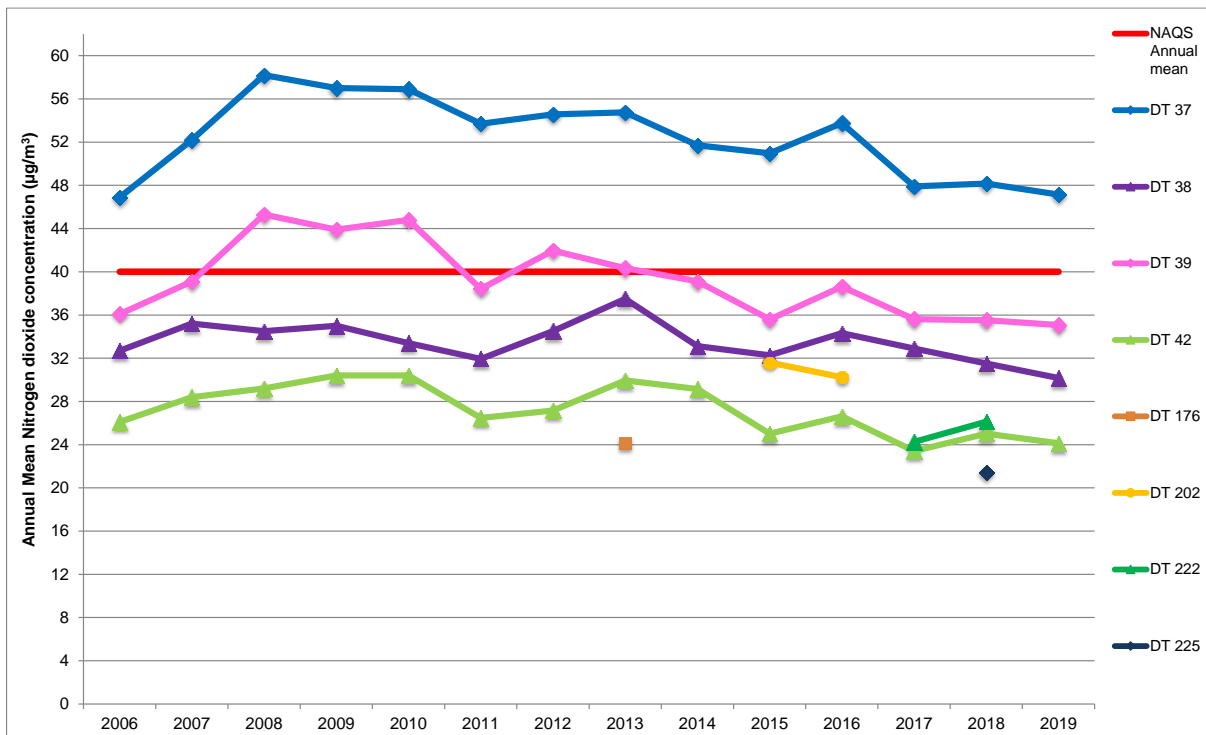


Figure C.15 Overview of NO₂ Diffusion Tube Concentrations in Logie St.



Albert Street / Arbroath Road

Figure C.16 NO₂ Diffusion Tube Locations in Albert St. / Arbroath Road

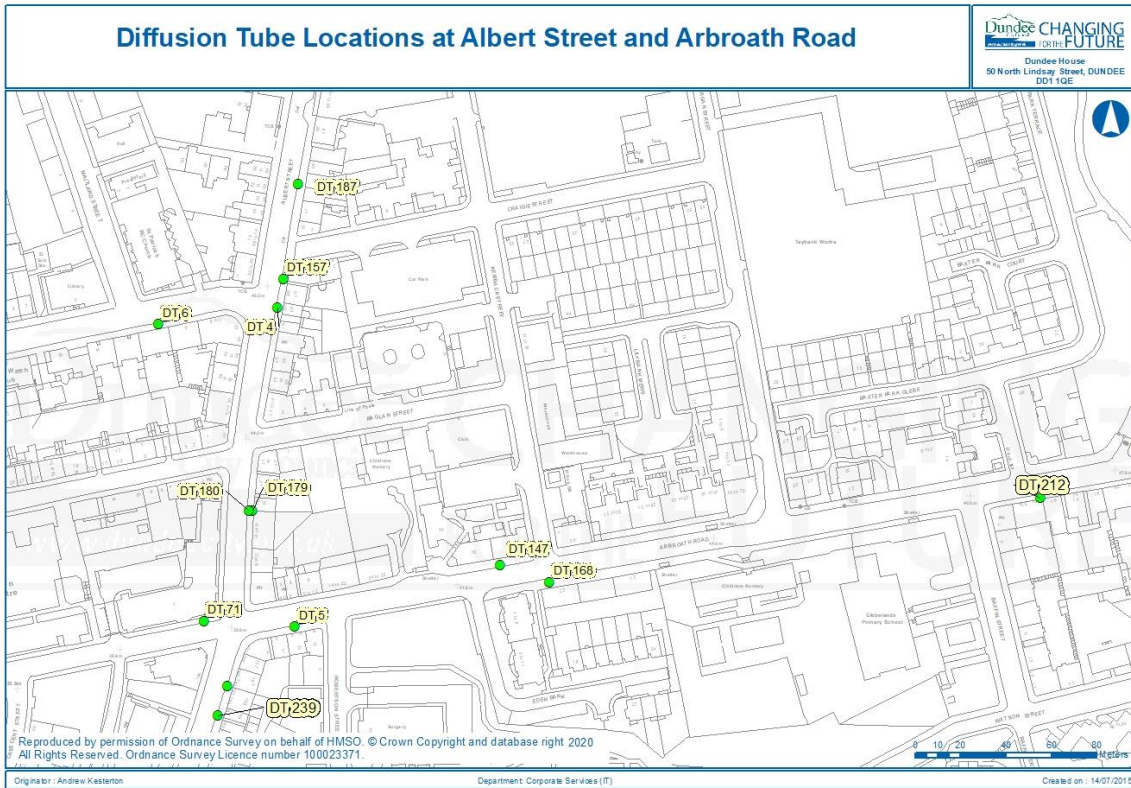
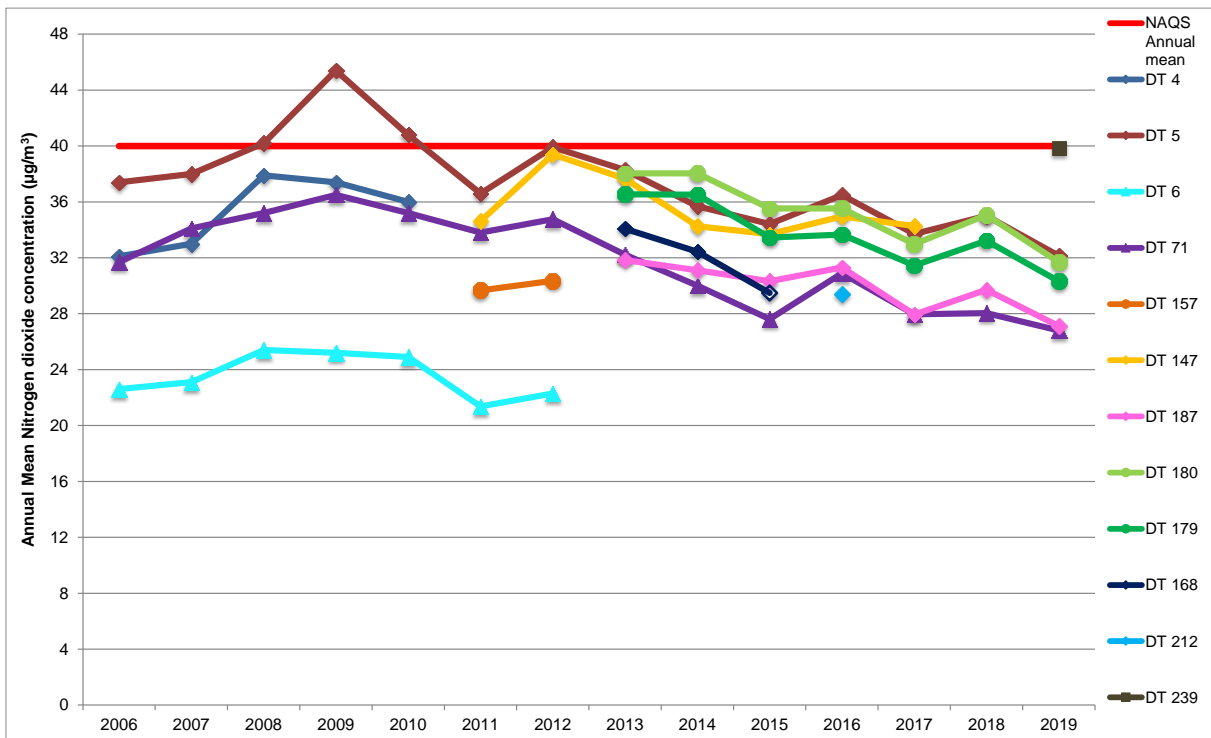


Figure C.17 Overview of NO₂ Diffusion Tube Concentrations in Albert St. / Arbroath Road



Kingsway / Forfar Road.

