Air Quality Impact Assessment for Proposed Mixed Use development Hatton Mains Edinburgh

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Executive Summary

Hatton Mains Ltd proposes to make application to the City of Edinburgh Council (CEC) to develop agricultural land at Hatton Mains to the north of the A71 for residential use. The local authority has advised that the application must include an air quality impact assessment (AQIA). The Airshed has been appointed by the applicant to conduct the AQIA to assess the impacts from the scheme.

The proposed development will increase road traffic on the A71, mainly on road links to the east, towards the A720 and the city centre, where the greatest increase will be on Dalmahoy Road (an additional 3447 vehicles per day) and on the A71 east of Dalmahoy Road (an additional 2822 vehicles per day).

Air pollution from road traffic can affect human health through inhalation of toxic gases and particles. The main pollutants of concern in the study area are considered to be long-term exposure to NO_2 and airborne particles e.g. PM_{10} and $PM_{2.5}$. Three traffic Scenarios have been used to assess local air quality:

1. Baseline 2015 and 2016, to enable model verification
2. Baseline traffic for 2030, including committed development
3. Baseline and Scheme traffic 2030

A computer based dispersion model (ADMS Roads 4.1) has been used to predict road traffic emissions. The two main traffic Scenarios for 2030 (Scenarios 2 and 3) assume 2016 vehicle fleet composition and 2016 background air quality. A model sensitivity analysis has been conducted to assess the significance of meteorological variability and surface roughness. The worst case one year in five for meteorological data has been used to predict air quality impacts. The results from CEC's diffusion tube monitoring in the study area have been used to compare the measured and predicted levels of NO_2. The results from the dispersion model are significantly lower than the estimated road NOx and have been adjusted in accordance with the Scottish Government's Technical Guidance TG16. This indicates that the predicted levels are robust. Impacts have been assessed in accordance with the non-statutory guidance published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK). The predictions in this assessment are very pessimistic as they assume no reduction in background air pollution and no reduction in vehicle exhaust emissions between 2016 and 2030.

Baseline 2030 levels of NO_2 are predicted to comply with the EC annual mean Limit Value of 40 ug/m^3 at all sensitive receptors considered within the study area. The predicted increase in the annual mean exposure to all pollutants (NO_2, PM_{10} and $PM_{2.5}$) as a consequence of the scheme is of negligible significance at all sensitive receptors considered within the study area, with the exception of a single receptor at Wester Row where the impacts are predicted to be of slight adverse significance.

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Acronyms & Abbreviations

AADT	Annual Average Daily Traffic
ADMS 4	Air Dispersion Modelling System Roads Version 4
AQIA	Air Quality Impact Assessment
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ATC	Automatic Traffic Count
CEC	City of Edinburgh Council
CERC	Cambridge Environmental Research Consultants
CO	Carbon Monoxide
^{o}C	Degrees Centigrade
DEFRA	Department for Environment, Food and Rural Affairs (England)
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency for England and Wales
EAL	Environmental Assessment Level
EPUK	Environmental Protection UK
EQS	Environmental Quality Standard
ES	Environmental Statement
g/s	grams per second
H1	Horizontal Guidance Note 1
IAQM	Institute of Air Quality Management
IPPC	Integrated Pollution Prevention & Control
K	degrees Kelvin
LAQM	Local Air Quality Management
m/s	metres per second
m^3/s	cubic metres per second
mg/m^3	milligrams per cubic metre (10^{-3})
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
O_2	Oxygen
O_3	Ozone
OS	Ordnance Survey
PM_{10}	Particles with aerodynamic diameter less than 10 microns
$PM_{2.5}$	Particles with aerodynamic diameter less than 2.5 microns
RMSE	Root mean square error
ug/m^3	micrograms per cubic metre (10^{-6})

Prediction is very difficult, especially about the future.
Niels Bohr, Danish physicist (1885 - 1962)

1.0 INTRODUCTION

Background to Report

1.1. Hatton Mains Ltd of 56 George Street, Edinburgh EH2 2LR propose to make an application for planning permission in principle to the City of Edinburgh Council (CEC) to develop agricultural land at Hatton Mains for a mixed residential development consisting of up to 1200 new houses and associated community infrastructure. The development traffic will access the site off Dalmahoy Road. The location of the proposed development site is shown in Figure 1.

1.2. A scoping study has been conducted for the proposed development.[1] This proposed that an air quality impact assessment (AQIA) would be conducted as part of Environmental Impact Assessment (EIA) for the planning application.

1.3. AECOM has conducted a transport assessment (TA) on behalf of the applicant.[2] This study considered baseline and scheme flows for the study area along the A71, from the junction with the B7015 to Camps, east to the junction with Saughton Road. This assessment includes baseline traffic flows for the year 2019, and baseline, committed development and scheme traffic flows for the year 2030. The predicted baseline and scheme traffic flows for the year of development (2030) are summarised in Table 1.1 below. Further details on the traffic flows are presented in Appendix 1. The extent of the study area for the TA was agreed in consultation with CEC.

Table 1.1 – Summary of Traffic Flows for Study Area (2030)

No	Link	Baseline	Scheme	Increase
1	A71 west of B7031	14,334	14,934	600
2	A71 west of B7015	13,697	14,298	600
3	B7015 east of Camps	4,136	4,136	0
4	A71 west of B7030	17,356	17,956	600
5	A71 west of Dalmahoy Road	16,571	17,196	625
6	Dalmahoy Road	2,509	5,956	3,447
7	Main Street Ratho	3,594	4,174	580
8	A71 east of Dalmahoy Road	18,696	21,518	2,822
9	Curriehill Road	2,903	3,060	157
10	A71 west of Curriehill Road	17,296	19,961	2,666
11	A71 east of Riccarton Mains	31,875	34,540	2,666
12	A71 west of Wester Hailes	42,058	43,884	1,826
13	A71 east of Wester Hailes	38,279	39,896	1,616
14	A71 west of Saughton Road	36,294	37,787	1,494
15	A71 east of Saughton Road	34,220	35,680	1,461
16	Harvest Road	2,973	3,553	580

N.B. Flows = 24 hour average annual flows

1.4. The scheme is predicted to generate an additional 3,447 vehicle movements (as AADT) on Dalmahoy Road near the site and up to 2,822 (AADT) additional vehicle movements per day on the A71 to the east of Dalmahoy Road.

[1] Babbity Environmental. September 2018. Hatton Mains Village City of Edinburgh EIA Scoping Report
[2] AECOM March 2019. Transportation Assessment

Potential Adverse Impacts

1.5. Air pollution from road traffic can affect human health through inhalation of toxic gases and particles. The main pollutants of concern in the study area are likely to be long-term exposure to NO_2 and airborne particles e.g. PM_{10} and $PM_{2.5}$.

Scope of Assessment

1.6. Current professional non-statutory Guidance indicates that a quantitative AQIA should be conducted where a scheme is predicted to increase the 24 hour AADT by >500 vehicles per day[3]. On the basis of the IAQM/EPUK Guidance the impacts on the A71 throughout the study area are above the threshold that would normally trigger the requirement for an AQIA.

1.7. The aim of this report is to assess the impacts of changes in traffic on existing and future residents and other sensitive receptors within the study area shown in Figure 2.

1.8. The potential air quality impacts of dust from groundworks and construction operations associated with the development have not been assessed. Mitigation measures to prevent or minimise the release of dusts during construction are set out in Appendix 2.

1.9. Relevant air quality standards are discussed in Section 2. Baseline conditions are described in Section 3. The prediction methodology is outlined in Section 4. The results from the prediction exercise are presented in Section 5. The requirement for mitigation measures is discussed in Section 6. The overall significance of the air quality impacts is considered in Section 7.

[3] IAQM/EPUK January 2017 Land-Use Planning & Development Control : Planning for Air Quality

2.0 STANDARDS AND METHODS

Air Quality and Land Use Planning

2.1. The Scottish Government has issued Guidance on how air quality issues should be considered within the planning system.[4] This emphasises that local authorities need to understand the links between air quality and land use planning policies if the planning system is to contribute to the improvement of air quality.

2.2. This Guidance should be considered in conjunction with Planning Advice Note (PAN) 51: Planning and Environmental Protection.[5] PAN 51 advises on the policies and practices that should be adopted by planning authorities and others involved in planning new developments and redevelopments.

Environment Act 1995

2.3. Part IV of the Environment Act 1995 requires local authorities to review and assess local air quality. The local authority is obliged to take any potential exceedance of Air Quality Objectives into account. Where the Air Quality Objectives are likely to be exceeded then the relevant local authority must declare an Air Quality Management Area.

2.4. Under the Guidance to local authorities published by the Scottish Government, local authorities are required to carry out a staged assessment of local air quality.

2.5. The most recent Technical Guidance to local authorities for the review and assessment of air quality was issued in February 2018.[6] This Guidance (TG16) sets out the methods to be used to determine if the Air Quality Objectives are likely to be achieved.

Air Quality Objectives

2.6. European Council Directive 96/62/EC on ambient air quality assessment and management (The Air Quality Framework Directive) established a framework for setting limit or target values for air pollutants throughout the European Union. The limits within the Directive were implemented in The Air Quality Limit Values (Scotland) Regulations.[7] European Council Directive 2008/50/EC consolidated earlier air quality directives and introduced new mandatory limit values for $PM_{2.5}$.

2.7. The UK Government has published an Air Quality Strategy[8] which sets out how the Government proposes to fulfil the UK's obligations under the Air Quality Directive. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland sets out the policy, targets and objectives for air pollutants. Further details on Scottish Government policy are set out in Policy Guidance.[9]

[4] Scottish Executive 2004. Air Quality and Land Use Planning.
[5] Scottish Executive 2006. Planning Advice Note 51 Planning and Environmental Protection
[6] The Scottish Government 2018. Local Air Quality Management Technical Guidance (TG16).
[7] HMSO 2003. No. 428 ENVIRONMENTAL PROTECTION The Air Quality Limit Values (Scotland) Regulations 2003.
[8] DEFRA & Scottish Executive 2007. UK Air Quality Strategy Vols. 1 & 2
[9] Scottish Government March 2016. Policy Guidance PG(S) (16)

2.8. The UK Air Quality Strategy includes more exacting objectives for some pollutants than are required by European legislation.[10] The Scottish Government has adopted a strict annual mean objective of 18 ug/m^3 for PM_{10}.[11] This assessment refers only to Scottish Air Quality Objectives for particles, as compliance with these objectives will also meet the less demanding European Air Quality Limit Values.

2.9. The World Health Organisation (WHO) has published air quality guidelines for particles.[12] It proposes guidelines and interim guidelines for a range of pollutants including PM_{10} and $PM_{2.5}$, where the recommended annual mean exposure to PM_{10} and $PM_{2.5}$ is less than 20 ug/m^3 and 10 ug/m^3 respectively. These guidelines state that when assessing impacts from particles the use of $PM_{2.5}$ is preferred, due to the effects of ultrafine particles on human health.

2.10. The Scottish Government revised the Air Quality Objective for $PM_{2.5}$ in 2016.[13] This set a $PM_{2.5}$ objective of 10 ug/m^3. The change for PM_{10} (increasing the annual mean objective from 18 ug/m^3 to 20 ug/m^3) has been delayed to allow for the establishment of a $PM_{2.5}$ monitoring network.

2.11. CEC has conducted numerous reviews of air quality, the most recent being published in October 2018.[14] There are no air quality management areas (AQMA) within 6km of the proposed development. The nearest AQMA to the study area is at St John's Road Corstophine, which is ~2km to the north of the A71 at the east end of the study area.[15] There is one air quality monitoring site within the study area.

Sensitive Receptors

2.12. Air Quality Objectives should apply to all locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant objective. Thus, short term standards such as the 1 hour objective for NO_2 should apply to locations which may be frequented by the public even for a short period of time.

2.13. Longer term objectives such as the 24 hour or annual mean for NO_2 and PM_{10} should apply only at houses or other sensitive locations which the public can be expected to occupy on a continuous basis. These objectives do not apply to exposure at the workplace.

IAQM/EPUK Guidance

2.14. The revised IAQM/EPUK Guidance[2] on the assessment of air quality impacts proposes an assessment framework for combustion air pollutants (including road traffic). These are described in Table 2.2 below. In assessing particulate exposure the IAQM Guidance recommends that $PM_{2.5}$ should be used to assess the impacts from exposure to particulates rather than PM_{10}. This reflects the advice in the 2005 WHO Guidance discussed above.

[10] HMSO 2002. No. 297 ENVIRONMENTAL PROTECTION The Air Quality (Scotland) Amendment Regulations 2002.
[11] Scottish Statutory Instrument 2000 No. 97. Air Quality (Scotland) Regulations (as amended).
[12] WHO Europe, 2005. Air Quality Guidelines
[13] Scottish Statutory Instrument 2016 No. 162. Environmental Protection. The Air Quality (Scotland) Amendment Regulations 2016
[14] City of Edinburgh Council October 2018. Annual Progress Report
[15] http://www.scottishairquality.scot/laqm/aqma

Assessment Criteria

2.15. The assessment criteria used in this study are set out in Table 2.1 below. These are based on EC Limit Values and the current Scottish Objectives.

Table 2.1 – Summary of Assessment Criteria

Pollutant	Assessment Level	Justification
PM_{10}	18 ug/m^3 annual mean	Scottish Air Quality Objective
$PM_{2.5}$	10 ug/m^3 annual mean	Scottish Air Quality Objective
NO_2	40 ug/m^3 annual mean	European Limit Value

2.16. The criteria used to assess the significance of the impacts are set out in Table 2.2 below. These are for annual mean concentrations only and are based on non-statutory professional Guidance.

Table 2.2 – Definition of Impact (EPUK IAQM 2017)

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

N.B. A predicted change of 0% (i.e. <0.5%) is considered to be of negligible significance.

3.0 BASELINE CONDITIONS

Baseline Air Quality

3.1 Estimates of background pollution of particles (PM_{10}) and oxides of nitrogen (NO_x and NO_2) have been obtained from the Scottish Government sponsored air quality archive.[16] The baseline data for $PM_{2.5}$ are based on DEFRA estimates.[17] The data in Table 3.1 below present the reported estimated background concentrations for 2016 within the study area.

Table 3.1 – Annual Mean Estimates of Background Air Pollution 2016

	NO_x	NO_2	PM_{10}	$PM_{2.5}$
Average	19.5	12.9	11.8	6.6
Maximum	41.6	24.4	14.3	7.8

N.B. Units = ug/m^3 annual mean

3.2. This assessment assumes that background air pollution levels within the study area will not reduce after 2016 and that there will be no reduction in vehicle emissions arising from improvements in vehicle engine technology due to replacement of ageing vehicles with Euro 6 compliant vehicles. This is intended to be pessimistic, to take account of uncertainties in predictions of background air pollution and vehicle exhaust emissions for future years.

CEC Diffusion Tube Air Quality Measurements

3.3. Monitoring for NO_2 was conducted at a single location within the study area between 2011 and 2016 [DT4a at OS 318894, 670493]. The results for this site for the period for which data is available is presented in Table 3.2 below.

Table 3.2 – Summary of Diffusion Tube Monitoring Data DT4a

Year	2011	2012	2013	2014	2015	2016
NO_2	32	32	30	26	25	28

N.B. units = NO_2 ug/m^3 annual mean

3.4. The results from this monitoring location indicate that air quality is well below the EC annual mean Limit Value for NO_2. The summary of results published by CEC indicates that levels of NO_2 have been trending slightly downwards within the study area in recent years.

Baseline Traffic Flows

3.5. Reliable estimates of traffic flows are essential to enable realistic modelling of vehicle exhaust emissions. The traffic flows used in this study are based on traffic flows provided by AECOM. A summary of the traffic flow data used for this assessment is presented in Appendix 1.

[16] http://www.scottishairquality.co.uk/data/mapping?view=data
[17] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013

4.0. METHODOLOGY

Justification for Approach

4.1. The aim of this assessment is to determine if the road traffic generated by the proposed scheme will significantly affect local air quality within the study area.

4.2. The approach used here is to:

- Estimate the emissions from road traffic using traffic survey data and UK vehicle emission estimates; and
- Predict local air pollution levels using a suitable mathematical dispersion model and national estimates of background air pollution.

4.3. This assessment considers the Scottish annual mean Objectives for $PM_{2.5}$ and PM_{10} and the EC annual mean Limit Value for NO_2. It is assumed that the short-term levels are unlikely to be exceeded where the annual means comply with the relevant air quality criterion.

4.4. The assessment considers the air quality impacts within the study area. These predictions are based on the available road traffic survey data and scheme traffic predictions provided by the transport consultants for the project. The extent of the roads considered in the assessment is shown in Figure 2.

Scenarios Assessed

4.5. Three traffic Scenarios have been assessed:

- Baseline for 2015 and 2016, for model verification;
- Baseline 2030, taking account of traffic growth and committed developments; and
- Scheme 2030, with the proposed scheme in place.

4.6. The 2030 Baseline and Scheme Scenarios (Scenarios 2 and 3) ignore any potential reductions in emissions after 2017 due to improvements in the UK vehicle fleet by the elimination of older, more polluting vehicles, and do not take account of Scottish Government and DEFRA predicted reductions in background air pollution for future years. Both Scenarios for 2030 assume Scottish Government background estimates for NO_x, NO_2 and PM_{10} and DEFRA estimates for $PM_{2.5}$ for the year 2016.

4.7. Scenarios 2 and 3 assume UK EFT v8.0 (2VC) emission factors for 2016, and Scottish urban emission factors. Road traffic speeds on all links are based on posted speed limits. Diurnal variations in flow have been taken into account based on typical diurnal flows on Scottish A class roads.

Model Inputs

4.8. The transport and transformation of a pollutant in the boundary layer[18] can be predicted with a reasonable degree of confidence using an appropriate mathematical model. The model used for this exercise is ADMS Roads 4.1 (version 4.1.1.0).[19] This mathematical model enables the calculation of multiple line sources.