Figure C.18 NO₂ Diffusion Tube Locations on/near the Kingsway

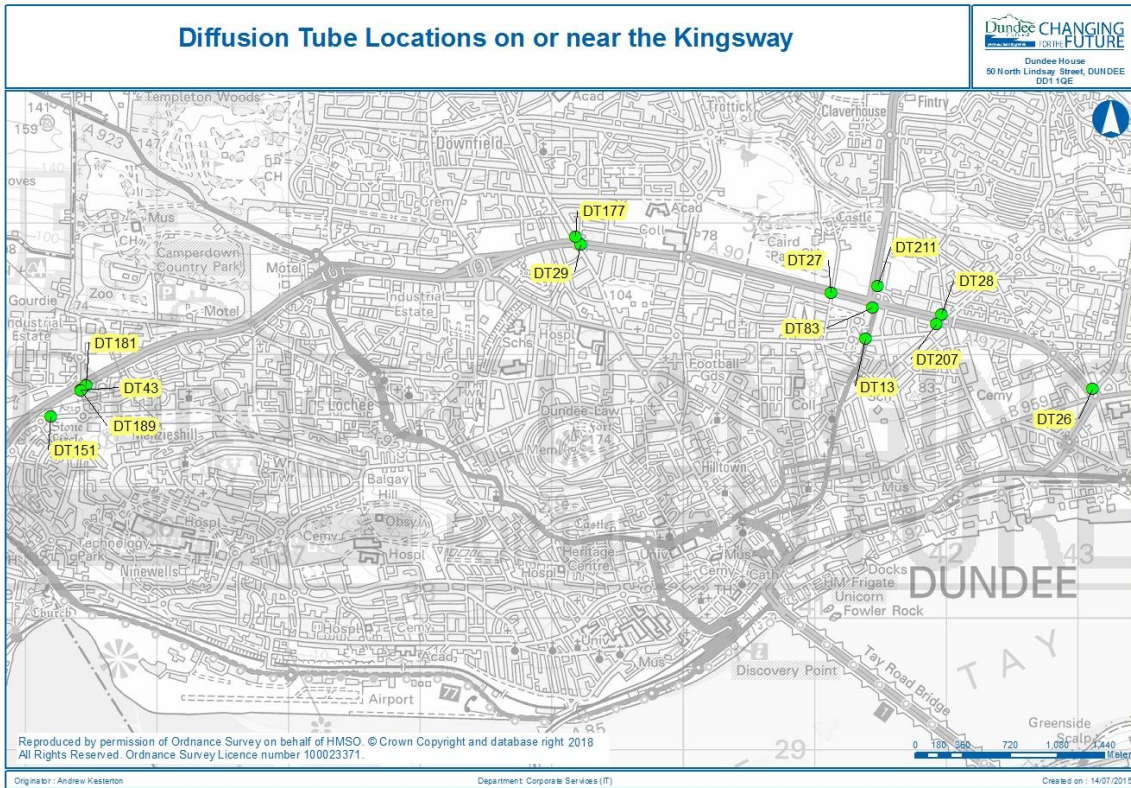
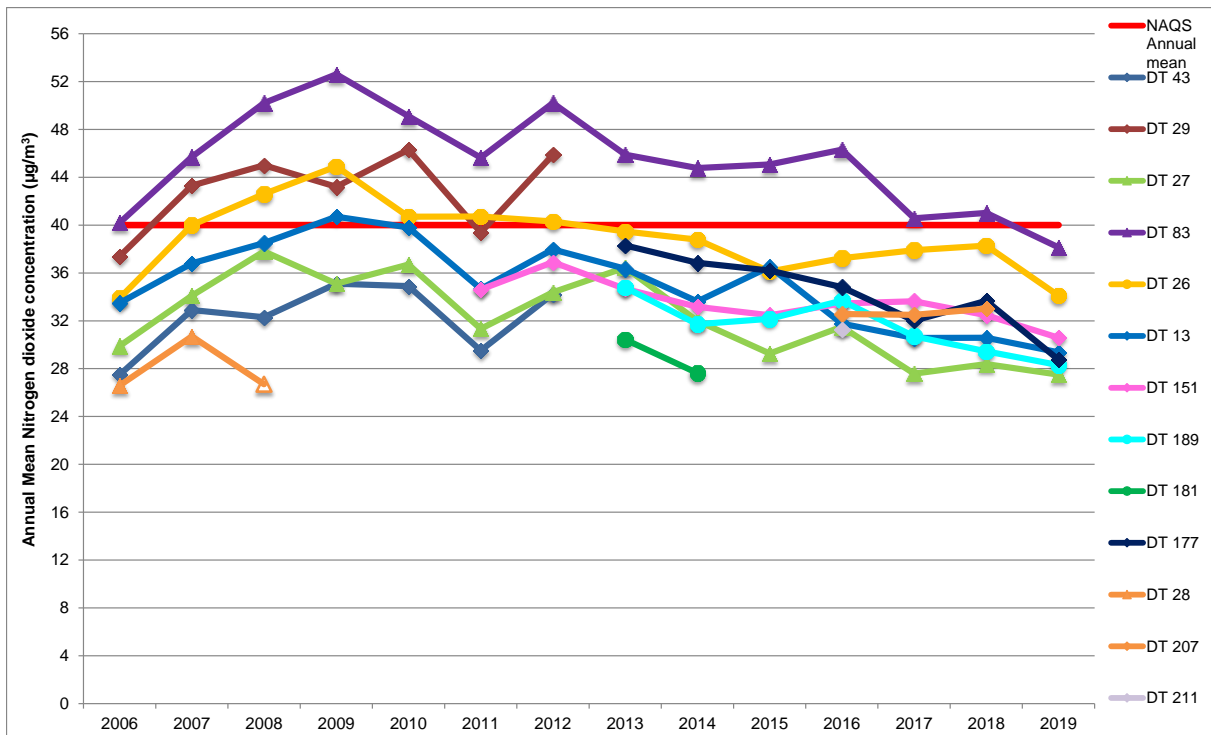


Figure C.19 Overview of NO₂ Diffusion Tube Concentrations on/near the Kingsway



Bus Corridor

Figure C.20 Other NO₂ Diffusion Tube Locations on Bus Corridor

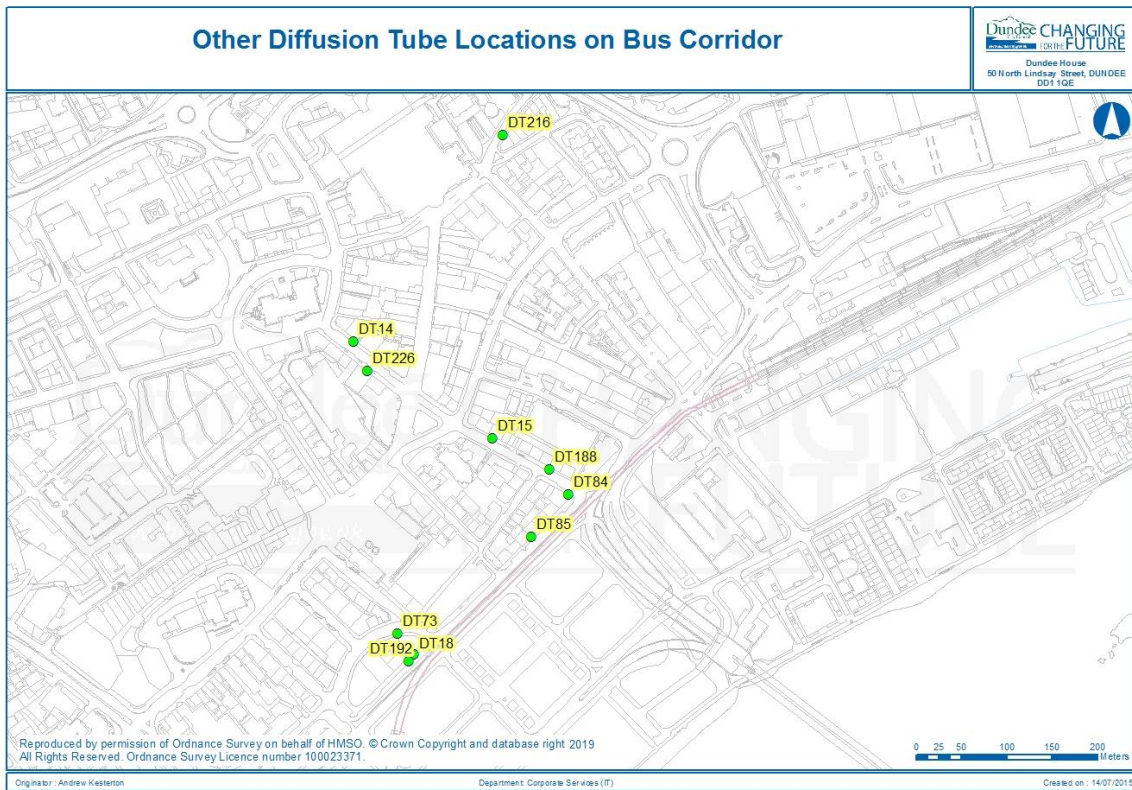
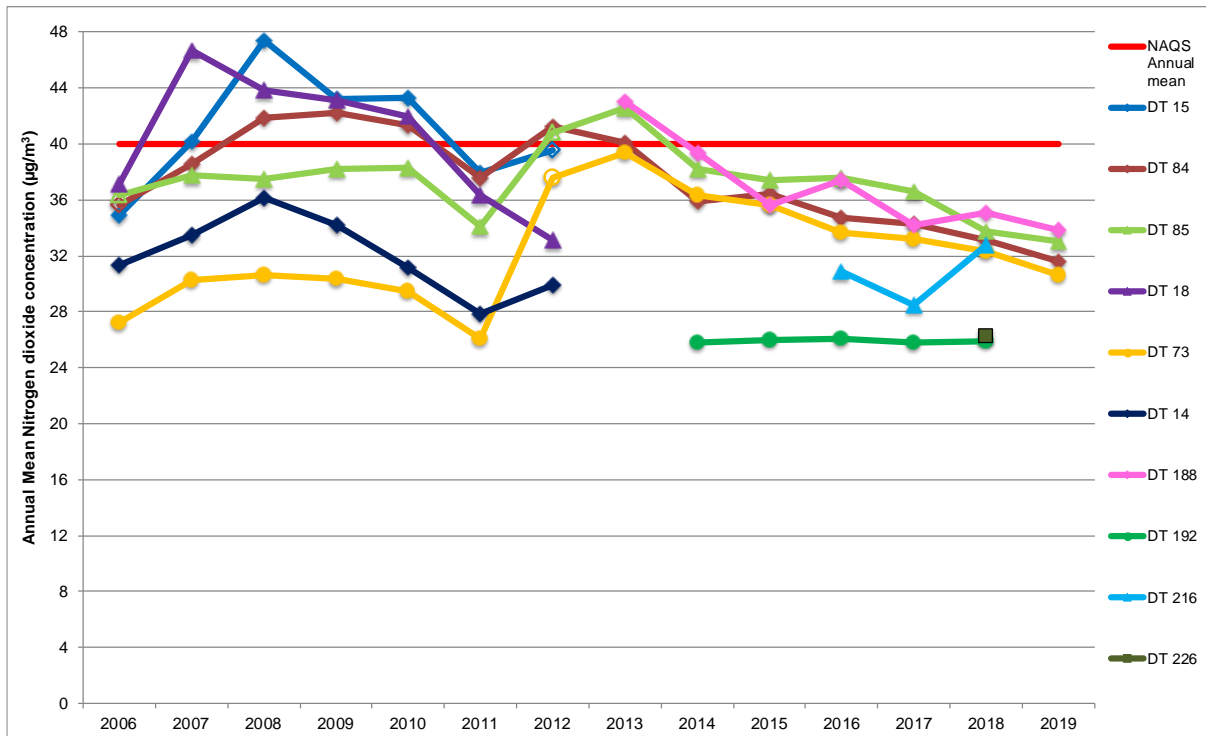