4.9. The principal factors affecting the concentration of a pollutant are:

- The source characteristics including source strength, the height of emission and the density and temperature of the release;
- The prevailing atmospheric conditions including wind speed, wind direction, cloud cover, precipitation, ambient temperature and the depth of the boundary layer; and
- Where appropriate, the effect of local buildings and surface conditions on dispersion.

These factors can be assigned numerical values and the resultant downwind concentrations of pollutants may be predicted.

4.10 ADMS describes the boundary layer structure based on the Monin-Obukhov length and the boundary layer height. Results from the model provide a better fit with measured concentrations of pollutants than was previously achievable using classical Gaussian modelling techniques. Details of model validation studies are available at http://www.cerc.co.uk/software/publications.htm.

Source Condition, Location and Height

4.11. The sources for all Scenarios have been considered as line source releases. All roads have been modelled as two way flows, with both directions aggregated as a single line source. Time varying emissions have been considered, based on the aggregate of two-way flows on the A71. The dimensions of all roads have been obtained from the OS map base at 1:10,000 scale.

Surface Roughness

4.12. The surface roughness conditions in the study area have been assumed to be typical of a suburban setting, with a surface roughness length of 0.5m. This value has been used across the domain. The effects of surface roughness have been considered in the sensitivity analysis in Section 5.

Meteorological Data

4.13. The selection of suitable meteorological data needs to be conducted with care. The main limiting factor for suitable meteorological data is continuous observations of cloud cover, used in the model to determine atmospheric stability. Five years of hourly sequential meteorological data (2013 – 2017 inclusive) for the Met. Office Station at Edinburgh

[18] The boundary layer is the layer of the atmosphere near the surface of the Earth that is affected by mechanical turbulence from surface friction and convective turbulence through local surface heating.
[19] CERC 2018. http://www.cerc.co.uk/environmental-software/ADMS-Roads-model.html

Gogarbank, which is within 2km of the nearest part of the A71 within the study area, have been used to predict the dispersion. A summary of the meteorological data is presented in Appendix 3. A minimum Monin-Obukhov length of 10m has been assumed, typical of small towns.

Canyon Effects

4.14. Atmospheric dispersion may be adversely affected by the inhibiting effect of taller buildings close to the road, which can reduce local wind speeds and consequently prevent dilution of exhaust emissions. This is sometimes referred to as a canyon effect, where the height of buildings on both sides of the carriageway exceeds the combined width of the road and pavements. The roads in the study area do not fall into this definition and have therefore not been modelled as street 'canyons'.

Terrain Effects

4.15. Terrain effects have been discounted because the land around the proposed development is relatively flat. The terrain calculation algorithm need not normally be used to consider slopes of less than 1:10.

Chemistry

4.16. Chemistry effects have been ignored. Oxides of Nitrogen have been modelled as NO_x. The revised method issued by DEFRA in 2017 (version 6.1) has been used to convert NO_x to NO_2.[20]

Time Averaging and Percentiles

4.17. The averaging time for oxides of nitrogen is based on a 1 hour average**.** PM_{10} and $PM_{2.5}$ have been modelled as a 24 hour average.

Grid Resolution and Receptors

4.18. Predictions have been made at 50 fixed point receptors across the study area to assist with the model sensitivity analysis. The locations of these receptor locations are shown in Figure 2.

Removal Effects

4.19. Particle sedimentation, photo-lytic reactions, washout and other removal effects have been ignored.

Overview of the Modelling Process

4.20. Model runs consider the effects on predicted air quality using 5 years of historic meteorological data; and the effects of different surface roughness values on dispersion.

[20] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc

Approach to Modelling Uncertainty

4.21. The Environment Agency policy statement on dispersion modelling[21] refers to the Royal Meteorological Society Guidelines on Dispersion Modelling.[22] According to this Guidance and a subsequent review[23], dispersion modelling studies should include a sensitivity analysis for model inputs, to provide an estimate of the possible errors in the predictions. The sensitivity analysis is discussed in more detail in Section 5. The Environment Agency has also published Guidance on reporting requirements for dispersion modelling.[24] These Guidance documents have been taken into account in the assessment.

4.22. The predictions have been obtained using a widely recognised mathematical model (ADMS Roads 4.1) to predict how emissions will be dispersed taking account of: the source conditions (the traffic flows and vehicle emission estimates); meteorological conditions from a representative site (in this case near ground measurements at Edinburgh Gogarbank, supplied by the Met Office); and surface conditions (surface roughness).

4.23. ADMS Roads is widely used in the UK for environmental assessment and is generally considered by UK regulatory agencies to be suitable for air quality impact assessment, subject to its proper use. Potential difficulties and limitations in this type of study when applied to air quality impact assessments include:

- Lack of good information about the background conditions. There are limited local air quality measurements available within the study area, based on a single indicative diffusion tube site, so that it is possible to compare predicted and observed levels (model verification) only by comparing the results over the two most recent years for which data is available (2015 and 2016). The assessment assumes no reduction in background air pollution in future years (post 2016), with the intention of reducing uncertainties in baseline estimates. The assessment assumes no reduction in vehicle exhaust emissions in future years (post 2016) with the intention of reducing uncertainties in emission estimates.

- Poor quality emission estimates. Source terms for the dispersion model are based on recent measurements of road traffic, measured fleet composition and emission estimates EFT v8.1 (2VC) Scottish urban.

- Errors inherent in the dispersion model used. The model is considered to be suitable for use in this application and has been widely validated.

- Errors introduced by the model user due to the use of inappropriate or unrepresentative input values such as surface roughness values. The effects of surface roughness on model predictions are considered within the model sensitivity analysis.

[21] Environment Agency EAS/2007/1/1
[22] Department of Environment & Royal Met. Soc. 1995
[23] ADMLC 2004. Guidelines for the Preparation of Dispersion Modelling Assessments for Compliance with Regulatory Requirements – an Update to the 1995 Royal Meteorological Society Guidance.
[24] Environment Agency (undated) Air Dispersion Modelling Report Requirements (for detailed dispersion modelling)

4.24. The approach used in this assessment is to present a detailed account of the modelling process and to consider the model sensitivity to the main user inputs. An inventory of the model runs for this project is presented in Table 4.1 at the end of the text.

5.0 MODEL RESULTS

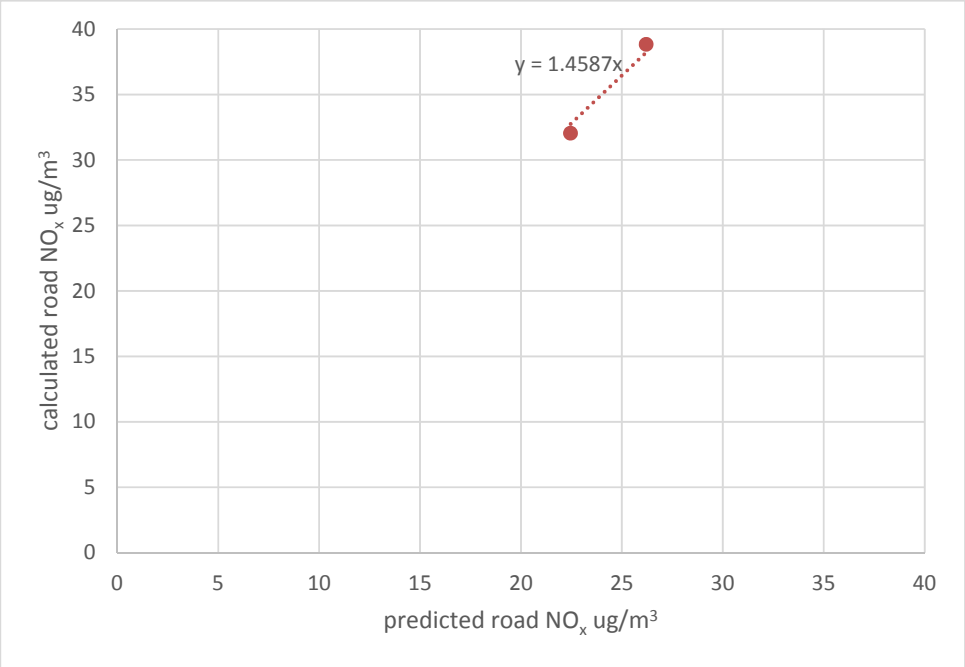
Comparison between Measured and Predicted Levels (Scenario 1)

5.1. Model verification (where the differences between the measured and predicted levels are considered, to estimate model uncertainties) has been conducted using the NO_2 diffusion tube data from CEC's diffusion tube site DT4a for the years 2015 and 2016.

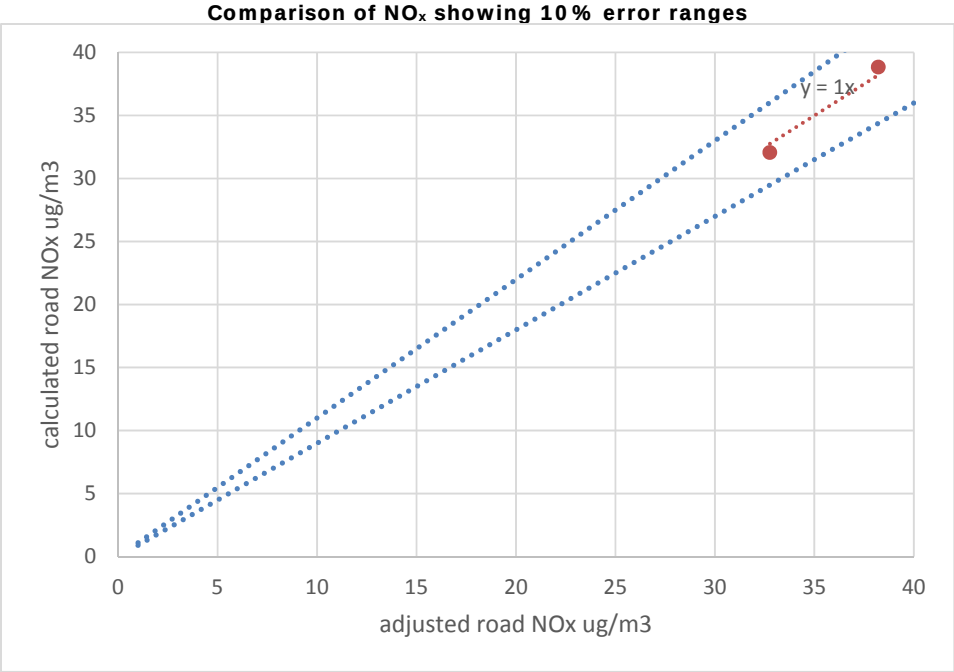
5.2. The baseline road NO_x at the diffusion tube monitoring site has been calculated using the DEFRA v6.1 diffusion tube spreadsheet. This calculates the contribution of local road NO_x from the NO_2 concentrations measured by diffusion tubes. This is in accordance with the method set out in Box 7.15 of TG16. The calculated levels of road NO_x from the diffusion tubes have been compared to the modelled road NO_x contributions predicted using the dispersion model.

5.3. The model predictions for the two years for which data is available indicate that the road NOx predicted by the dispersion model is underestimated by ~46% over the two years under consideration and that the predicted road source contribution of NO_x should be adjusted by a factor of 1.4587 to achieve a better fit with the calculated road NO_x.

Comparison of calculated and predicted Road NO_x at DT4a for 2015-2016



5.4. The predicted levels of NO_x from the roads in the study area have therefore been adjusted using this factor, in accordance with the method set out in Box 7.15 of TG16. The adjusted predicted road NO_x from the roads in the study area is compared with the calculated road NO_x below. This indicates that the modelled road NO_x levels agree well overall with the calculated levels when adjusted using this factor.

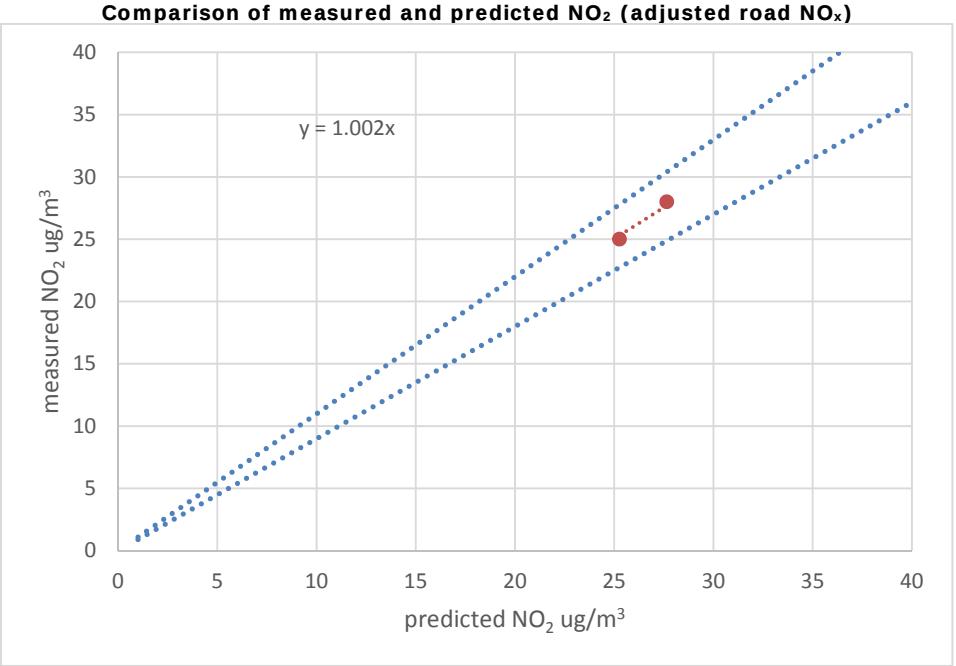


5.5. The predicted NO_x levels at CEC's diffusion tube site over the two years (where the road NO_x levels are adjusted using the above factor) have been converted to NO_2 using the NO_x:NO_2 spreadsheet (v6.1). These are summarised in Table 5.1 below.

Table 5.1 - Comparison of Measured and Predicted NO_2 (Diffusion Tubes)

Year	Location	Predicted	Measured
2015	DT4a	25	25
2016	DT4a	28	28

N.B. Units = NO_2 ug/m^3 annual mean



5.6. TG16 suggests that a dispersion model is performing well where the differences between measured and predicted levels at most sites are within

25% of each other, ideally within 10%. All predicted levels of NO_2 are $\pm$10% of the measured levels, as can be seen from the above graph.

5.7. TG16 also includes advice on how to evaluate model performance to establish confidence in model results. TG16 advises that ideally model error should be within 10% of the Limit Value, derived using the root mean square error (RMSE). The RMSE for model predictions is $\pm$0.3 ug/m^3 which is <1% of the EC annual mean Limit Value. The model predictions have no overall fractional bias (FB = 0.00), which indicates that the model has no tendency to under-predict or to over-predict. The comparison between the measured and predicted levels of NO_2 in the study area indicates that the model results are likely to be robust, particularly for the section of the A71 to the east of the A720.

Model Sensitivity Analysis – Meteorological Variability

5.8. The effect of meteorological variability has been considered for Scenario 2 (baseline traffic 2030) using 5 years of recent historic data. The predicted NO_x annual mean from the roads considered in the study area (ignoring the background contribution) varies by up to 21% from year to year as a worst case for the receptor locations considered. A similar pattern occurs in the case of PM_{10}. The worst case annual mean for both PM_{10} and NO_x occurs when the meteorological data for the year 2016 is used. This has been taken into account in the worst case assessment. [See Tables in Appendix 4].

Model Sensitivity Analysis – Surface Roughness

5.9. The effects of surface roughness on dispersion have been considered. The model runs described above assume a surface roughness of 1.0m, typical of an urban location. The same model setup has been considered with a surface roughness of 0.5m (suburban) and 0.3m (agricultural areas). The worst case occurs when a surface roughness of 0.3m is adopted. This is unlikely to represent the surface roughness conditions to the east of the A720, so a surface roughness of 0.5m has been used as an approximation to represent both urban and rural conditions.

Model Results for Baseline and Scheme (2030)

5.10. The main Scenarios used for prediction are Scenarios 2 (Baseline 2030) and Scenario 3 (Scheme 2030). Both these Scenarios are based on the worst case dispersion year (2016) and assume 2016 fleet emission conditions and 2016 background air quality. The predicted annual mean NO_2 for Scenarios 2 and 3 is presented in Table 5.2 at the end of the text.

5.11. The annual mean NO_2 for the 2030 baseline Scenario is predicted to range from 15– 34 ug/m^3 at sensitive receptors within the study area, where the highest predicted levels are at Calder View (R35), east of the A720 and south of the A71. The predicted increase in NO_2 is 1% at this location. The predicted impacts at all sensitive receptor locations considered within the study area are of negligible significance, with the exception of one receptor at Wester Row (R27), where an impact of slight adverse significance is predicted in terms of the assessment framework set out in Section 2.

5.12. The predicted levels of NO_2 for the baseline and scheme Scenarios (2030) are plotted in Figures 3.1 – 3.2. The predicted pollutants for these Scenarios have been calculated over the study area at ground level using

a high definition grid. The resulting predictions have been adjusted in accordance with the factor 1.4587, and contoured using Surfer ® and plotted on a scaled map. These plots are based on the predicted annual mean from roads within the study area, where NO_2 is calculated using the DEFRA v6.1 NOx:NO_2 spreadsheet tool. These plots assume the background NO_x and NO_2 for 2016 from the data for the baseline levels for the closest grid point to the study area, as presented in Table 3.1, and emission factors for 2016.

5.13. The predicted annual mean PM_{10} for the 2030 baseline and scheme Scenarios is presented in Table 5.3 at the end of the text. The annual mean PM_{10} for the baseline is predicted to range from 15.0 – 17.4 ug/m^3 within the study area, where the highest predicted levels are at Calder View (R35). The annual mean PM_{10} is predicted to increase by 1% at some sensitive receptors. The impact is predicted to be of slight adverse significance at one receptor location at Wester Row (R27). Impacts at all other receptors considered in the study area are predicted to be of negligible significance in terms of the assessment framework set out in Section 2. The PM_{10} assessment assumes the highest baseline levels as presented in Table 3.1.

5.14. The predicted annual mean $PM_{2.5}$ for the 2030 baseline and scheme Scenarios is presented in Table 5.4 at the end of the text. The annual mean PM_{10} for the baseline is predicted to range from 8.2 – 9.6 ug/m^3 within the study area, where the highest predicted levels are at Calder View (R35). The annual mean PM_{10} is predicted to increase by 1% at some sensitive receptors. The impact is predicted to be of slight adverse significance at one receptor location at Wester Row (R27). Impacts at all other receptors considered in the study area are predicted to be of negligible significance in terms of the assessment framework set out in Section 2. The $PM_{2.5}$ assessment assumes the highest baseline levels as presented in Table 3.1.

Assessment against Criteria

5.15. This assessment predicts air quality impacts using the detailed dispersion modelling methods set out in the current Technical Guidance. The worst case assessed levels at Wester Row (R27), the only receptor considered in the study area with impacts of slight adverse significance, are summarised in Table 5.5 below.

Table 5.5 – Worst Case Predicted Impact Air Pollution 2030 (Wester Row R27)

Pollutant	Baseline S2	Scheme S3	Change	Significance
NO_2	17	17	1%	Slight Adverse
PM_{10}	16.9	17.2	1%	Slight Adverse
$PM_{2.5}$	9.4	9.5	1%	Slight Adverse

N.B. Units = ug/m^3 annual mean (includes 2016 background and 2016 emission factors)

5.16. The worst case predicted level at any sensitive receptor considered in the study area is at Calder View (R35). These impacts are summarised in Table 5.6 below.

Table 5.6 – Worst Case Predicted Pollutant Concentrations 2030 (Calder View R35)

Pollutant	Baseline S2	Scheme S3	Change	Significance
NO_2	34.0	34.5	1%	Negligible
PM_{10}	17.4	17.5	0%	Negligible
$PM_{2.5}$	9.6	9.7	0%	Negligible

N.B. Units = ug/m^3 annual mean (includes 2016 background and 2016 emission factors)

5.17. Baseline 2030 levels of NO_2 are predicted to comply with the annual mean Limit Value of 40 ug/m^3 at all sensitive receptors considered within the study area. The predicted increase in the annual mean NO_2 as a consequence of the scheme is of slight adverse significance or less at all sensitive receptors considered within the study area in terms of the IAQM/EPUK assessment framework.

5.18. The baseline 2030 annual mean levels of PM_{10} are predicted to comply with the Scottish Air Quality Objective of 18 ug/m^3 at all sensitive receptor locations considered within the study area. The predicted increase in PM_{10} exposure as a consequence of the scheme is of slight adverse significance or les at all sensitive receptors within the study area in terms of the IAQM/EPUK assessment framework.

5.19. The predicted increase in $PM_{2.5}$ is of slight adverse significance or less at all sensitive receptors considered within the study area in terms of the IAQM/EPUK assessment framework.

6.0 MITIGATION

6.1. The methods for controlling dust and other air quality impacts during construction are set out in Appendix 2.

7.0. SIGNIFICANCE OF RESIDUAL EFFECTS

7.1. Existing levels of air pollution at sensitive receptors within the study area comply with the European annual mean Limit Value for NO_2.

7.2. The predictions in this assessment are very pessimistic as they assume no reduction in background air pollution and no reduction in vehicle exhaust emissions between 2016 and 2030.

7.3. The baseline conditions in 2030 are predicted to comply with the EC annual mean Limit Value for NO_2 at all sensitive receptors considered within the study area. The predicted increase in the annual mean NO_2 as a consequence of the scheme is of slight adverse significance at one receptor (Wester Row R27) and of negligible significance at all other sensitive receptors considered within the study area in terms of the IAQM/EPUK assessment framework.

7.4. The predicted increases in the annual mean PM_{10} and $PM_{2.5}$ are of negligible significance at all sensitive receptors considered within the study area as a consequence of the proposed scheme in terms of the IAQM/EPUK assessment framework, with the exception of a single receptor (Wester Row R27).

7.5. Levels of NO_2, PM_{10} and $PM_{2.5}$ within the proposed development site are predicted to comply with EC Limit Values and Scottish Air Quality Objectives with the scheme in place.

Tables

Model Sensitivity Analysis

Run	Name		Met Data	Surface roughness (m)	traffic flows	objective
1	S1 2015	.upl	Gogarbank 2015	1.0	2015	
2	S1 2016	.upl	Gogarbank 2016	1.0	2016	to compare modelled with calculated road NOx
2	gogar 2013	.upl	gogarbank 2013	0.3	S2	
3	gogar 2014	.upl	gogarbank 2014	0.3	S2	
4	gogar 2015	.upl	gogarbank 2015	0.3	S2	
5	gogar 2016	.upl	gogarbank 2016	0.3	S2	
6	gogar 2017	.upl	gogarbank 2017	0.3	S2	to determine worst case dispersion conditions
7	surface 0.5m	.upl	gogarbank 2014	0.5	S2	
8	surface 1.0m	.upl	gogarbank 2014	1.0	S2	to determine significance of surface roughness on dipsersion
9	S2	.upl	gogarbank 2016	0.5	S2	to predict worst case in study area for both Scenarios using worst case surface
10	S3	.upl	gogarbank 2016	0.5	S3	roughness values and worst case year from met. data

No.	Receptor name	X(m)	Y(m)	S2	S3	% Change	% EAL	Significance	EAL
1	Coxydene	311227	668446	14.8	14.9	0%	37%	Negligible	40
2	East Coxydene Farm	311695	668494	22.9	23.1	1%	58%	Negligible	40
3	Wilkieston Village	312125	668463	30.7	31.1	1%	78%	Negligible	40
4	Wilkieston Village	312080	668458	24.9	25.2	1%	63%	Negligible	40
5	Wilkieston Village	312232	668461	23.9	24.2	1%	61%	Negligible	40
6	Orchardfield	312445	668488	16.0	16.2	0%	40%	Negligible	40
7	West Lodge	312778	668442	24.9	25.2	1%	63%	Negligible	40
8	Burnwynd	313102	668500	26.9	27.3	1%	68%	Negligible	40
9	Burnwynd	313238	668509	28.5	28.8	1%	72%	Negligible	40
10	Burnwynd	313263	668506	31.4	31.8	1%	79%	Negligible	40
11	Burnwynd	313308	668514	24.8	25.1	1%	63%	Negligible	40
12	Bridgend Cottages	313806	668870	29.1	29.6	1%	74%	Negligible	40
13	Hatton Bridge	313970	668976	24.4	24.8	1%	62%	Negligible	40
14	Dalmahoy Road Ratho	313856	670702	18.1	18.7	1%	47%	Negligible	40
15	Easter Hatton Mains	314095	669047	20.6	20.9	1%	52%	Negligible	40
16	Easter Hatton Cottages	314125	669025	23.3	23.7	1%	59%	Negligible	40
17	Main Street Ratho	313910	670732	19.3	19.9	2%	50%	Negligible	40
18	Entry Level	314520	669163	23.0	23.8	2%	59%	Negligible	40
19	Entry Level	314542	669167	20.7	21.5	2%	54%	Negligible	40
20	Dalmahoy Gatehouse	314573	669172	18.4	19.2	2%	48%	Negligible	40
21	House	314669	669248	27.3	28.9	4%	72%	Negligible	40
22	Lodge	315404	669599	26.7	28.2	4%	70%	Negligible	40
23	Addiston Mains	315800	669899	19.3	20.1	2%	50%	Negligible	40
24	Research Park	316689	669813	15.5	15.9	1%	40%	Negligible	40
25	Research Park	317152	669921	16.0	16.5	1%	41%	Negligible	40
26	Research Park	317485	670029	15.1	15.4	1%	39%	Negligible	40
27	Wester Row	317442	670122	30.1	31.5	4%	79%	Slight Adverse	40
28	Hermiston Steading	317581	670177	25.6	26.7	3%	67%	Negligible	40
29	Hermiston Steading	317630	670196	23.2	24.1	2%	60%	Negligible	40
30	Long Hermiston	317856	670263	18.2	18.7	1%	47%	Negligible	40
31	Calder Road	317878	670224	21.3	22.0	2%	55%	Negligible	40
32	Calder Road	317921	670226	21.4	22.1	2%	55%	Negligible	40
33	Research Park	317807	670153	18.7	19.3	1%	48%	Negligible	40
34	Calder View	318805	670456	31.0	31.3	1%	78%	Negligible	40
35	Calder View	318870	670486	34.0	34.5	1%	86%	Negligible	40
36	Calder View	318968	670496	28.4	28.7	1%	72%	Negligible	40
37	Calder Gardens	319121	670549	31.0	31.5	1%	79%	Negligible	40
38	Calder Gardens	319308	670611	32.4	32.8	1%	82%	Negligible	40
39	St Nicholas Church	319463	670657	28.0	28.4	1%	71%	Negligible	40
40	Bowling Green	319545	670668	23.3	23.6	1%	59%	Negligible	40
41	Sighthill	319628	670703	27.5	27.9	1%	70%	Negligible	40
42	Sighthill	319732	670726	27.8	28.2	1%	71%	Negligible	40
43	Sighthill	319858	670750	25.1	25.5	1%	64%	Negligible	40
44	Sighthill	320015	670783	21.5	21.8	1%	54%	Negligible	40
45	Parkhead	320150	670834	25.3	25.6	1%	64%	Negligible	40
46	West Drive	320157	670904	29.0	29.4	1%	74%	Negligible	40
47	Parkhead	320390	670933	27.8	28.2	1%	70%	Negligible	40
48	Parkhead	320674	671044	23.6	23.9	1%	60%	Negligible	40
49	Fairbrae	320592	671085	27.0	27.4	1%	68%	Negligible	40
50	Saughton	320801	671163	28.5	28.9	1%	72%	Negligible	40

Max	34.0	34.5	4%
Min	14.8	14.9	

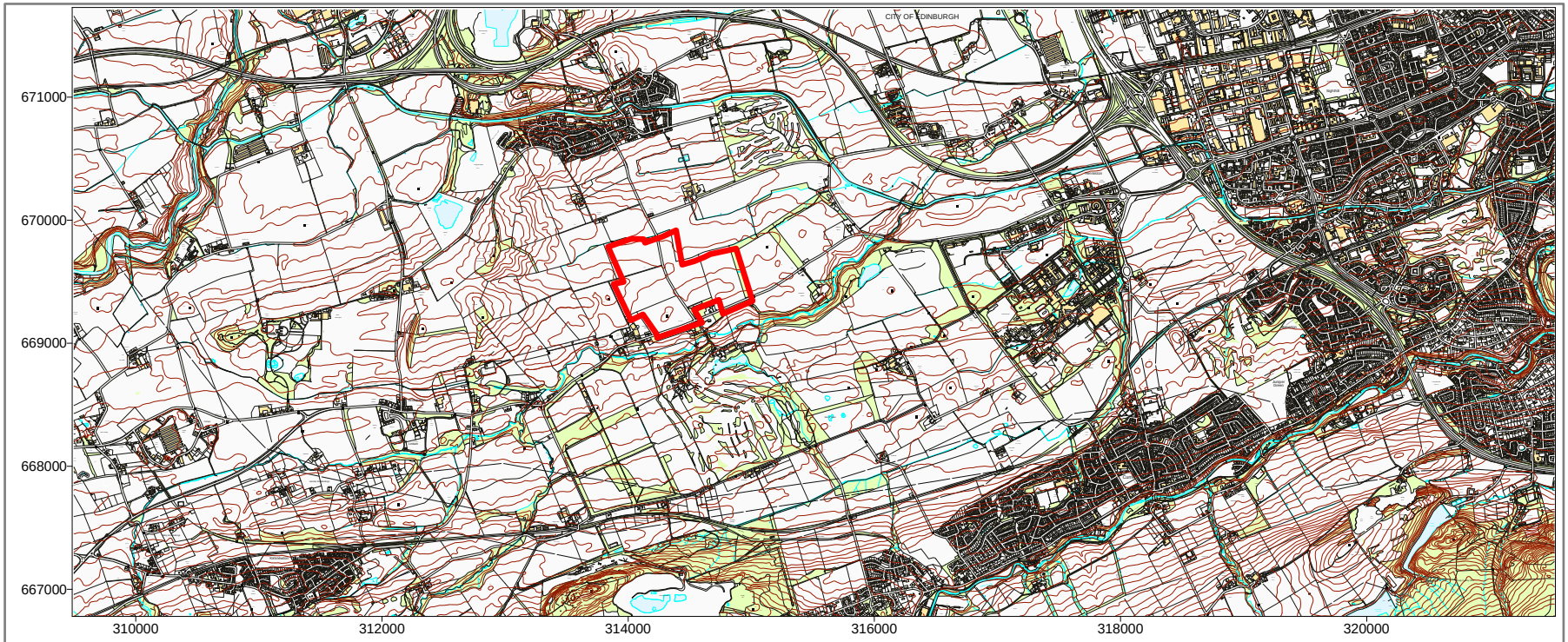
No.	Receptor name	X(m)	Y(m)	S2	S3	% Change	% EAL	Significance	EAL	Baseline
1	Coxydene	311227	668446	15.0	15.0	0%	84%	Negligible	18	14.3
2	East Coxydene Farm	311695	668494	15.8	15.8	0%	88%	Negligible	18	14.3
3	Wilkieston Village	312125	668463	16.6	16.7	0%	93%	Negligible	18	14.3
4	Wilkieston Village	312080	668458	16.0	16.0	0%	89%	Negligible	18	14.3
5	Wilkieston Village	312232	668461	15.8	15.9	0%	88%	Negligible	18	14.3
6	Orchardfield	312445	668488	15.0	15.1	0%	84%	Negligible	18	14.3
7	West Lodge	312778	668442	16.0	16.0	0%	89%	Negligible	18	14.3
8	Burnwynd	313102	668500	16.2	16.2	0%	90%	Negligible	18	14.3
9	Burnwynd	313238	668509	16.4	16.4	0%	91%	Negligible	18	14.3
10	Burnwynd	313263	668506	16.7	16.8	0%	93%	Negligible	18	14.3
11	Burnwynd	313308	668514	16.1	16.1	0%	90%	Negligible	18	14.3
12	Bridgend Cottages	313806	668870	16.9	16.9	0%	94%	Negligible	18	14.3
13	Hatton Bridge	313970	668976	16.2	16.3	0%	90%	Negligible	18	14.3
14	Dalmahoy Road Ratho	313856	670702	15.2	15.2	0%	85%	Negligible	18	14.3
15	Easter Hatton Mains	314095	669047	15.7	15.8	0%	88%	Negligible	18	14.3
16	Easter Hatton Cottages	314125	669025	16.1	16.1	0%	90%	Negligible	18	14.3
17	Main Street Ratho	313910	670732	15.2	15.3	0%	85%	Negligible	18	14.3
18	Entry Level	314520	669163	16.0	16.2	1%	90%	Negligible	18	14.3
19	Entry Level	314542	669167	15.7	15.9	1%	88%	Negligible	18	14.3
20	Dalmahoy Gatehouse	314573	669172	15.5	15.6	1%	87%	Negligible	18	14.3
21	House	314669	669248	16.6	16.8	1%	94%	Negligible	18	14.3
22	Lodge	315404	669599	16.5	16.8	1%	93%	Negligible	18	14.3
23	Addiston Mains	315800	669899	15.6	15.7	1%	87%	Negligible	18	14.3
24	Research Park	316689	669813	15.1	15.1	0%	84%	Negligible	18	14.3
25	Research Park	317152	669921	15.1	15.2	0%	84%	Negligible	18	14.3
26	Research Park	317485	670029	15.0	15.1	0%	84%	Negligible	18	14.3
27	Wester Row	317442	670122	16.9	17.2	1%	95%	Slight Adverse	18	14.3
28	Hermiston Steading	317581	670177	16.3	16.5	1%	92%	Negligible	18	14.3
29	Hermiston Steading	317630	670196	16.0	16.1	1%	90%	Negligible	18	14.3
30	Long Hermiston	317856	670263	15.4	15.5	0%	86%	Negligible	18	14.3
31	Calder Road	317878	670224	15.8	15.9	1%	88%	Negligible	18	14.3
32	Calder Road	317921	670226	15.8	15.9	1%	88%	Negligible	18	14.3
33	Research Park	317807	670153	15.5	15.6	0%	86%	Negligible	18	14.3
34	Calder View	318805	670456	17.0	17.1	0%	95%	Negligible	18	14.3
35	Calder View	318870	670486	17.4	17.5	0%	97%	Negligible	18	14.3
36	Calder View	318968	670496	16.6	16.7	0%	93%	Negligible	18	14.3
37	Calder Gardens	319121	670549	17.0	17.0	0%	95%	Negligible	18	14.3
38	Calder Gardens	319308	670611	17.1	17.2	0%	96%	Negligible	18	14.3
39	St Nicholas Church	319463	670657	16.6	16.6	0%	92%	Negligible	18	14.3
40	Bowling Green	319545	670668	16.0	16.0	0%	89%	Negligible	18	14.3
41	Sighthill	319628	670703	16.5	16.6	0%	92%	Negligible	18	14.3
42	Sighthill	319732	670726	16.5	16.6	0%	92%	Negligible	18	14.3
43	Sighthill	319858	670750	16.2	16.3	0%	90%	Negligible	18	14.3
44	Sighthill	320015	670783	15.8	15.8	0%	88%	Negligible	18	14.3
45	Parkhead	320150	670834	16.2	16.3	0%	90%	Negligible	18	14.3
46	West Drive	320157	670904	16.7	16.7	0%	93%	Negligible	18	14.3
47	Parkhead	320390	670933	16.5	16.6	0%	92%	Negligible	18	14.3
48	Parkhead	320674	671044	16.0	16.0	0%	89%	Negligible	18	14.3
49	Fairbrae	320592	671085	16.4	16.5	0%	91%	Negligible	18	14.3
50	Saughton	320801	671163	16.6	16.7	0%	93%	Negligible	18	14.3