Figure C.21 Overview of Other NO₂ Diffusion Tube Concentrations on Bus Corridor



Inner Ring Road

Figure C.22 NO₂ Diffusion Tube Locations on Inner Ring Road

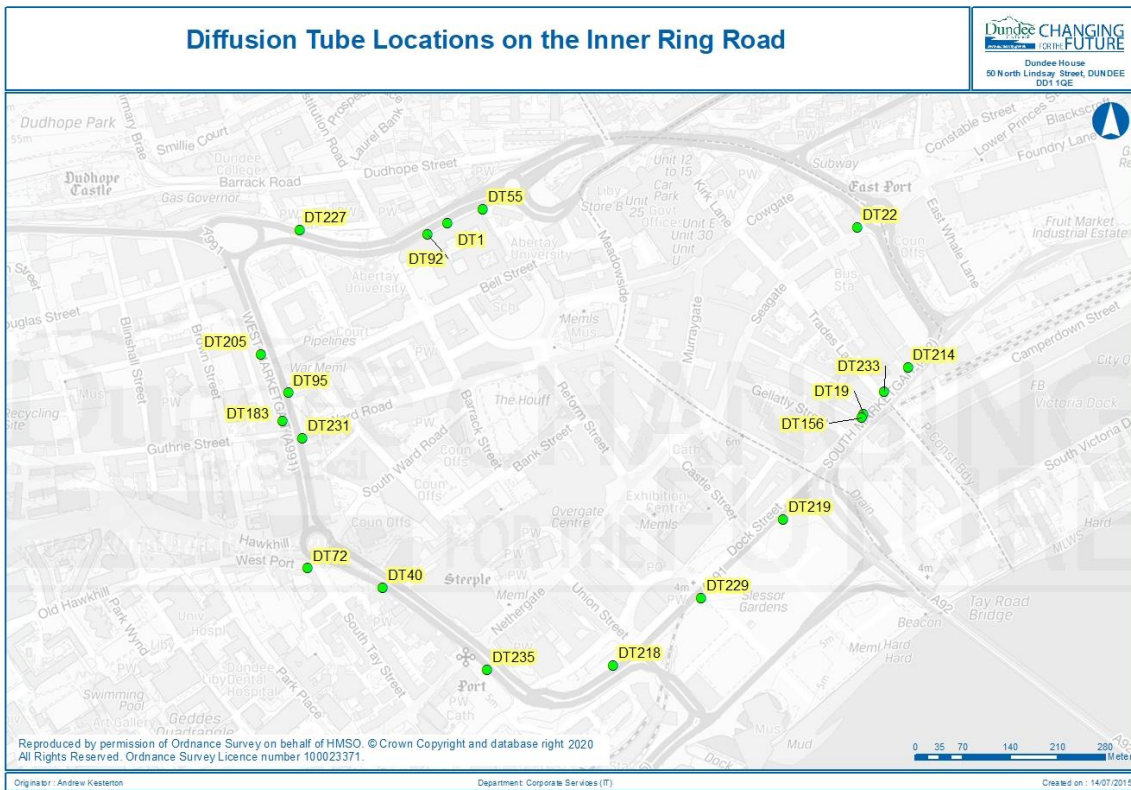


Figure C.23a Overview of NO₂ Diffusion Tube Concentrations on Inner Ring Road (West & North Marketgait)

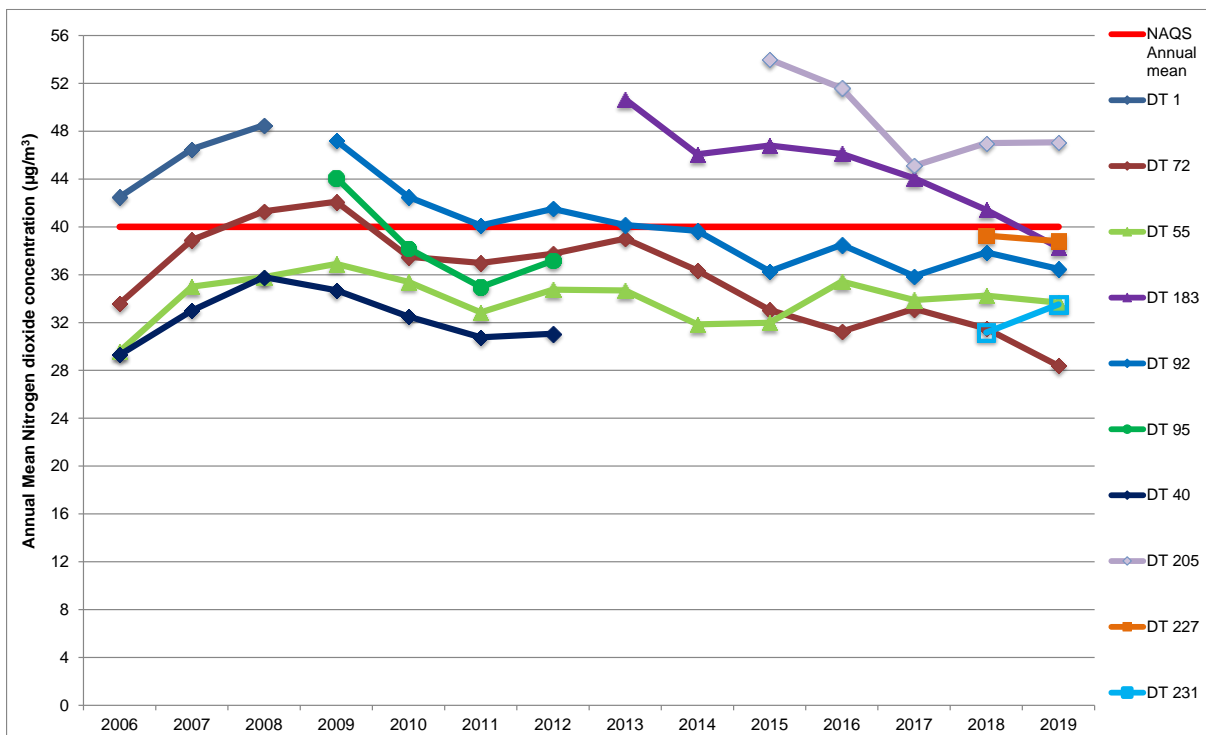
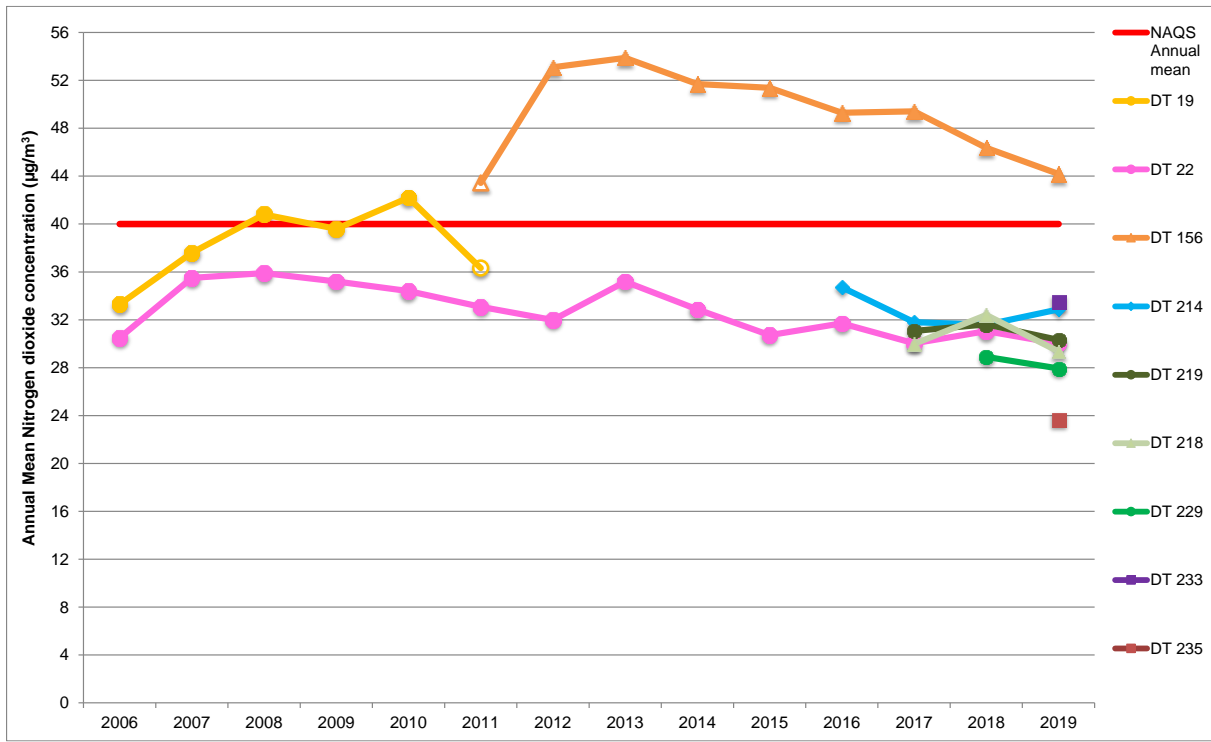