Max	17.4	17.5	1%
Min	15.0	15.0	

No.	Receptor name	X(m)	Y(m)	S2	S3	% Change	% EAL	Significance	EAL	Baseline
1	Coxydene	311227	668446	8.2	8.2	0%	82%	Negligible	10	7.8
2	East Coxydene Farm	311695	668494	8.7	8.7	0%	87%	Negligible	10	7.8
3	Wilkieston Village	312125	668463	9.2	9.2	0%	92%	Negligible	10	7.8
4	Wilkieston Village	312080	668458	8.8	8.8	0%	88%	Negligible	10	7.8
5	Wilkieston Village	312232	668461	8.7	8.8	0%	88%	Negligible	10	7.8
6	Orchardfield	312445	668488	8.2	8.3	0%	83%	Negligible	10	7.8
7	West Lodge	312778	668442	8.8	8.8	0%	88%	Negligible	10	7.8
8	Burnwynd	313102	668500	8.9	9.0	0%	90%	Negligible	10	7.8
9	Burnwynd	313238	668509	9.0	9.1	0%	91%	Negligible	10	7.8
10	Burnwynd	313263	668506	9.2	9.3	0%	93%	Negligible	10	7.8
11	Burnwynd	313308	668514	8.9	8.9	0%	89%	Negligible	10	7.8
12	Bridgend Cottages	313806	668870	9.3	9.4	0%	94%	Negligible	10	7.8
13	Hatton Bridge	313970	668976	8.9	9.0	0%	90%	Negligible	10	7.8
14	Dalmahoy Road Ratho	313856	670702	8.3	8.4	0%	84%	Negligible	10	7.8
15	Easter Hatton Mains	314095	669047	8.7	8.7	0%	87%	Negligible	10	7.8
16	Easter Hatton Cottages	314125	669025	8.9	8.9	0%	89%	Negligible	10	7.8
17	Main Street Ratho	313910	670732	8.3	8.4	0%	84%	Negligible	10	7.8
18	Entry Level	314520	669163	8.8	8.9	1%	89%	Negligible	10	7.8
19	Entry Level	314542	669167	8.7	8.7	1%	87%	Negligible	10	7.8
20	Dalmahoy Gatehouse	314573	669172	8.5	8.6	1%	86%	Negligible	10	7.8
21	House	314669	669248	9.2	9.3	1%	93%	Negligible	10	7.8
22	Lodge	315404	669599	9.1	9.3	1%	93%	Negligible	10	7.8
23	Addiston Mains	315800	669899	8.6	8.6	1%	86%	Negligible	10	7.8
24	Research Park	316689	669813	8.3	8.3	0%	83%	Negligible	10	7.8
25	Research Park	317152	669921	8.3	8.3	0%	83%	Negligible	10	7.8
26	Research Park	317485	670029	8.2	8.3	0%	83%	Negligible	10	7.8
27	Wester Row	317442	670122	9.4	9.5	1%	95%	Slight Adverse	10	7.8
28	Hermiston Steading	317581	670177	9.0	9.1	1%	91%	Negligible	10	7.8
29	Hermiston Steading	317630	670196	8.8	8.9	1%	89%	Negligible	10	7.8
30	Long Hermiston	317856	670263	8.5	8.5	0%	85%	Negligible	10	7.8
31	Calder Road	317878	670224	8.7	8.8	1%	88%	Negligible	10	7.8
32	Calder Road	317921	670226	8.7	8.8	1%	88%	Negligible	10	7.8
33	Research Park	317807	670153	8.5	8.5	0%	85%	Negligible	10	7.8
34	Calder View	318805	670456	9.4	9.4	0%	94%	Negligible	10	7.8
35	Calder View	318870	670486	9.6	9.7	0%	97%	Negligible	10	7.8
36	Calder View	318968	670496	9.2	9.2	0%	92%	Negligible	10	7.8
37	Calder Gardens	319121	670549	9.4	9.4	0%	94%	Negligible	10	7.8
38	Calder Gardens	319308	670611	9.5	9.5	0%	95%	Negligible	10	7.8
39	St Nicholas Church	319463	670657	9.1	9.2	0%	92%	Negligible	10	7.8
40	Bowling Green	319545	670668	8.8	8.8	0%	88%	Negligible	10	7.8
41	Sighthill	319628	670703	9.1	9.1	0%	91%	Negligible	10	7.8
42	Sighthill	319732	670726	9.1	9.2	0%	92%	Negligible	10	7.8
43	Sighthill	319858	670750	8.9	9.0	0%	90%	Negligible	10	7.8
44	Sighthill	320015	670783	8.7	8.7	0%	87%	Negligible	10	7.8
45	Parkhead	320150	670834	8.9	9.0	0%	90%	Negligible	10	7.8
46	West Drive	320157	670904	9.2	9.2	0%	92%	Negligible	10	7.8
47	Parkhead	320390	670933	9.1	9.1	0%	91%	Negligible	10	7.8
48	Parkhead	320674	671044	8.8	8.8	0%	88%	Negligible	10	7.8
49	Fairbrae	320592	671085	9.1	9.1	0%	91%	Negligible	10	7.8
50	Saughton	320801	671163	9.2	9.2	0%	92%	Negligible	10	7.8

Max	9.6	9.7	1%
Min	8.2	8.2	

Figures

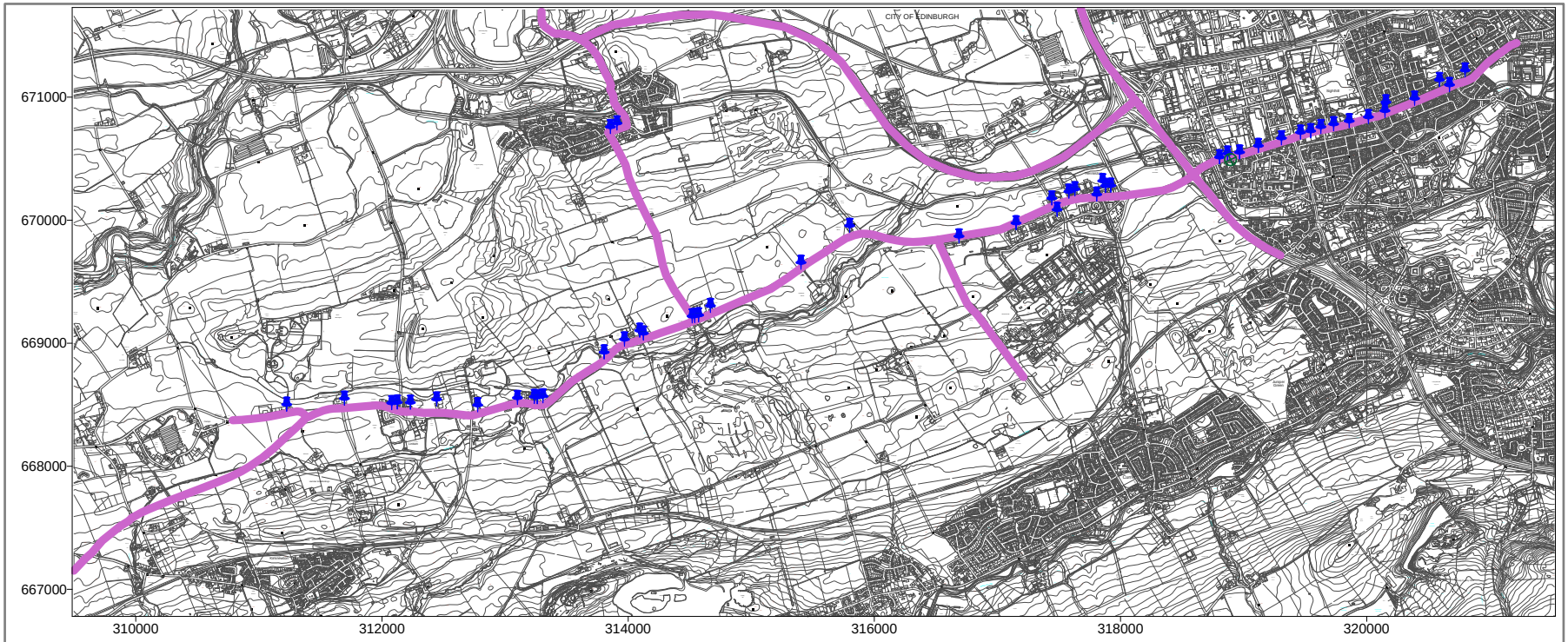


Site Location

indicative planning boundary

Figure 6

The Airshed



Study Area

road considered in dispersion model

receptor considered in dispersion model

diffusion tube site used for model verification in dispersion model

Figure 2

The Airshed

Baseline NO_2

ADMS Roads 4.1
2030 baseline traffic
Scenario 2.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
surface roughness = 0.5m
receptor height = 1.5m
met data Gogar 2016
background SG 2016
assumes 2016 fleet composition
UK EFT v8.0 (2 VC) Scottish Urban
V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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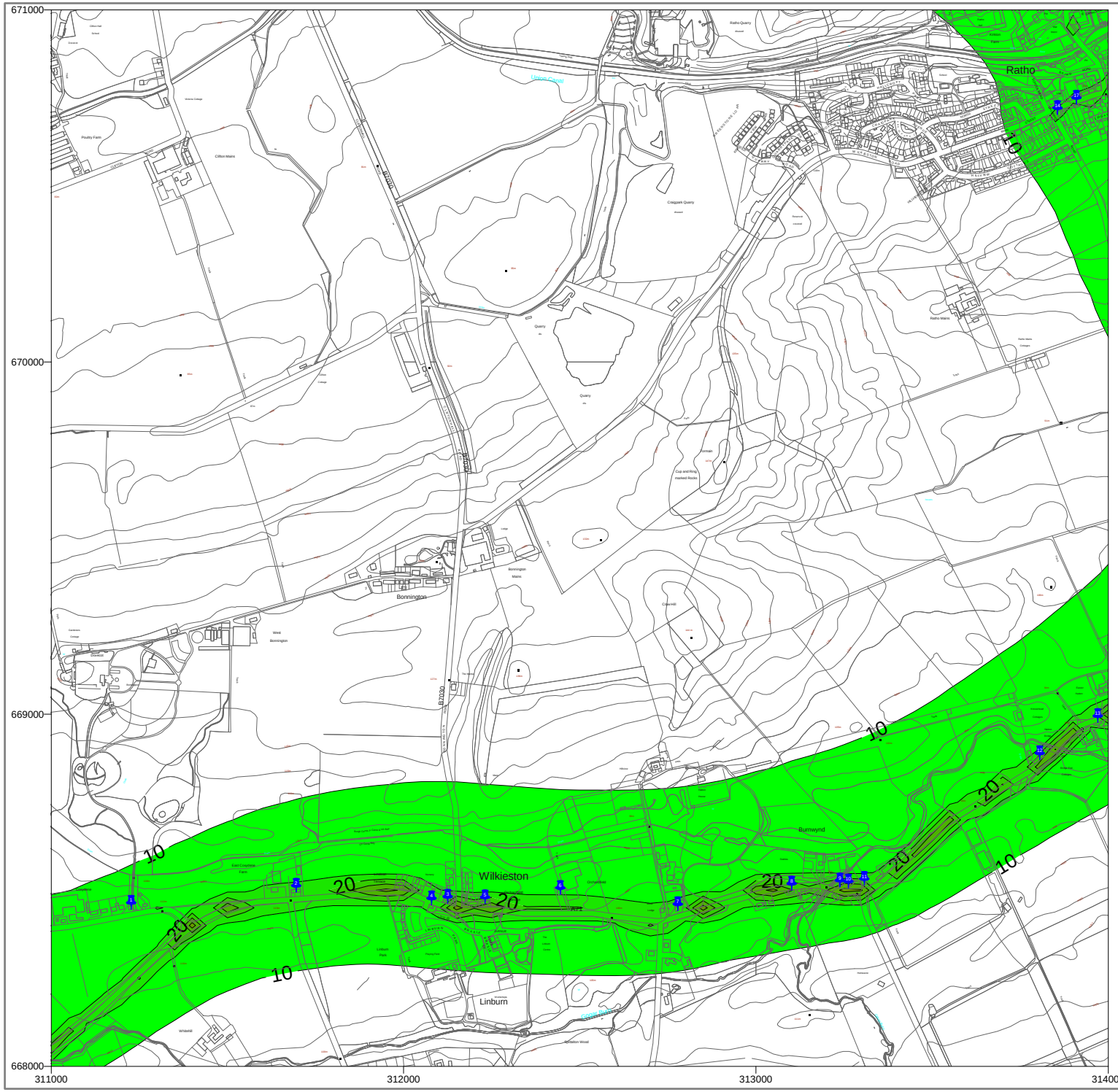
Figure 3.1a

The Airshed



Scheme NO_2

ADMS Roads 4.1
2030 scheme traffic
Scenario 3.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
surface roughness = 0.5m
receptor height = 1.5m
met data Gogar 2016
background SG 2016
assumes 2016 fleet composition
UK EFT v8.0 (2 VC) Scottish Urban
V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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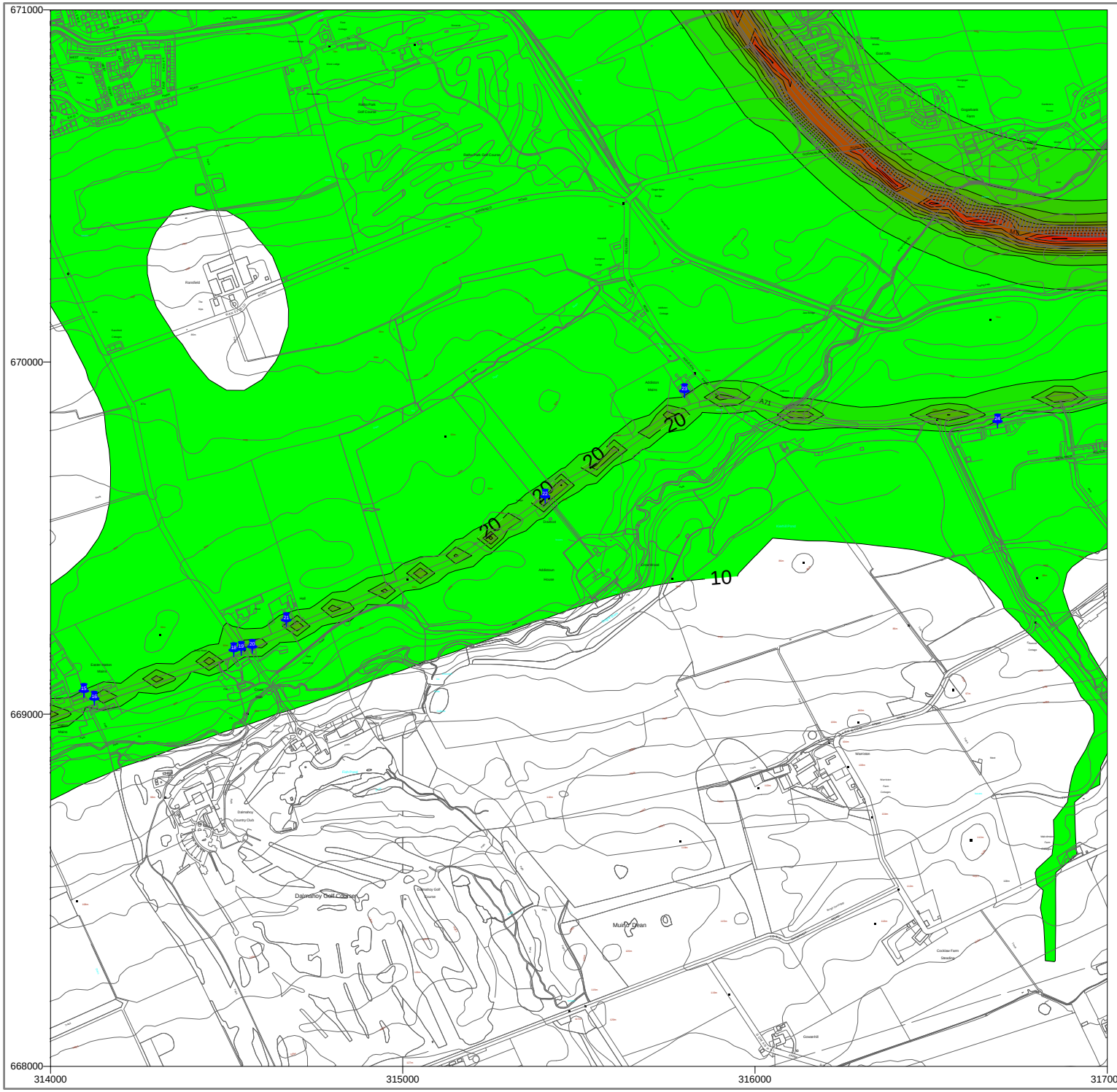
Figure 3.2a

The Airshed



Baseline NO_2

ADMS Roads 4.1
2030 baseline traffic
Scenario 2.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
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assumes 2016 fleet composition
UK EFT v8.0 (2 VC) Scottish Urban
V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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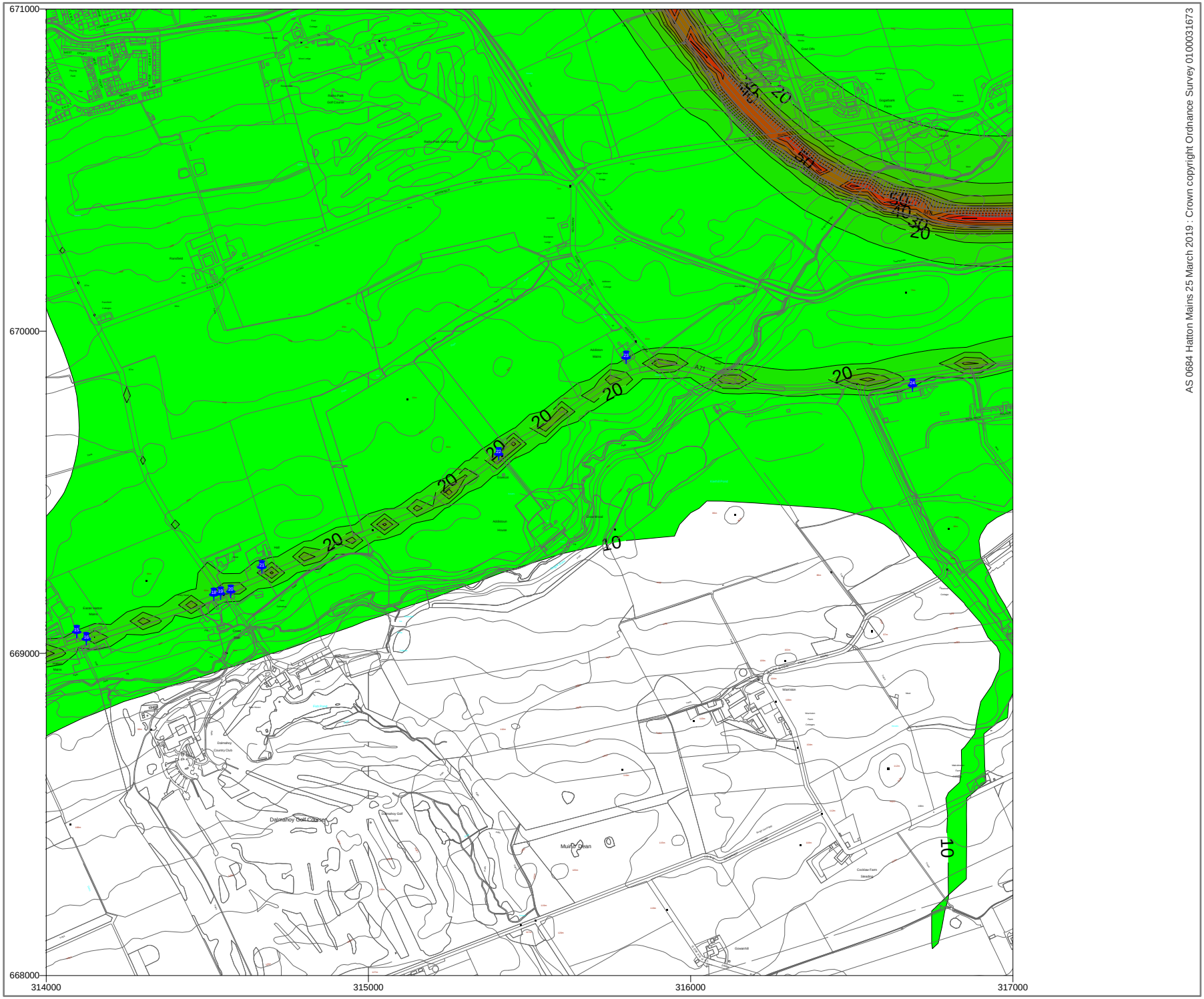
Figure 3.1b

The Airshed



Scheme NO_2

ADMS Roads 4.1
2030 scheme traffic
Scenario 3.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
surface roughness = 0.5m
receptor height = 1.5m
met data Gogar 2016
background SG 2016
assumes 2016 fleet composition
UK EFT v8.0 (2 VC) Scottish Urban
V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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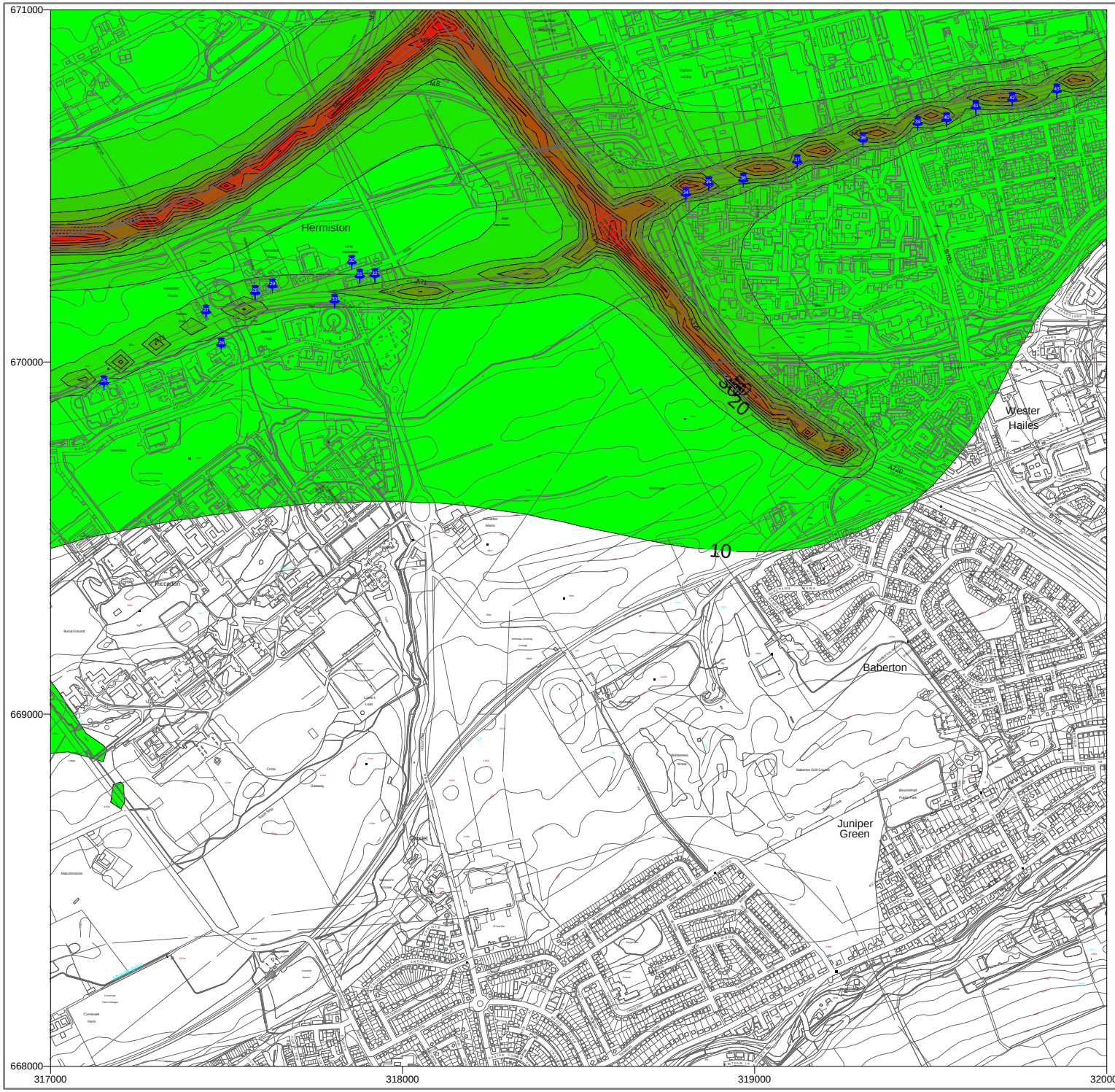
Figure 3.2b

The Airshed



Baseline NO_2

ADMS Roads 4.1
2030 baseline traffic
Scenario 2.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
surface roughness = 0.5m
receptor height = 1.5m
met data Gogar 2016
background SG 2016
assumes 2016 fleet composition
UK EFT v8.0 (2 VC) Scottish Urban
V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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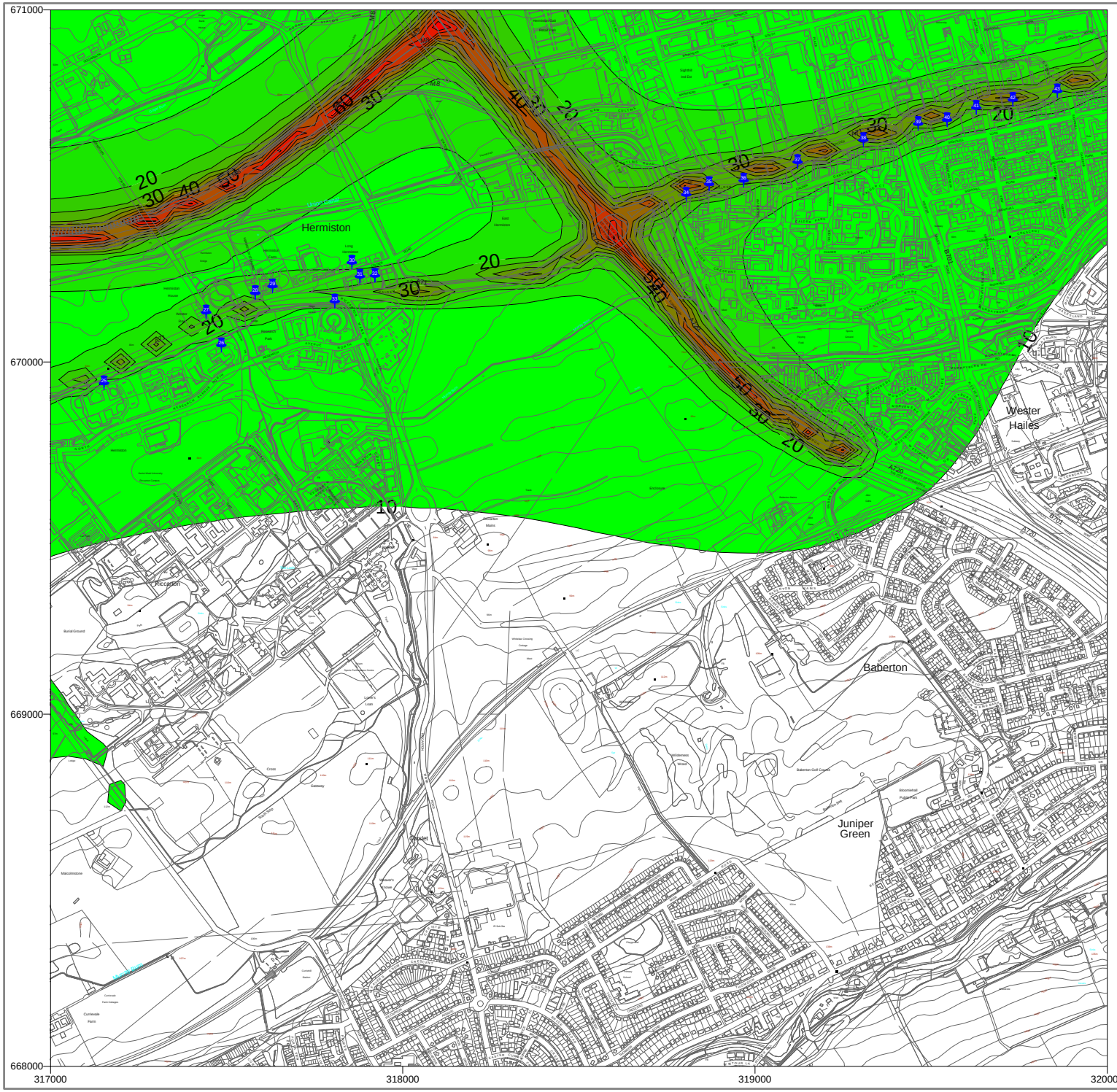
Figure 3.1c

The Airshed



Scheme NO_2

ADMS Roads 4.1
2030 scheme traffic
Scenario 3.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
surface roughness = 0.5m
receptor height = 1.5m
met data Gogar 2016
background SG 2016
assumes 2016 fleet composition
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V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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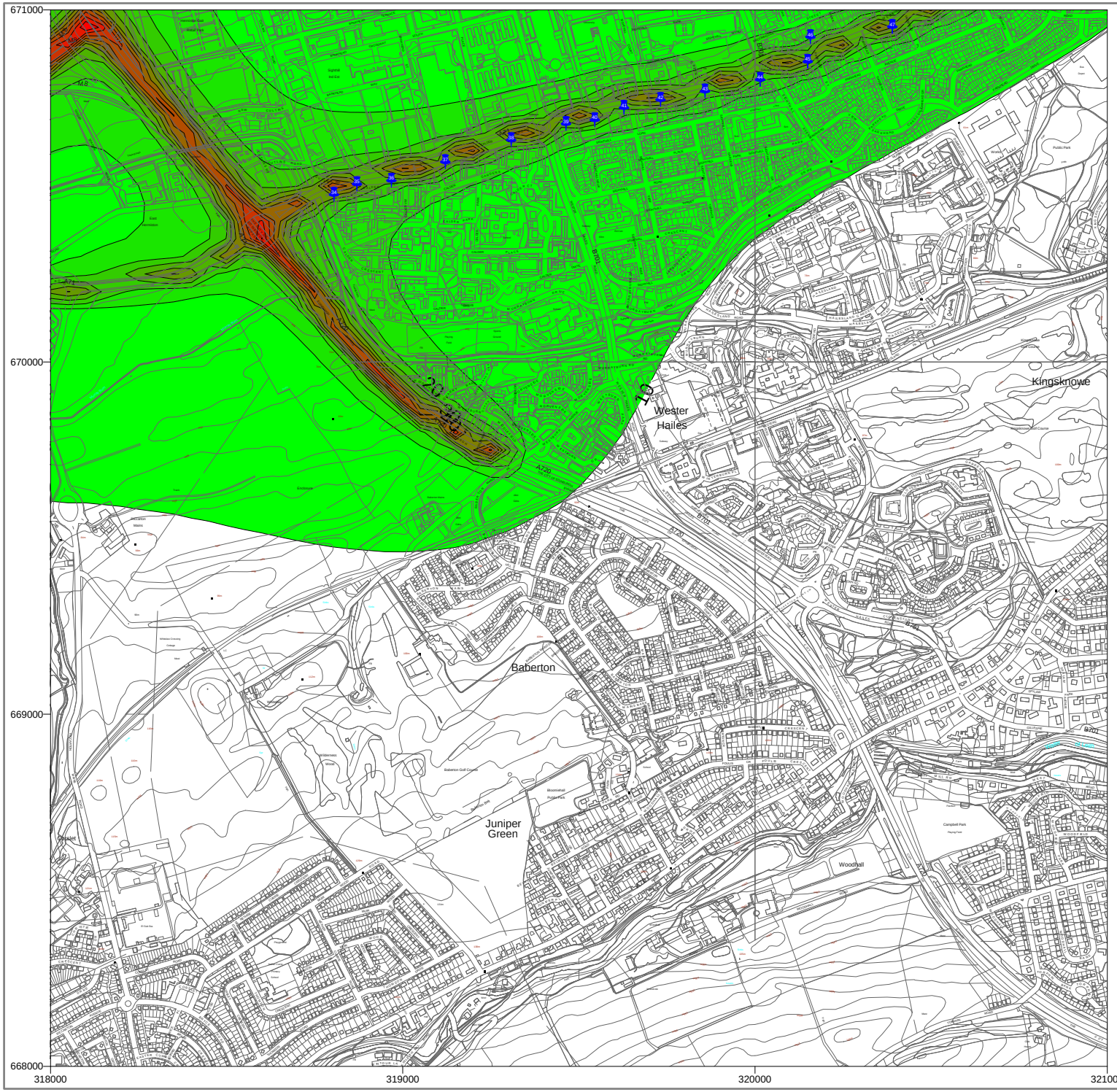
Figure 3.2c