Figure C.23b Overview of NO₂ Diffusion Tube Concentrations on Inner Ring Road (East & South Marketgait)



Stannergate Roundabout

Figure C.24 NO₂ Diffusion Tube Location at Stannergate Roundabout

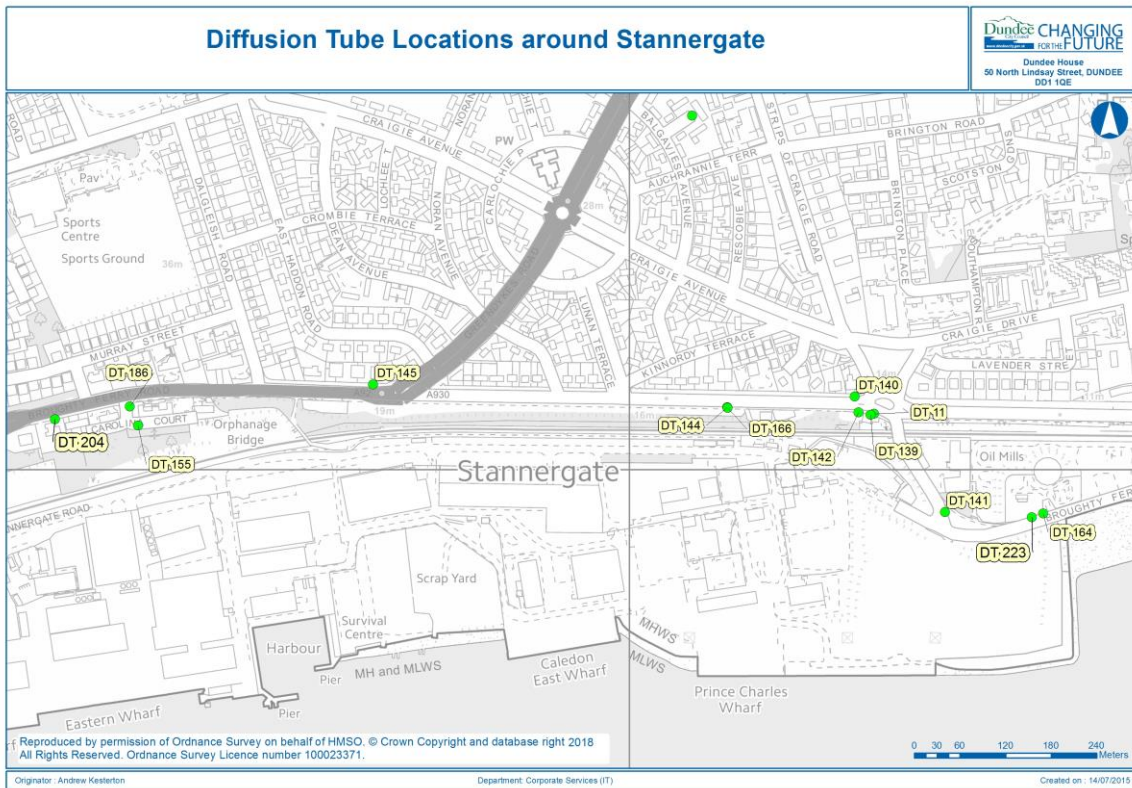
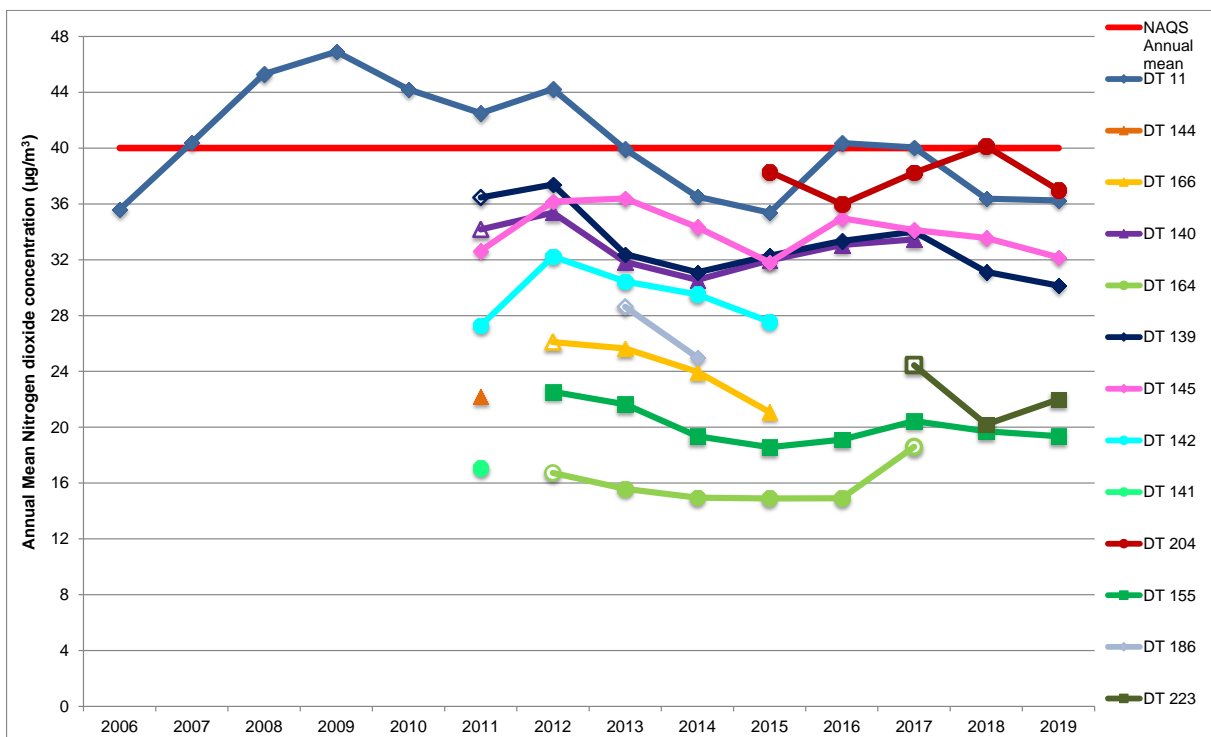


Figure C.25 Overview of NO₂ Diffusion Tube Concentration at Stannergate Roundabout