The Airshed



Baseline NO_2

ADMS Roads 4.1
2030 baseline traffic
Scenario 2.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
surface roughness = 0.5m
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V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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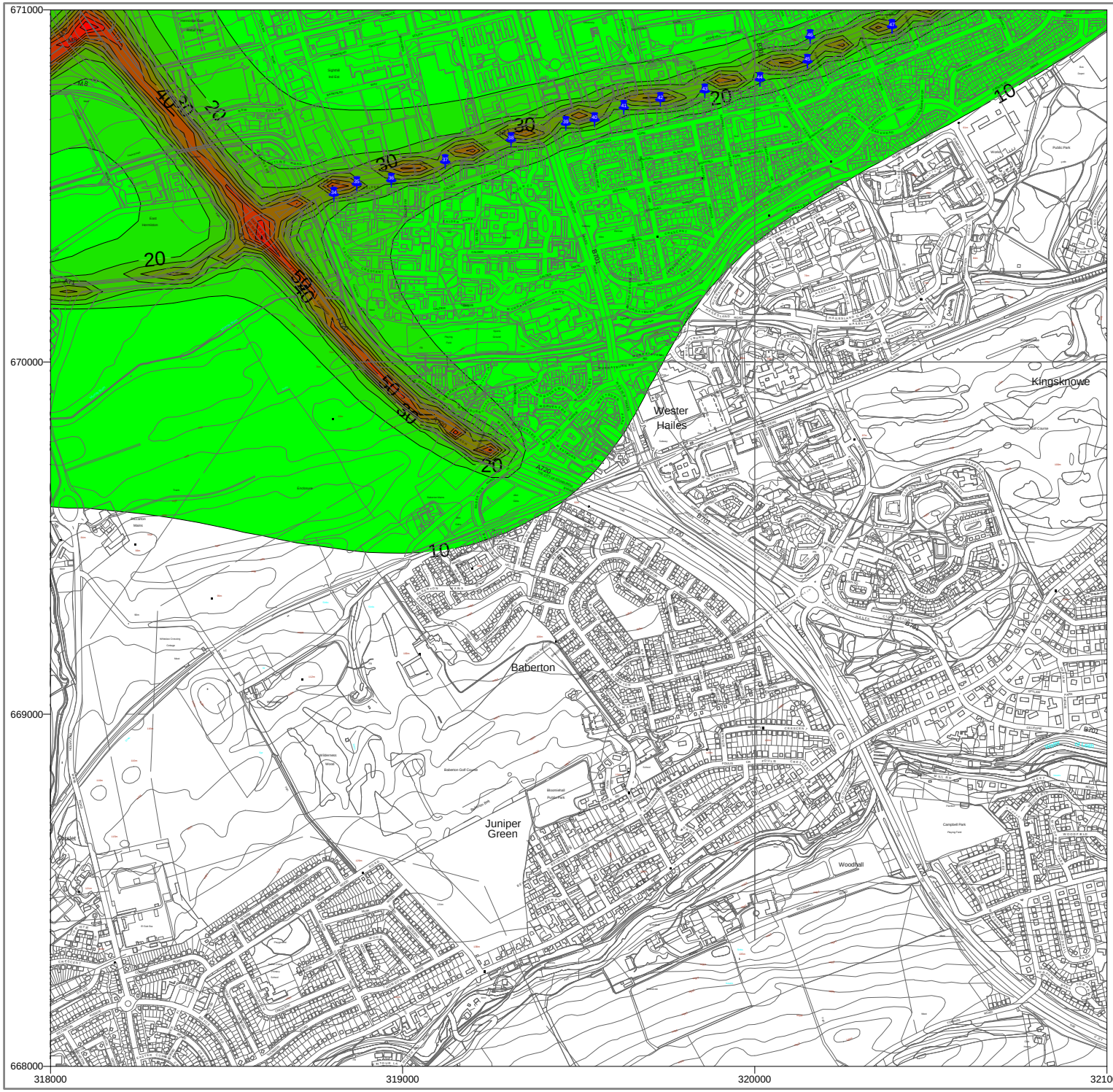
Figure 3.1d

The Airshed



Scheme NO_2

ADMS Roads 4.1
2030 scheme traffic
Scenario 3.upl
with diurnal variation in traffic flow
no canyon effects
no terrain effects
road speeds posted
grid resolution ~50m
surface roughness = 0.5m
receptor height = 1.5m
met data Gogar 2016
background SG 2016
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UK EFT v8.0 (2 VC) Scottish Urban
V6.1 NOx:NO2
includes 2016 background
units = ug/m3 NO2 annual mean

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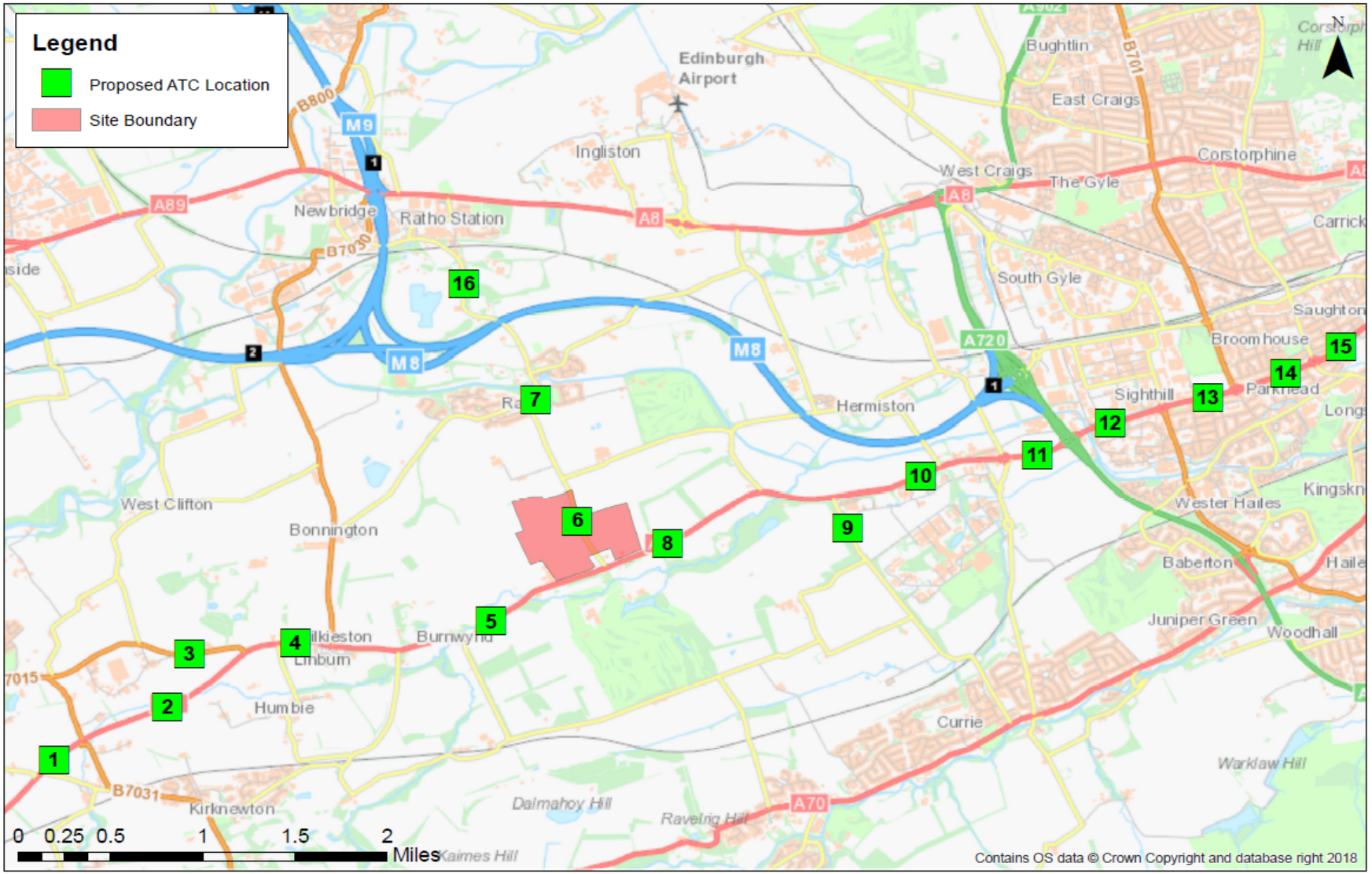
Figure 3.2d

The Airshed

Appendix 1 – Traffic Data


Legend
Proposed ATC Location
Site Boundary
N
Edinburgh Airport
Ingliston
Bughtlin
East Craigs
Corstorphine
West Craigs
The Gyle
Carrick
Newbridge
Ratho Station
South Gyle
Saughton
Broomhouse
Sighthill
Parkhead
Hermiston
West Clifton
Bonnington
Wester Hailes
Kingskn
Baberton
Juniper Green
Woodhall
Currie
Humbie
Kirknewton
Dalmahoy Hill
Ravelrig Hill
Warklaw Hill
Kaimes Hill
M9
M8
A8
A89
A720
A70
B800
B7030
B7031
B701
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0 0.25 0.5 1 1.5 2
Miles
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ALL TRAFFIC

COUNT POINT	LOCATION	BASELINE (B)				CUMULATIVE DEVELOPMENTS (C)		2030 BASELINE (B+C)		DEVELOPMENT (D)		2030 TOTAL ((B+C)+D)			
		2019 18 HOUR AAWT	2019 24 HOUR AADT	2030 18 HOUR AAWT	2030 24 HOUR AADT	18 HOUR AAWT	24 HOUR AADT	18 HOUR AAWT	24 HOUR AADT	18 HOUR AAWT	24 HOUR AADT	18 HOUR AAWT	DEV IMPACT	24 HOUR AADT	DEV IMPACT
1	A71	13,653	12,430	15,660	14,257	84	77	15,744	14,334	655	600	16,399	4.2%	14,934	4.2%
2	A71	12,987	11,875	14,897	13,621	84	77	14,980	13,697	655	600	15,635	4.4%	14,298	4.4%
3	B7015	4,092	3,591	4,693	4,119	19	17	4,712	4,136	0	0	4,712	0.0%	4,136	0.0%
4	A71	16,615	15,064	19,057	17,279	84	77	19,141	17,356	655	600	19,796	3.4%	17,956	3.5%
5	A71	15,832	14,381	18,160	16,495	84	77	18,243	16,571	682	625	18,925	3.7%	17,196	3.8%
6	DALMAHOY ROAD	2,145	1,983	2,461	2,275	256	234	2,716	2,509	3,762	3,447	6,478	138.5%	5,956	137.4%
7	MAIN STREET, RATHO	3,267	2,938	3,748	3,370	245	224	3,992	3,594	633	580	4,625	15.9%	4,174	16.1%
8	A71	17,764	16,124	20,375	18,494	220	202	20,595	18,696	3,080	2,822	23,675	15.0%	21,518	15.1%
9	CURRIEHILL ROAD	2,858	2,531	3,278	2,903	0	0	3,278	2,903	171	157	3,449	5.2%	3,060	5.4%
10	A71 CALDER ROAD	16,116	14,903	18,486	17,094	220	202	18,706	17,296	2,909	2,666	21,615	15.6%	19,961	15.4%
11	A71 CALDER ROAD	28,636	26,286	32,845	30,150	1,882	1,725	34,727	31,875	2,909	2,666	37,636	8.4%	34,540	8.4%
12	A71 CALDER ROAD	36,569	35,465	41,945	40,678	1,506	1,380	43,450	42,058	1,993	1,826	45,443	4.6%	43,884	4.3%
13	A71 CALDER ROAD	32,749	32,423	37,564	37,189	1,189	1,090	38,753	38,279	1,764	1,616	40,517	4.6%	39,896	4.2%
14	A71 CALDER ROAD	30,998	30,768	35,555	35,291	1,094	1,003	36,649	36,294	1,630	1,494	38,279	4.4%	37,787	4.1%
15	A71 CALDER ROAD	29,465	28,977	33,796	33,237	1,072	983	34,868	34,220	1,594	1,461	36,462	4.6%	35,680	4.3%
16	HARVEST ROAD	2,774	2,429	3,182	2,786	204	187	3,386	2,973	633	580	4,019	18.7%	3,553	19.5%
2019 -> 2030 'HIGH' FACTOR		1.147	0.096												
TOTAL TRAFFIC GROWTH		14.7%	1%												

HGVS ONLY

COUNT POINT	LOCATION	2019				2030			
		18 HOUR AAWT HGVS	% HGV	24 HOUR AADT HGVS	% HGV	18 HOUR AAWT HGVS	% HGV	24 HOUR AADT HGVS	% HGV
1	A71	1,545	11.3%	1,343	10.8%	1,772	11.3%	1,540	10.8%
2	A71	1,463	11.3%	1,273	10.7%	1,678	11.3%	1,460	10.7%
3	B7015	572	14.0%	465	12.9%	656	14.0%	533	12.9%
4	A71	1,821	11.0%	1,568	10.4%	2,089	11.0%	1,798	10.4%
5	A71	1,785	11.3%	1,534	10.7%	2,047	11.3%	1,759	10.7%
6	DALMAHOY ROAD	314	14.6%	270	13.6%	360	14.6%	310	13.6%
7	MAIN STREET, RATHO	443	13.6%	450	15.3%	508	13.6%	516	15.3%
8	A71	1,905	10.7%	1,678	10.4%	2,185	10.7%	1,925	10.4%
9	CURRIEHILL ROAD	284	9.9%	251	9.9%	326	9.9%	288	9.9%
10	A71 CALDER ROAD	2,022	12.5%	1,760	11.8%	2,319	12.5%	2,019	11.8%
11	A71 CALDER ROAD	3,227	11.3%	2,821	10.7%	3,701	11.3%	3,236	10.7%
12	A71 CALDER ROAD	4,653	12.7%	4,217	11.9%	5,337	12.7%	4,837	11.9%
13	A71 CALDER ROAD	3,898	11.9%	3,694	11.4%	4,471	11.9%	4,237	11.4%
14	A71 CALDER ROAD	3,981	12.8%	3,754	12.2%	4,566	12.8%	4,306	12.2%
15	A71 CALDER ROAD	3,897	13.2%	3,572	12.3%	4,470	13.2%	4,097	12.3%
16	HARVEST ROAD	443	16.0%	363	14.9%	508	16.0%	416	14.9%

DISCLAIMER:

CALCULATED AAWT AND AADT IS BASED ON SURVEYED FLOWS FROM RATHO. CHECKS HAVE BEEN CARRIED OUT AGAINST DFT AADT COUNTERS IN SURROUNDING AREA AND CALCULATED FLOWS ARE WITHIN AN ACCEPTABLE MARGIN
2030 HGV TOTALS DO NOT INCLUDE COMMITTED OR CUMULATIVE DEVELOPMENTS. INCREASE EXPECTED TO BE NEGLIGIBLE DUE TO DEVELOPMENTS BEING RESIDENTIAL
5% TRAFFIC GROWTH HAS BEEN USED TO ACCOUNT FOR LDP ALLOCATION WHICH COULD CONTAIN COMMITTED DEVELOPMENT TRAFFIC
POINT 6 IS WITHIN PROPOSED DEVELOPMENT. ALL A71 TRAFFIC HAS BEEN ASSUMED TO PASS THIS POINT TO PROVIDE ROBUST ASSESSMENT

NOTE:

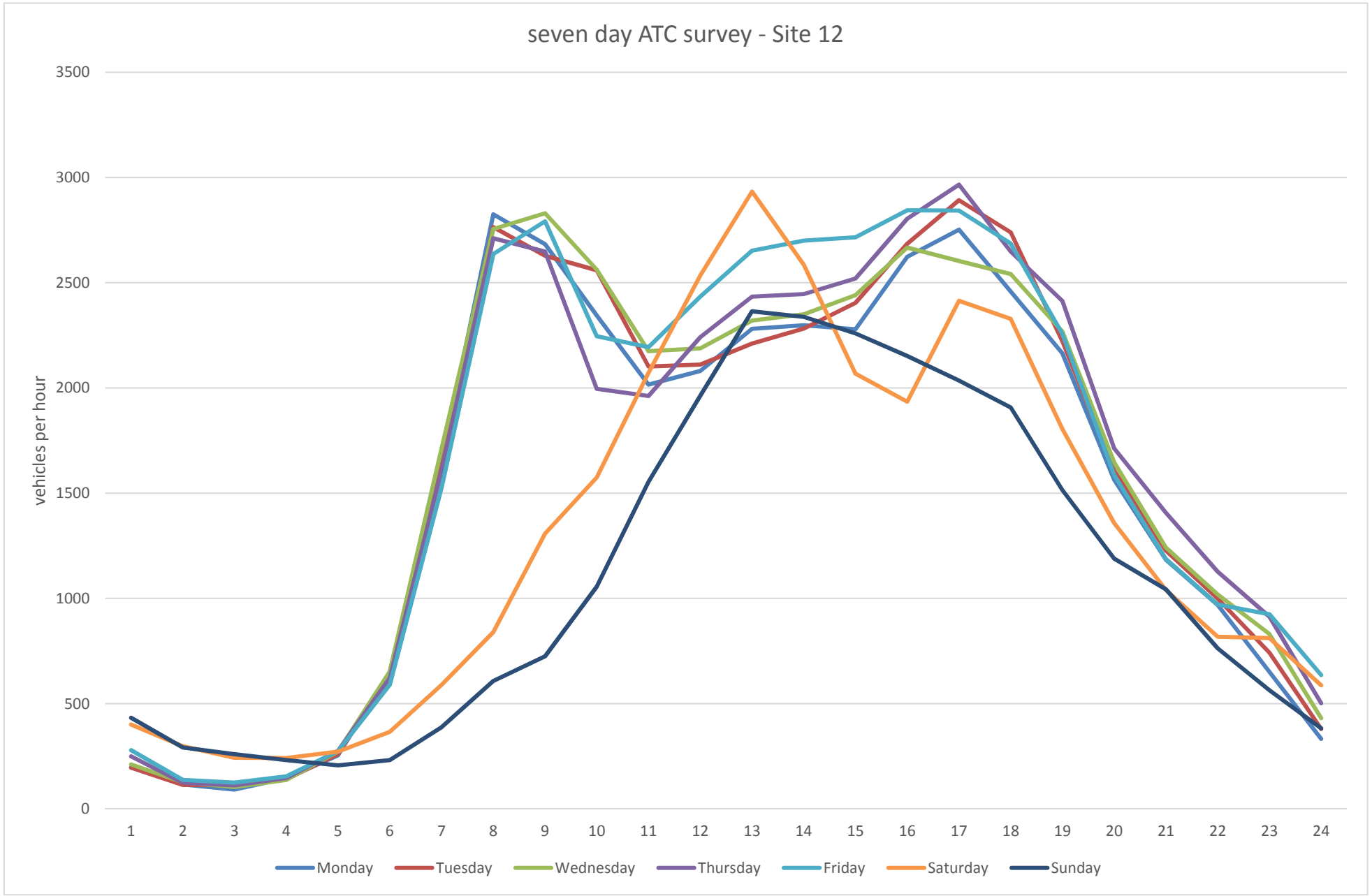
ALL FLOWS ARE 2-WAY
SEE COUNT POINT MAP FOR POSITION OF COUNT POINTS ON LOCAL ROAD NETWORK
SEE INCREASE MAPS TO SEE %AGE INCREASE AT COUNT POINTS
PASSWORD = Hatton2019

Road	RoadCategory	Easting	Northing	StartJunction	EndJunction	LinkLength_km	LinkLength_miles	PedalCycles	Motorcycles	CarsTaxis	BusesCoaches	LightGoodsVehicles	V2AxleRigidHGV	V3AxleRigidHGV	V4or5AxleRigidHGV	V3or4AxleArticHGV	V5AxleArticHGV	V6orMoreAxleArticHGV	AllHGVs	AllMotorVehicles
A720	TA	323900	667960	Dreghorn Link junction	A702	1.8	1.12	0	291	58527	315	12413	2395	448	625	281	770	736	5255	76800
A720	TA	329000	667090	A701	A772	3.3	2.05	0	309	45501	240	8889	1807	237	412	279	561	847	4143	59083
A720	TA	325500	667300	A702	A701	2.7	1.68	0	532	56358	184	14052	1539	297	565	207	646	1329	4584	75710
M8	TM	311350	671120	LA boundary	M8 split	1.5	0.93	0	132	41335	201	10055	1413	489	258	276	405	2103	4943	56665
A720	TA	318436	670570	M8	A71	0.9	0.56	0	569	71304	187	14377	1371	267	525	138	1363	377	4042	90478
A720	PA	317600	672000	A8	M8	1.8	1.12	0	145	31926	100	5874	619	119	193	1	101	240	1273	39318
M8	TM	315000	671650	2	1	6.4	3.98	0	261	50587	287	11182	2711	370	554	525	1109	1160	6430	68747
M8	TM	312589	671998	2	3	1.4	0.87	0	367	51934	354	11474	1433	344	422	184	804	2564	5751	69879
A720	TA	319330	669710	A71	Dreghorn Link junction	5.8	3.6	0	432	57018	301	10488	2358	331	453	477	971	963	5554	73793
A720	TA	330900	667900	A772	A7/A6106	1.3	0.81	0	313	34503	184	6724	1542	216	315	361	747	938	4120	45844

Road	RoadCategory	Easting	Northing	StartJunction	EndJunction	LinkLength_km	LinkLength_miles	PedalCycles	Motorcycles	CarsTaxis	BusesCoaches	LightGoodsVehicles	V2AxleRigidHGV	V3AxleRigidHGV	V4or5AxleRigidHGV	V3or4AxleArticHGV	V5AxleArticHGV	V6orMoreAxleArticHGV	AllHGVs	AllMotorVehicles
A720	TA	323900	667960	Dreghorn Link junction	A702	1.8	1.12	0	291	58527	315	12413	2395	448	625	281	770	736	5255	76800
A720	TA	329000	667090	A701	A772	3.3	2.05	0	309	45501	240	8889	1807	237	412	279	561	847	4143	59083
A720	TA	325500	667300	A702	A701	2.7	1.68	0	532	56358	184	14052	1539	297	565	207	646	1329	4584	75710
M8	TM	311350	671120	LA boundary	M8 split	1.5	0.93	0	132	41335	201	10055	1413	489	258	276	405	2103	4943	56665
A720	**TA**	**318436**	**670570**	**M8**	**A71**	**0.9**	**0.56**	**0**	**569**	**71304**	**187**	**14377**	**1371**	**267**	**525**	**138**	**1363**	**377**	**4042**	**90478**
A720	PA	317600	672000	A8	M8	1.8	1.12	0	145	31926	100	5874	619	119	193	1	101	240	1273	39318
M8	TM	315000	671650	2	1	6.4	3.98	0	261	50587	287	11182	2711	370	554	525	1109	1160	6430	68747
M8	TM	312589	671998	2	3	1.4	0.87	0	367	51934	354	11474	1433	344	422	184	804	2564	5751	69879
A720	TA	319330	669710	A71	Dreghorn Link junction	5.8	3.6	0	432	57018	301	10488	2358	331	453	477	971	963	5554	73793
A720	TA	330900	667900	A772	A7/A6106	1.3	0.81	0	313	34503	184	6724	1542	216	315	361	747	938	4120	45844

Road	RoadCategory	Easting	Northing	StartJunction	EndJunction	LinkLength_km	LinkLength_miles	PedalCycles	Motorcycles	CarsTaxis	BusesCoaches	LightGoodsVehicles	V2AxleRigidHGV	V3AxleRigidHGV	V4or5AxleRigidHGV	V3or4AxleArticHGV	V5AxleArticHGV	V6orMoreAxleArticHGV	AllHGVs	AllMotorVehicles
A720	TA	323900	667960	Dreghorn Link junction	A702	1.8	1.12	0	291	58527	315	12413	2395	448	625	281	770	736	5255	76800
A720	TA	329000	667090	A701	A772	3.3	2.05	0	309	45501	240	8889	1807	237	412	279	561	847	4143	59083
A720	TA	325500	667300	A702	A701	2.7	1.68	0	532	56358	184	14052	1539	297	565	207	646	1329	4584	75710
M8	TM	311350	671120	LA boundary	M8 split	1.5	0.93	0	132	41335	201	10055	1413	489	258	276	405	2103	4943	56665
A720	**TA**	**318436**	**670570**	**M8**	**A71**	**0.9**	**0.56**	**0**	**569**	**71304**	**187**	**14377**	**1371**	**267**	**525**	**138**	**1363**	**377**	**4042**	**90478**
A720	PA	317600	672000	A8	M8	1.8	1.12	0	145	31926	100	5874	619	119	193	1	101	240	1273	39318
M8	TM	315000	671650	2	1	6.4	3.98	0	261	50587	287	11182	2711	370	554	525	1109	1160	6430	68747
M8	TM	312589	671998	2	3	1.4	0.87	0	367	51934	354	11474	1433	344	422	184	804	2564	5751	69879
A720	TA	319330	669710	A71	Dreghorn Link junction	5.8	3.6	0	432	57018	301	10488	2358	331	453	477	971	963	5554	73793
A720	TA	330900	667900	A772	A7/A6106	1.3	0.81	0	313	34503	184	6724	1542	216	315	361	747	938	4120	45844

Road	RoadCategory	Easting	Northing	StartJunction	EndJunction	LinkLength_km	LinkLength_miles	PedalCycles	Motorcycles	CarsTaxis	BusesCoaches	LightGoodsVehicles	V2AxleRigidHGV	V3AxleRigidHGV	V4or5AxleRigidHGV	V3or4AxleArticHGV	V5AxleArticHGV	V6orMoreAxleArticHGV	AllHGVs	AllMotorVehicles
A720	TA	323900	667960	Dreghorn Link junction	A702	2	1	0	335	67306	362	14275	2754	515	719	323	886	846	6043	88320
A720	TA	329000	667090	A701	A772	4	2	0	355	52326	276	10222	2078	273	474	321	645	974	4764	67945
A720	TA	325500	667300	A702	A701	3	2	0	612	64812	212	16160	1770	342	650	238	743	1528	5272	87067
M8	TM	311350	671120	LA boundary	M8 split	2	1	0	152	47535	231	11563	1625	562	297	317	466	2418	5684	65165
A720	**TA**	**318436**	**670570**	**M8**	**A71**	1	1	0	654	82000	215	16534	1577	307	604	159	1567	434	4648	104050
A720	PA	317600	672000	A8	M8	2	1	0	167	36715	115	6755	712	137	222	1	116	276	1464	45216
M8	TM	315000	671650	2	1	7	5	0	300	58175	330	12859	3118	426	637	604	1275	1334	7395	79059
M8	TM	312589	671998	2	3	2	1	0	422	59724	407	13195	1648	396	485	212	925	2949	6614	80361
A720	TA	319330	669710	A71	Dreghorn Link junction	7	4	0	497	65571	346	12061	2712	381	521	549	1117	1107	6387	84862
A720	TA	330900	667900	A772	A7/A6106	1	1	0	360	39678	212	7733	1773	248	362	415	859	1079	4738	52721


seven day ATC survey - Site 12
vehicles per hour
3500
3000
2500
2000
1500
1000
500
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday

	hourly flows						
Time	Monday	Tuesday	Wednesda	Thursday	Friday	Saturday	Sunday
01:00	198	196	211	250	279	401	433
02:00	116	114	127	124	138	298	292
03:00	92	113	104	112	125	243	260
04:00	146	141	138	147	155	242	232
05:00	255	260	272	276	275	272	207
06:00	651	643	653	622	590	366	232
07:00	1645	1672	1711	1607	1526	589	388
08:00	2825	2764	2755	2711	2636	840	608
09:00	2683	2628	2830	2648	2792	1308	725
10:00	2344	2559	2562	1996	2246	1575	1056
11:00	2016	2102	2175	1962	2194	2072	1554
12:00	2081	2111	2188	2241	2434	2534	1963
13:00	2281	2211	2320	2434	2652	2933	2364
14:00	2298	2282	2350	2446	2700	2585	2338
15:00	2279	2404	2441	2520	2716	2068	2259
16:00	2623	2685	2667	2804	2844	1935	2152
17:00	2752	2892	2603	2966	2843	2414	2035
18:00	2458	2739	2541	2648	2686	2328	1907
19:00	2164	2221	2268	2413	2256	1805	1515
20:00	1564	1607	1647	1713	1587	1358	1189
21:00	1184	1227	1242	1407	1187	1040	1043
22:00	969	999	1019	1127	971	818	763
23:00	651	742	831	913	925	812	564
00:00	333	380	431	502	636	587	383

summary flows/hour		
5 days	Sat	Sun
227	401	433
124	298	292
109	243	260
145	242	232
268	272	207
632	366	232
1632	589	388
2738	840	608
2716	1308	725
2341	1575	1056
2090	2072	1554
2211	2534	1963
2380	2933	2364
2415	2585	2338
2472	2068	2259
2725	1935	2152
2811	2414	2035
2614	2328	1907
2264	1805	1515
1624	1358	1189
1249	1040	1043
1017	818	763
812	812	564
456	587	383

summary flows/hour		
5 days	Sat	Sun
0.153	0.271	0.293
0.084	0.202	0.198
0.074	0.164	0.176
0.098	0.164	0.157
0.181	0.184	0.140
0.427	0.248	0.157
1.104	0.399	0.263
1.853	0.568	0.411
1.838	0.885	0.491
1.584	1.066	0.714
1.414	1.402	1.051
1.496	1.714	1.328
1.610	1.984	1.599
1.634	1.749	1.582
1.673	1.399	1.528
1.843	1.309	1.456
1.902	1.633	1.377
1.769	1.575	1.290
1.532	1.221	1.025
1.099	0.919	0.804
0.845	0.704	0.706
0.688	0.553	0.516
0.550	0.549	0.382
0.309	0.397	0.259

seven day ATC survey Site 12

Appendix 2 – Dust Control Measures During Construction

APPENDIX 2
DUST CONTROL MEASURES DURING CONSTRUCTION

Scope

1. These procedures shall apply to the site clearance, groundworks and construction operations undertaken by the applicant and their appointed subcontractors at the proposed development at Hatton Mains, Edinburgh during the construction of the proposed development.

2. Potentially dusty operations include: changes to the landform, the removal and storage of topsoil and subsoils; the movement of vehicles on unpaved surfaces, road building, laying of services and other groundworks; the erection of buildings; the storage of building materials and waste products.

3. These measures include a formal consultation procedure with the City of Edinburgh Council to ensure that they are made aware of any potentially dusty activities.

Aims

4. The aim of these procedures is to prevent or minimise the release of dust particles from construction and demolition operations to atmosphere. Dust means all particles < 75um in diameter. Potential adverse effects from the release of dust particles include loss of amenity due to deposition and soiling of surfaces; damage to crops and other vegetation and human respiratory ill-health due to inhalation. Most airborne particles from construction and demolition are above the diameter at which adverse effects on human health are likely to occur. These procedures are intended to protect the amenity of sensitive receptors around the proposed development, with particular emphasis on adjacent residential areas.

Responsibility

5. The main contractor shall be responsible for ensuring that there are adequate resources for the effective implementation of these procedures.

6. The main contractor shall appoint a named senior manager who shall be responsible for ensuring that these procedures are implemented on a day to day basis during the construction project.

7. All employees and appointed sub-contractors engaged in the construction project shall be made aware of the potential environmental effects of dust and their respective roles in ensuring compliance with environmental standards.

Preamble

8. Design and engineering control to minimise impacts from each phase of any demolition, landform and construction operations include: the timing and phasing of operations; the location dusty activities away from sensitive receptors where practicable; the selection and use of appropriate plant and methods of working; and the use of dust suppression water sprays. Adequate process supervision is also required to ensure that members of staff are adequately trained and aware of their environmental

responsibilities and that the appropriate dust control measures are implemented.

Operating Procedures for Dust Suppression

9. Prior to the commencement of any new phase of ground works or construction the proposed method of working and dust suppression techniques shall be formally reviewed by the main contractor. Where practicable, dusty activities shall be kept as far as possible from sensitive receptors. The outcome of all such reviews shall be recorded.

10. The main contractor shall provide a telephone 'hotline' to enable direct contact between members of the public and the site agent, to enable rapid response to dust complaints.

11. The main contractor shall formally advise Environmental Health fro the City of Edinburgh Council of the proposed methods of working or any changes proposed. The main contractor shall take account of feedback as appropriate. The outcome of all consultations and feedback shall be recorded.

12. All mobile plant introduced onto the site shall comply with the Stage 1 emission limits for off road vehicles as specified by EC Directive 97/68/EC. All mobile plant shall be maintained to prevent or minimise the release of dark smoke from vehicle exhausts. Details of vehicle maintenance shall be recorded.

13. The main contractor shall ensure that risk of dust annoyance from the operations is assessed throughout the working day, taking account of wind speed, direction, and surface moisture levels. The main contractor shall ensure that the level of dust suppression implemented on site is adequate for the prevailing conditions. The assessment shall be recorded as part of documented site management procedures.

14. Internal un-surfaced temporary roadways shall be sprayed with water at regular intervals as conditions require. The frequency of road spraying shall be recorded as part of documented site management procedures.

15. Surfaced roads and the public road during all ground works shall be kept clean and swept at regular intervals using a road sweeper as conditions require. The frequency of road sweeping shall be recorded as part of documented site management procedures.

16. All vehicles operating within the site on unsurfaced roads shall not exceed 15mph to minimise the re-suspension of dust.

17. Where dust from the operations are likely to cause significant adverse impacts at sensitive receptors, then the operation(s) shall be suspended until the dust emissions have been abated. The time and duration of suspension of working and the reason shall be recorded.

18. This dust management plan shall be reviewed monthly during the construction project and the outcome of the review shall be recorded as part of the documented site management procedures.

19. No fires or burning of wastes shall be permitted on site during construction

Appendix 3 – Model Inputs

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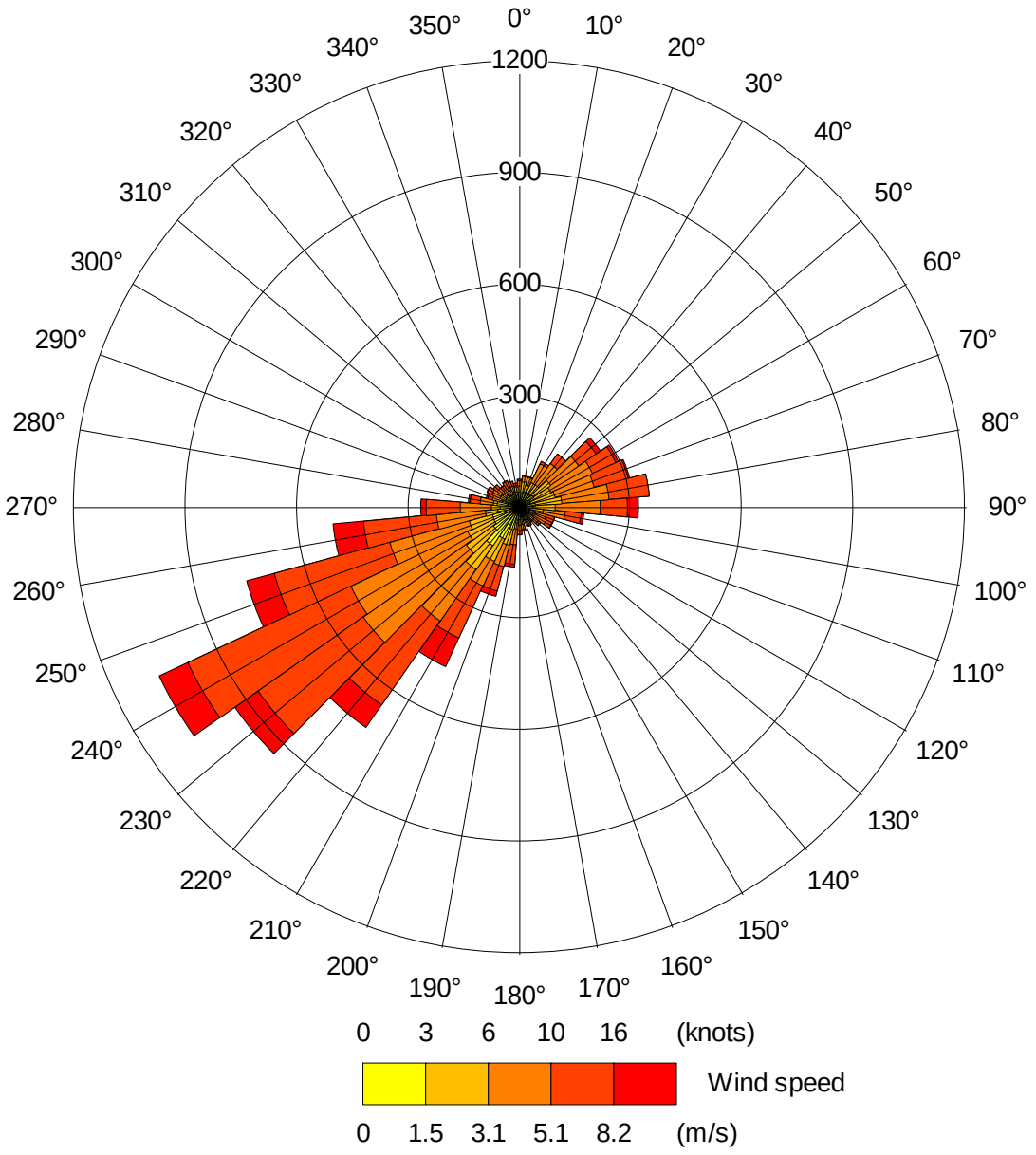