Strathmore Avenue

Figure C.26 NO₂ Diffusion Tube Location at Strathmore Avenue

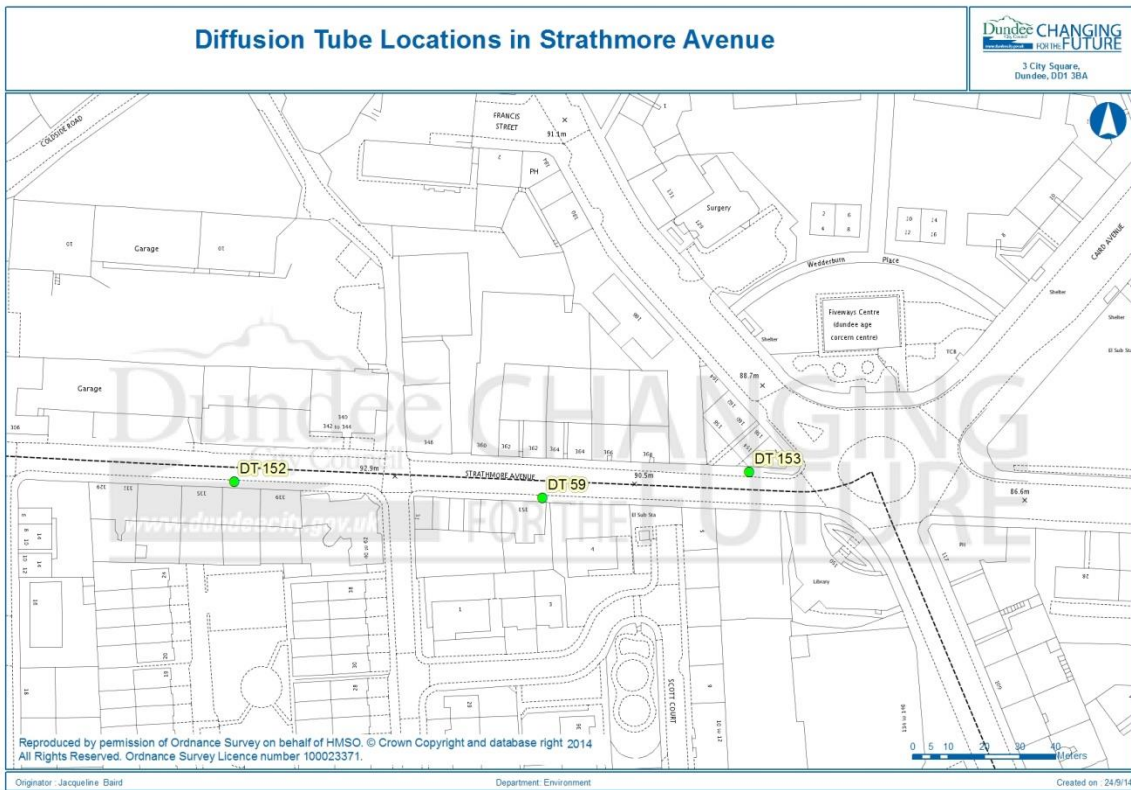


Figure C.27 Overview of NO₂ Diffusion Tube Concentration at Strathmore Avenue

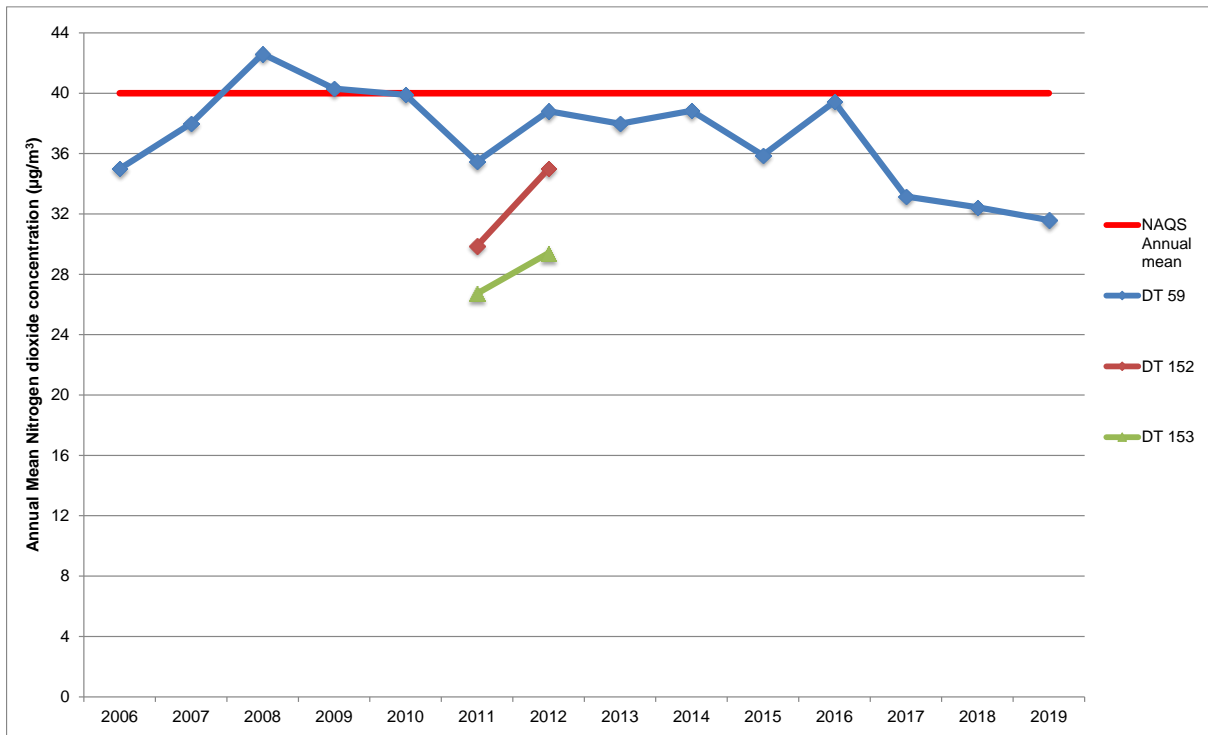


Figure C.28 Urban Background NO₂ Monitoring Locations

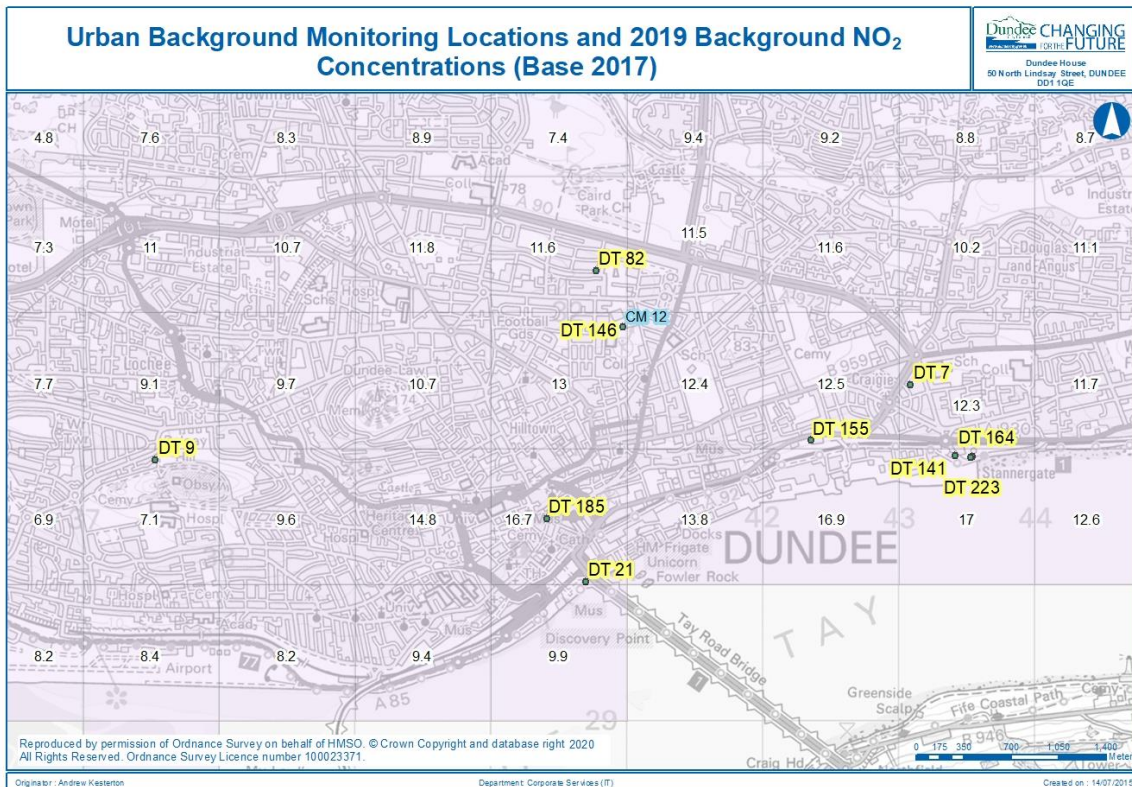


Figure C.29 Overview of NO₂ Concentrations at Urban Background Locations

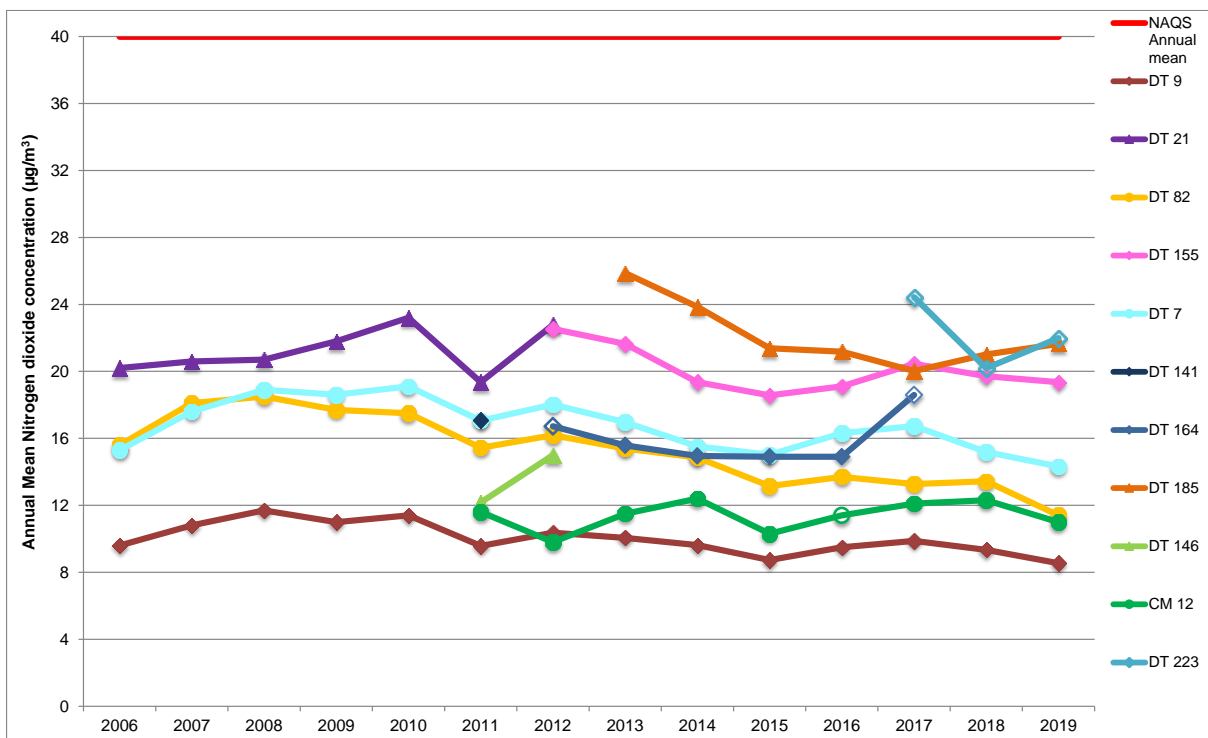
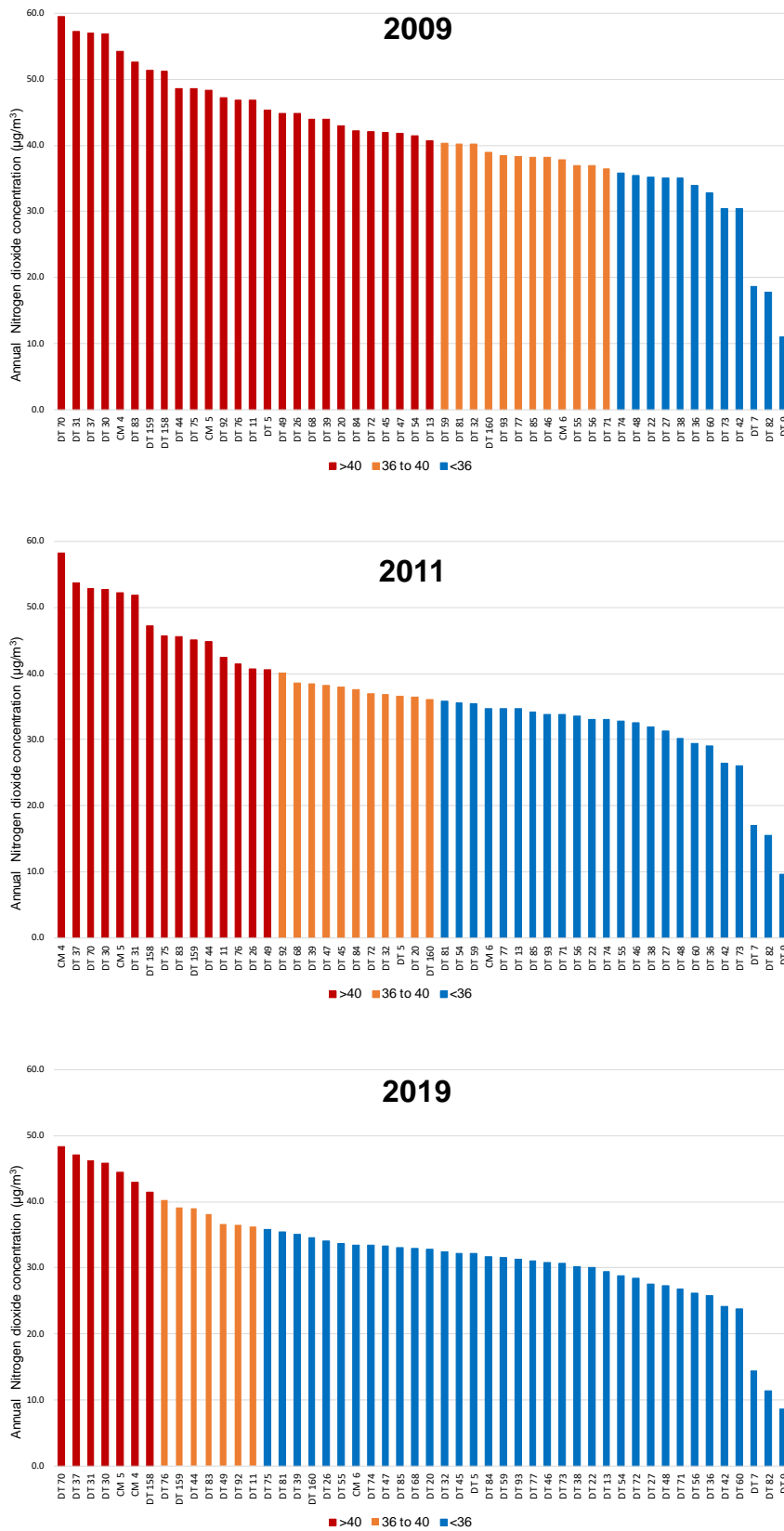
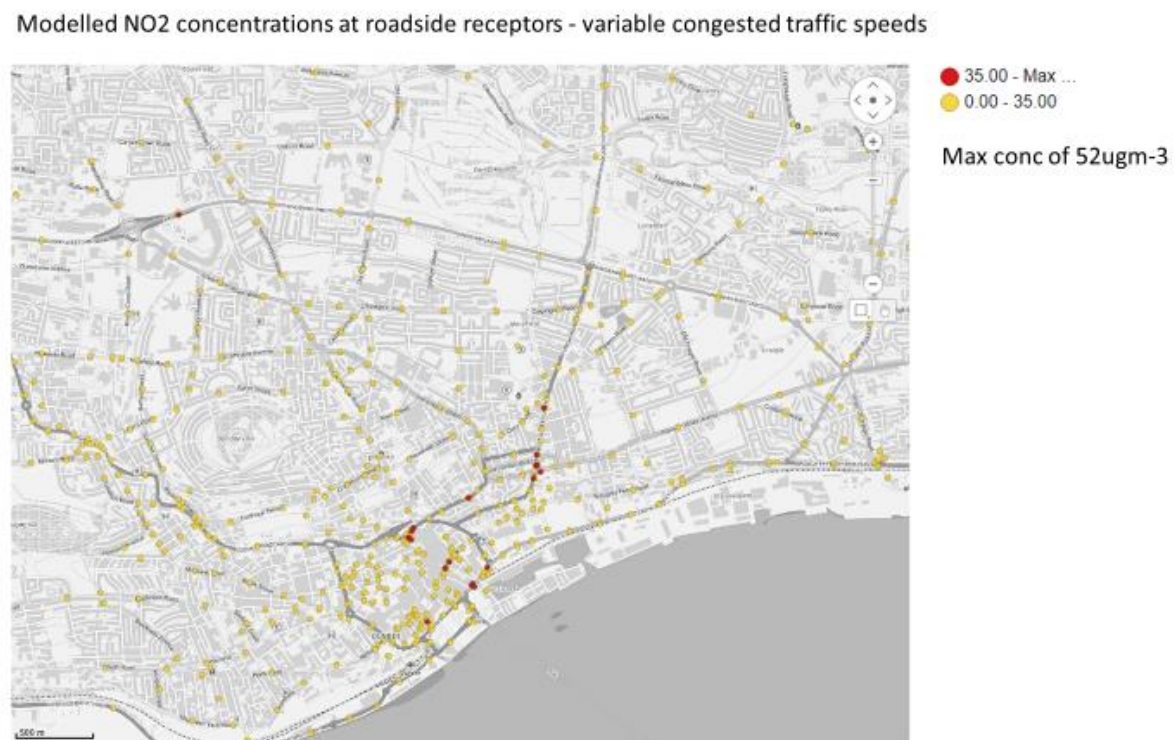


Figure C.30 Ranked Annual Mean NO₂ Concentrations at 50 Long-term Sites in 2009, 2011 and 2019



Appendix C.3 Road Traffic Data

Figure C.31 Modelled 2019 Kerbside NO₂ concentrations City Model for Dundee



Note: 2020-05-26 Picture provided by Andrew Malby of Scottish Environment Protection Agency

Table C.6 Road Traffic Reduction Sites – Annual Average Daily Traffic

RTRA count location	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Bar Chart
Arbroath Rd (E of Kenilworth Ave)	13186	13335	14054	13153	13846	12869	13283	13697	13142	13174	13287	13642	13784	13526	13030	
Blackness Rd (W of Marchfield)	6574	6675	6435	6195	6145	5938	5911	5844	5102	5509	5676	6487	5819	5810	5540	
Broughty Ferry Rd (E of Dalglish Rd)	31956	31802	31535	30098	27640	27756	27315	24741	29322	30272	26809	28161	29190	29832		
Dens Rd (S of Hillbank Rd)	10852	10664	10672	11023	10833	10083	10062	10178	9744	9707	10315	10322	10756	10409	9961	
Forfar Rd (N of Janefield Pl)	9278	9640	9880	8222	9224	9213	8861	9053	8768	9063	9209	8876	8991	9283	9055	
Hilltown (N of Stirling St)	6024	5710	5895	5701	5753	5656	5416	5492	5608	4268	5782	5828	5491	4601	4392	
Lochee Rd (N of Rankine St)	13477	13681	13438	13286	13296	12983	12684	11603	11285	11880	11821	11770	12453	12928	13135	
Perth Rd (E of Windsor St)	8341	7434	7583	7531	7695	7352	7053	7184	7180	7214	7328	6650	7316	7912	7495	
Pitkerro Rd (S of Baxter Park)	10107	9522	9975	9950	9789	9359	8623	8608	8827	8899	9085	9126	9584	8710	8774	
Rankine St (N of Lochee Rd)	8098	7294	8069	7927	7605	7121	7115	6862	7188	6939	7118	7035	7043	7484	7282	
Riverside Dr (nr Airport)	18875	19056	18918	19045	17907	17654	17024	15900	16213	15932	15923	17343	17503	15791	17315	
Rosebank St (N of Kinloch St)	4821	4867	4722	4623	4528	4603	4426	4489	4621	4587	4655	4615	4183	4015	4070	
Tay Bridge	24475	24686	24748	25045	25406	25235	25484	24753	24770	24925	21762	25993	26631	26633	27250	

Note: 1) Heights of the bars in the charts are relative to the range of values across all sites.
 2) The red and blue bars are the highest and lowest count, respectively, at that count location.

Table C.7 Road Traffic Reduction Sites – Percentage Growth

RTRA count location	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Bar Chart
Arbroath Rd (E of Kenilworth Ave)	100	101	107	100	105	98	101	104	100	100	101	104	105	103	99	
Blackness Rd (W of Marchfield)	100	102	98	94	93	90	90	89	78	84	86	99	89	88	84	
Broughty Ferry Rd (E of Dalgleish Rd)	100	100	99	94	86	87	85	77	92	95	84	88	91	93		
Dens Rd (S of Hillbank Rd)	100	98	98	102	100	93	93	94	90	89	95	95	99	96	92	
Forfar Rd (N of Janefield Pl)	100	104	106	89	99	99	96	98	95	98	99	96	97	100	98	
Hilltown (N of Stirling St)	100	95	98	95	96	94	90	91	93	71	96	97	91	76	73	
Lochee Rd (N of Rankine St)	100	102	100	99	99	96	94	86	84	88	88	87	92	96	97	
Perth Rd (E of Windsor St)	100	89	91	90	92	88	85	86	86	86	88	80	88	95	90	
Pitkerro Rd (S of Baxter Park)	100	94	99	98	97	93	85	85	87	88	90	90	95	86	87	
Rankine St (N of Lochee Rd)	100	90	100	98	94	88	88	85	89	86	88	87	87	92	90	
Riverside Dr (nr Airport)	100	101	100	101	95	94	90	84	86	84	84	92	93	84	92	
Rosebank St (N of Kinloch St)	100	101	98	96	94	95	92	93	96	95	97	96	87	83	84	
Tay Bridge	100	101	101	102	104	103	104	101	101	102	89	106	109	109	111	

Note: 1) Heights of the bars in the charts are relative to the range for that location.

2) The red and blue bars are the highest and lowest percentage growth, respectively, for that site.

Appendix C.4 List of Industrial Processes

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Rockwell Solutions, Wester Gourdie, Dundee	Chapter 6: Other Activities Surface treating with organic solvents - Also Chapter 7 SED	6.4.b	No	No	No	No	No	No	Variation in progress. Changes on site mean it's likely there has been a reduction of solvent emissions
MVV Environmental (Baldovie) Ltd Baldovie, Dundee	Chapter 5: Waste Management	Sector 5.1a and 5.1b under PPC 12	No	No	No	Yes, previously assessed	No	No	Substantial Variation for replacement plant issued in February 2019. Planning Application submitted late 2019 to continue use of old incinerator alongside the new one.
Nynas UK AB, East Camperdown Street, Dundee DD1 3LG	Chapter 1: Energy Industries	Section 1.2 Part A Paragraph (f) (i)	No	No	No	Yes, previously assessed	No	No	Site is now effectively a Part B process, but a formal surrender of the Part A has not yet been submitted. Site is now solely burning natural gas, with a much reduced inventory of bitumen and oil products.

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Nationwide Crash Repair Centres Ltd, Liff Road, Dundee	Chapter 6: Other Activities vehicle respraying	6.4.b	No	No	No	No	No	No	No Change
Hanson Aggregates Piper Street, Dundee	Chapter 3: Mineral Industries cement batchers	3.1.a.(ii)	No	No	No	No	No	No	Not operating.
Subsea Protection Systems	Chapter 3: Mineral Industries cement batching	3.1.b	No	No	No	Yes, previously assessed	No	No	Permit surrendered.
Discovery Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Brochtay Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Asda Stores Filling Station Kirkton	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tesco Stores Ltd, Methven Street, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	Surrendered 2015
BP Kingsway West Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Shell Caird Park	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Shell UK Ltd, East Kingsway Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	Closed 2015

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Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Asda Stores Ltd, Milton of Craigie, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tesco Stores Ltd, Riverside Drive, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tapedrive Ltd, Marketgait F/S, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Sainsburys Supermarket Ltd, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Jet Petrol Station, Forfar Road, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Dens Metals Ltd, West Pitkerro, Dundee	Chapter 2: Production and Processing of Metals	2.2.a	No	No	No	Yes, previously assessed	No	No	Surrendered 2015
Mctavish Ramsay Ltd, Barlow Ave, West Pitkerro	Chapter 6: Other Activities Timber Activity	6.6.(i)	No	No	No	No	No	No	Company in administration. Not operating
Johnsons, Asda Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Surrendered 2015
Breedon Aggregates Ltd, Longtown Street, Dundee	Chapter 3: Mineral Industries Cement Batching	3.1.a.(ii)	No	No	No	No, previously assessed	No	No	No Change
Aberdeen Valet Service Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	Site no longer operating.	Site no longer operating.	No	No	No	Surrendered 2015

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Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Lochee Dry cleaning Centre Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Ferry Laundrette Broughty Ferry	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Not operating since fire in 2016, may become operational again
Stay-Press Dry Cleaning Centre, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Surrendered 2015
Care Clean, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Dignity Ltd, Dundee Crematorium, Dundee	Chapter 5: Waste Management	5.1c	No	No	No	No	No	No	No change
Laundry On Line, Annfield Road, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	permit surrendered March 2016
Wm Morrison Supermarkets Plc, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Wm Morrison Supermarkets plc, 1 Afton Way	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Tesco Filling Station, South Road, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Halley Stevensons (Dyers & Finishers) Limited, Baltic Works, Annfield Road,	Chapter 6: Other Activities	Section 6.4 Part A Paragraph (a)	No	No	No	No	No	No	No Change

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Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Dundee DD1 5JH									
Discovery Flexibles, Kemback St Dundee	Chapter 6: Other Activities surface treatment using organic solvents also Chapter 7 SED coating flexible packaging	6.4.b	No	No	No	No	No	No	Replacement of one of the process lines with updated equipment. May mean slight change to emissions but not likely to be significant. Variation in progress.
J T Inglis, Riverside Works, Dundee	Chapter 6: Other Activities Textile Treatment	6.4.d	No	No	No	No	No	No	Site Closed 2016, surrender application ongoing
Michelin Tyre Plant, Dundee	Chapter 6: Other Activities surface treatment of rubber with organic solvents also Chapter 7	6.4.b	No	No	No	Yes, previously assessed	No	No	Plant was still operating in 2019 but since has ceased operating
Michelin Tyre Plant, Dundee	Chapter 1: Energy Industries, Combustion	1.1.a	No	No	No	Yes, previously assessed	No	No	Plant was still operating in 2019 but since has ceased operating.
D C Thomson Printers, Dundee	Chapter 6: Other Activities printing process	6.4.b	No	No	No	No	No	No	Not operating but still permitted.

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Day International Ltd, Balgray St, Dundee	Chapter 6: Other Activities surface treatment of rubber with organic solvents	6.4.b	No	No	No	Yes, previously assessed	No	No	Not operating at present.
RMC Readymix Ltd, Dundee	Chapter 3: Mineral Industries, Cement Batching	3.1.a.(ii)	No	No	No	No	No	No	No change
Brown & Tawse Steelstock Ltd, Fowler RD West Pitkerro - Dundee	Chapter 6: Other Activities, paint spraying	6.4.a	No	No	No	No	No	No	No Change
Armitages Pet Products Ltd, Broughty Ferry Road-Dundee	Chapter 6: Other Activities, Pet Food Manufacture	6.8.a	No	No	No	No	No	No	Permit surrender received December 2017
Tesco Stores Ltd, Kingsway Retail Park Dundee	Chapter 1: Energy Industries, Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Joinery and Timber Creations (65) Ltd,	Chapter 6: Other Activities, Timber Process	6.6.(i)	No	No	No	No, previously assessed	No	No	Waste wood boiler- permitted but not operating.
Ethiebeaton Quarry	Chapter 3 Mineral Activities - cement batching process 3.1a(ii), roadstone coating 3.5e, crushing and grinding 3.5c	3.1a(ii), 3.5e, 3.5c	No	No	No	Yes, previously assessed	No	No	No change
Health Care Environmental Services, Nobel Road, Wester Gourdie Ind. Estate	Chapter 5 Waste Management Part A Treatment of Clinical waste	5.3a	No	No	No	No, previously assessed	No	No	Site still permitted but facility closed.

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Petrol Filling Station, Asda, Myrekirk Road	Chapter 1: Energy Industries, Petrol Station	1.2.c.(ii)	No	No	No	Yes, but no relevant receptors	No	No	No change
ASKA Energy, 3B Edison Place, Dundee	Chapter 4. Chemical Industry, Part A, Producing organic chemicals (biodiesel)	Section 4, Part A, sub-section b	No	No	No	No (Emissions aren't LAQM pollutants)	No	No	Permit surrender received December 2017. Permit surrendered
Sherburn Cement, Shed 1, Eastern Wharf, Port of Dundee, DD1 3LZ	Chapter 3, Part B, section 3.1 (a)(i) Bulk Storage of Cement	PG 3/01(12)	No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2016 and operating PPC/B/1142921 No change
Crown Timber King George V Wharf Road, Dundee Harbour, Dundee, DD1 3LU	Section 6.6 Part A Wood Products Preservation with. Chemicals	Sector Guidance Note SG11 (draft status at issue)	No	No	No	No (No LAQM pollutants or fugitive emissions)	No	No	Existing process has come into the PPC regime (SEPA reference PPC/A/1132892) as part of the Industrial Emissions Directive. No change
Vericore Ltd, Kinnoull Road, Kingsway West, Dundee, DD2 3XR	Schedule 2 (PPC 2012) SED Part B Production of Veterinary Pharmaceuticals		No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2016 and operating – PPC/B/1141206 No change
Augean North Sea Services, Riverside Works, Princess Alexandra Wharf, Stannergate Road, Dundee, DD1 3LU	Chapter 5.3 Part A (b) (ii), (iii), (iv), (vi), (x)		No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2017– started operating May 2018 PPC/A/1151594 substantial

Process Name/Address	Process Type	PPC Sector	New source since APR 2019?	Existing process with new exposure?	Is change substantial (>30%)?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
									variation received Dec 2018 has since been withdrawn at request of applicant
Scotscreed Limited, Fishdock Road, Stannergate, Dundee, DD1 3LU	Chapter 3; Section 3.1 Part B (a) (ii)		No	No	No	Yes (possible fugitive emissions of particulates)	No	No	Site permitted 2017 and operating PPC/B/1155960 No change
Dover Fueling Solutions, West Pitkerro Industrial Estate, 3, Baker Rd, Dundee DD5 3RT	Chapter 6; Section 6.4 Part B (a) coating and paint process		Yes*	No	No	Yes (possible fugitive emissions of particulates)	No	No	Existing process has come into PPC regime due to threshold change. Emissions contained. PPC/B/1180866 (2)

Notes: Yes* see Section 4.3
 ~ With reference to Annex 2 Appendix E TG.03
 Part A - Processes shaded purple
 (1) – see Section 4.3 –New or Proposed installations for which an Air Quality Assessment has been carried out
 (2) See Section 4.3 – New or Significantly changed installations with No previous Air Quality Assessment

Appendix C.5 Erratum Meadowside Façade Correction

During the preparation of the APR 2020 and the updating of Table A.1 to include the measurements of the new Fidas units it was discovered that the measurements for CM14 Meadowside NO_x and BAM PM₁₀ analyser (from kerb to inlet) had not been updated to account for the pavement widening carried out as part of the Action Plan. The error was also found in Table A.2 relating to the co-located tubes (DT149 Meadowside Romon Average) and the spreadsheets used to calculate the reduction in NO₂ concentrations to façade. Measurements were found for the distances from the NO_x (4.71m) and PM₁₀ (4.74m) analysers' inlets to the kerb during the trial widening of pavement from October 2013. The diffusion tubes were known to be a further 9cm further back from the kerb (4.8m). The trial widening of the pavement was made permanent using paving slabs installed during February and March 2016. The permanent paving was not as wide as the trial and the distances from 2016 onwards are 3.59m from kerb to NO_x inlet and 3.65m from kerb to BAM PM₁₀ inlet. Please note façade reduction calculations are only applied to NO₂ results. A summary of the data and reports affected by the change in the distances from the kerb are shown below along with the previously report results and the amended results.

Reports Affected	Year of Results Affected	Site ID	Location	Distance from Kerb to where measurement was made (m)		Measured Annual mean NO ₂ concentration (µg/m ³) period adj & bias	Predicted Annual mean NO ₂ concentration at Receptor (µg/m ³) with bias & period adj	
				Reported	Amended		Reported	Amended
USA 2015	2014	DT 149	Meadowside (Romon) Average	1.85	4.80	43.7	42.7	43.2
		CM 14	Meadowside Romon	1.60	4.17	39.6	38.5	39.1
APR 2016	2015	DT 149	Meadowside (Romon) Average	1.85	4.80	41.2	40.3	40.7
		CM 14	Meadowside Romon	1.60	4.71	38.2	37.1	37.7
APR 2017	2016	DT 149	Meadowside (Romon) Average	1.85	3.68	41.0	40.3	40.5
		CM 14	Meadowside Romon	1.60	3.59	35.9	35.1	35.5
APR 2018	2017	DT 149	Meadowside (Romon) Average	1.85	3.68	39.3	38.6	38.9
		CM 14	Meadowside Romon	1.60	3.59	34.8	34.0	34.4
APR 2019	2018	DT 149	Meadowside (Romon) Average	1.85	3.68	40.4	39.6	39.9
		CM 14	Meadowside Romon	1.60	3.59	34.3	33.6	33.9

Glossary of Terms

AADT	Annual Average Daily Traffic Flow
ADMS	An atmospheric air pollution dispersion model
AEA	AEA Energy & Environment
annualise	the means of estimating an annual mean from a shorter study period mean by comparison with full datasets from background AURN sites
AQ Archive	UK Air Quality Archive
APR	Air quality Annual Progress Report
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA intends to achieve air quality limit values'
AQMA	Air Quality Management Area - An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQO	Air Quality Objective
AQS	Air Quality Strategy
ATC	Automatic Traffic Count
AURN	Automatic Urban and Rural Network (Defra funded UK air quality monitoring network)
Borderline	A concentration that is a potential exceedance (e.g. sites above 36µg/m ³ for NO ₂ or 16.2µg/m ³ for PM ₁₀ annual mean)
CAFS	Cleaner Air for Scotland Strategy
CHP	Combined Heat and Power
CO	Carbon Monoxide
DCC	Dundee City Council
Defra	Department for Environment, Food and Rural Affairs
DERL	Dundee Energy Recycling Ltd
DMRB	Design Manual for Roads and Bridges - – Air quality screening tool produced by Highways England
EC	European Community
EPA	The Environmental Protection Act 1990
EPAQS	Expert Panel on Air Quality Standards
EU	European Union
GF	Ground floor
GIS	Geographical Information System
HDV	Heavy goods vehicles and buses
HFO	Heavy Fuel Oil
HGV	Heavy Goods Vehicle
HSL	Health & Safety Laboratory
IPC	Integrated Pollution Control
kerbside	0 to 1 metre from the kerb
LAQM	Local Air Quality Management
LAQM.TG(03)	Local Air Quality Management: Technical Guidance (2003)
LAQM.TG(09)	Local Air Quality Management: Technical Guidance (2009)
LAQM.TG(16)	Local Air Quality Management: Technical Guidance (2016) updated February 2018
LDP	Local Development Plan
LEZ	Low Emission Zone
Limit Value	An EU definition for a mandatory air quality standard of a pollutant

	listed in the air quality directives
MW	Mega Watts
mg/kg	Milligrams per Kilogram
mg/m ³	Milligrams per cubic metre
NAEI	National Atmospheric Emission Inventory
NAQS	National Air Quality Standard
NLEF	National Low Emission Framework (part of CAFS)
NMF	National Modelling Framework (part of CAFS)
NO	Nitric Oxide
NO ₂	Nitrogen Dioxide
NO _x	Oxides of nitrogen
ng/m ³	Nanograms per cubic metre
NPL	National Physical Laboratory
NRS	National Registers of Scotland
NRTF	National Road Traffic Forecast
OLEV	Office of Low Emission Vehicles
Osiris	the brand name given by Turnkey Instruments Ltd. to their particle measuring nephelometer
PDT	Passive Diffusion Tube
PHV	Private Hire Vehicles
P&T	Planning and Transportation
PM _{2.5}	Legal definition ¹⁸ of Particulate Matter less than 2.5µm aerodynamic diameter
PM ₁₀	Legal definition ¹⁹ of Particulate Matter less than 10µm aerodynamic diameter
Pb	Lead
percentile	The percentage of results below a given value
ppb	Parts per billion
ppm	Parts per million
QA/QC	Quality Assurance and Quality Control
receptor	In this study, the relevant location where air quality is assessed or predicted (for example, houses, hospitals and schools)
roadside	1 to 5 m from the kerb
SCA	Smoke Control Area
SED	Solvent Emissions Directive
SEPA	Scottish Environment Protection Agency
SO ₂	Sulphur Dioxide
SPG	Supplementary Planning Guidance
Street Canyon	A relatively narrow street with buildings on both sides, where the height of the buildings is generally greater than the width of the road
SULP	Sustainable Urban Logistics Plan
TEA	Triethanolamine
TEOM	Tapered Element Oscillating Microbalance
UKAS	United Kingdom Accreditation Service
ULEV	Ultra Low Emission Vehicle
USA	Updating and Screening Assessment
µg/m ³	Micrograms per cubic metre
VCM	Volatile Correction Method
VOC	Volatile Organic Compound
vpd	Vehicles per day
WASP	Workplace Analysis Scheme for Proficiency

¹⁸ <http://www.legislation.gov.uk/ssi/2016/162/regulation/2/made>

¹⁹ <http://www.legislation.gov.uk/ssi/2000/97/schedule/made>

References

This report includes references where appropriate throughout the text as footnotes.