Appendix 4

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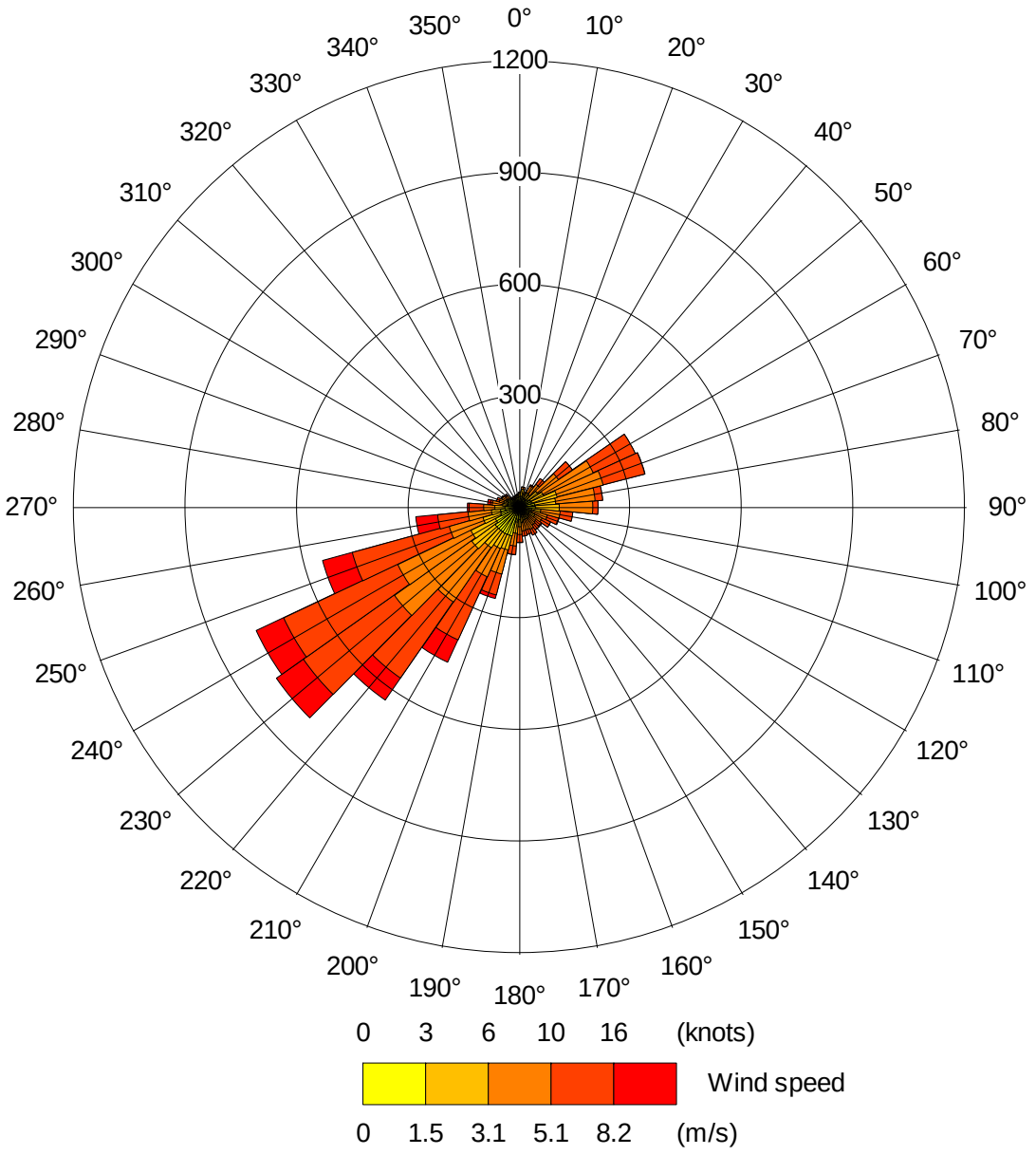

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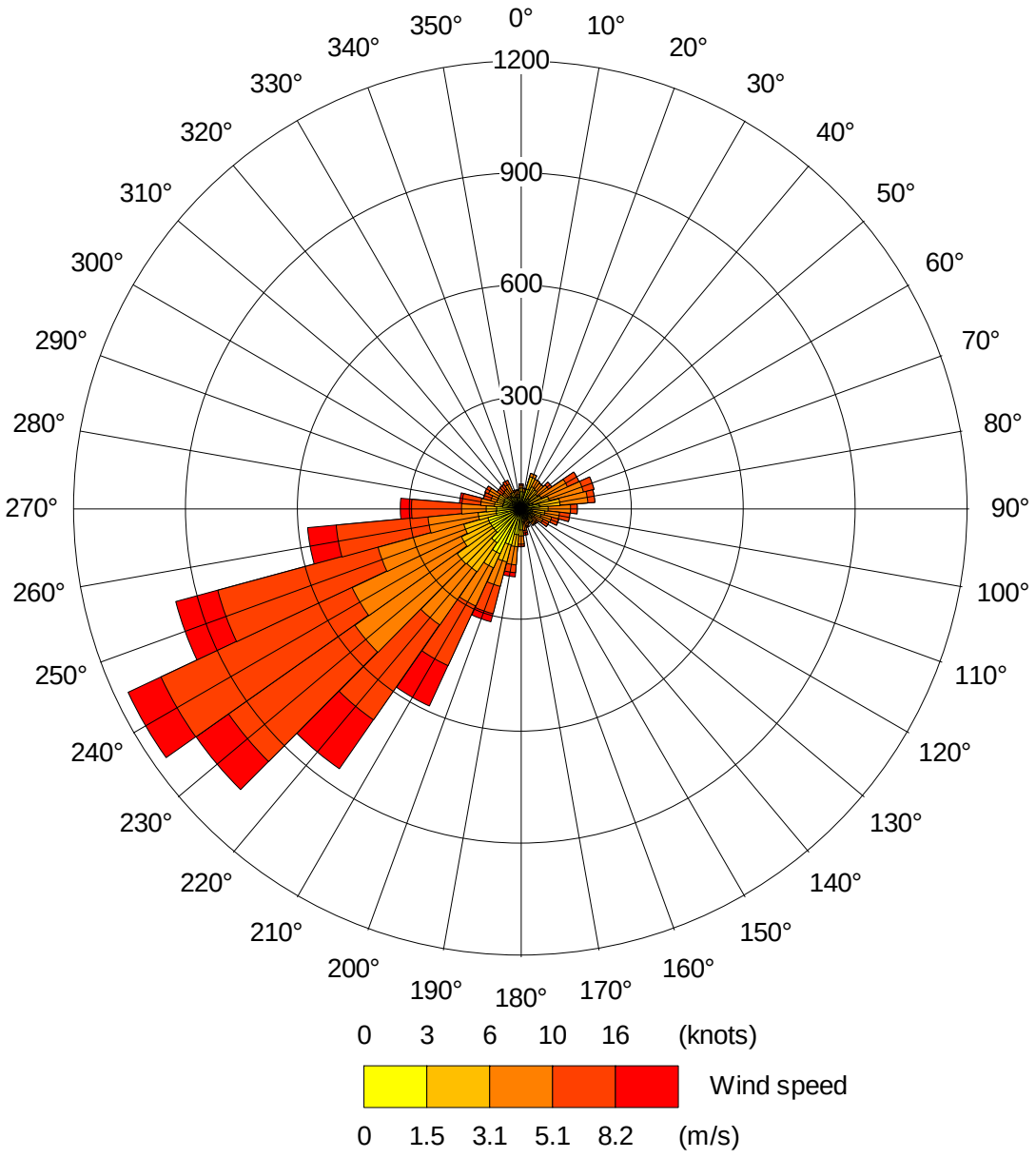

Appendix 4

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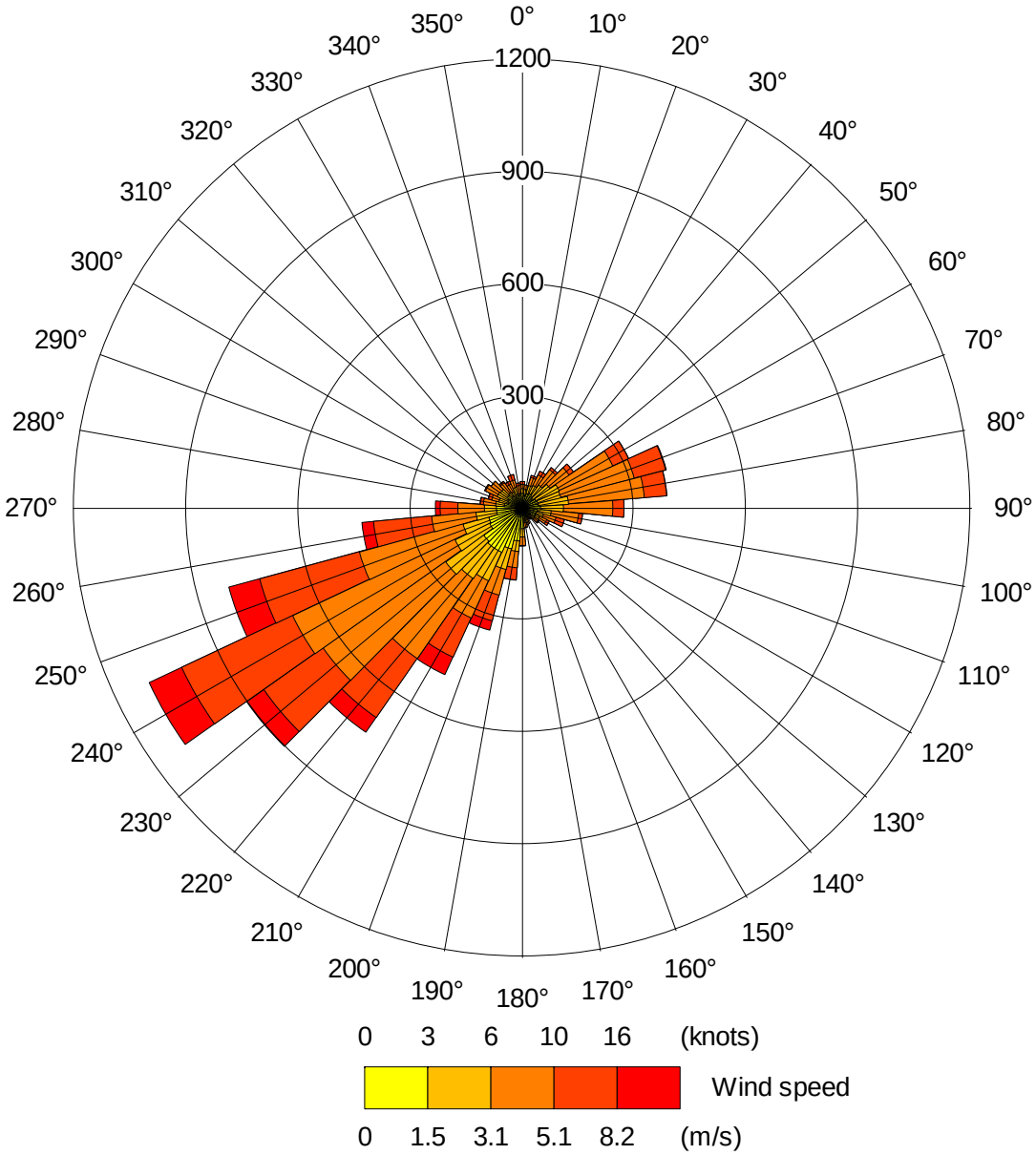

Met. Data

Appendix 4

The Airshed

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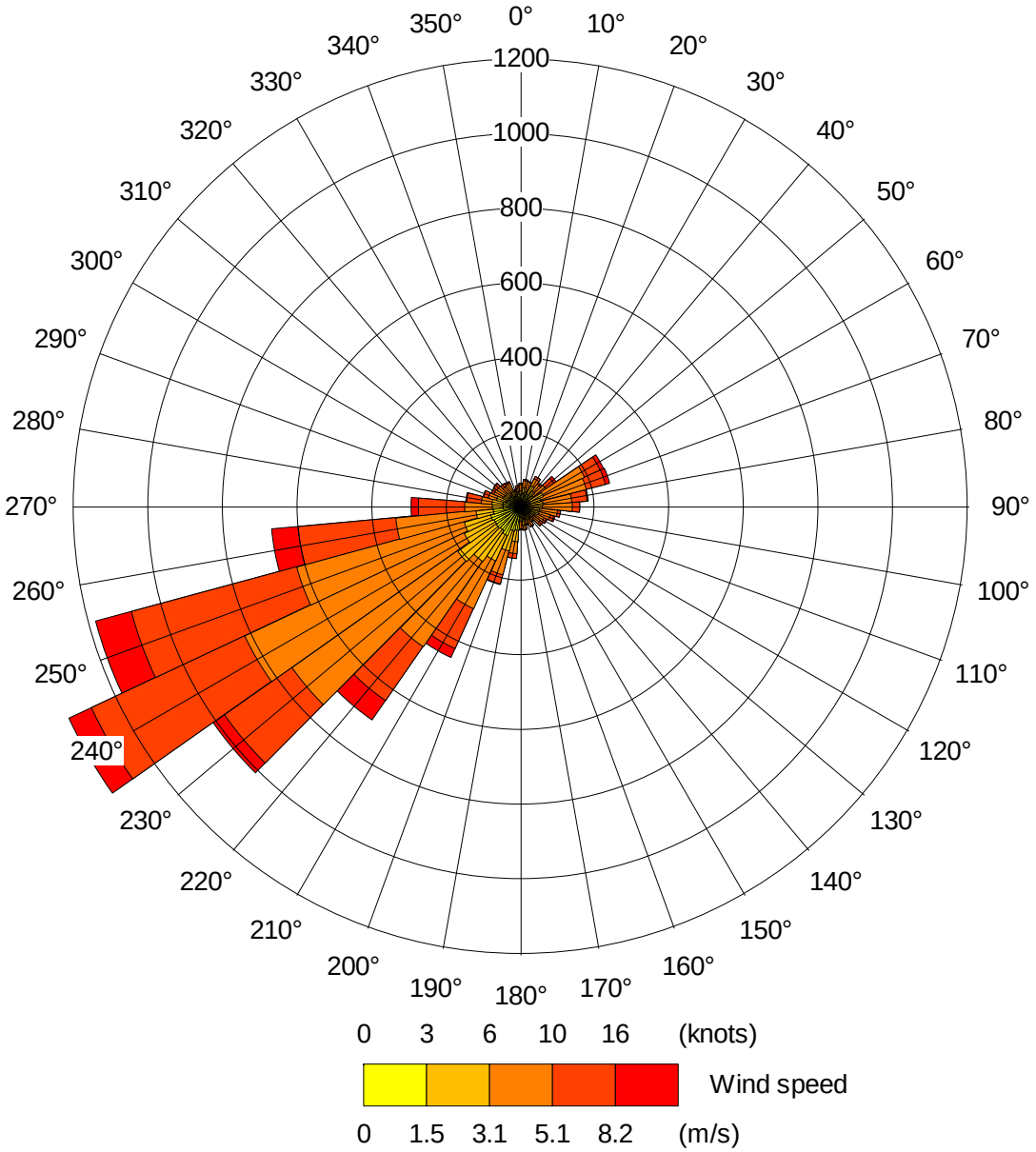

Met. Data

Appendix 4

No.	Link	Description	Baseline 2019	Baseline 2015	2016 1 hour flow	LDV	HGV
1	A71	west of B7031	12,430	11,684	487	434	53
2	A71	west of B7015	11,875	11,163	465	415	50
3	B7015	east of Camps	3,591	3,376	141	122	18
4	A71	west of B7030	15,064	14,161	590	529	61
5	A71	west of Dalmahoy	14,381	13,518	563	503	60
6	DALMAHOY ROAD	North of A71	1,983	1,864	78	67	11
7	MAIN STREET, RATHO	south of Baird Road	2,938	2,762	115	97	18
8	A71	east of Dalmahoy	16,124	15,157	632	566	66
9	CURRIEHILL ROAD	south of A71	2,531	2,379	99	89	10
10	A71 CALDER ROAD	weast of Curriehill Road	14,903	14,009	584	515	69
11	A71 CALDER ROAD	east of Riccarton Mains	26,286	24,709	1030	919	110
12	A71 CALDER ROAD	west of Wester Hailes	35,465	33,337	1389	1224	165
13	A71 CALDER ROAD	east of Wester Hailes	32,423	30,478	1270	1125	145
14	A71 CALDER ROAD	west of Saughton Road	30,768	28,922	1205	1058	147
15	A71 CALDER ROAD	east of Saughton Road	28,977	27,239	1135	995	140
16	HARVEST ROAD	North of M8	2,429	2,283	95	81	14
17	A720	North of A71				3529	165
18	A720	South of A71				2786	227
19	M8	M8 west of A720				2545	263
20	A720	north of M8				1554	52

flows on A720 and M8 from DoT figures for 2017 adjusted to year
all other flows are from AECOM TA 2019 adjusted to year

No.	Link	Description	Baseline 2019	Baseline 2016	2016 1 hour flow	LDV	HGV
1	A71	west of B7031	12,430	11,833	493	440	53
2	A71	west of B7015	11,875	11,305	471	421	50
3	B7015	east of Camps	3,591	3,419	142	124	18
4	A71	west of B7030	15,064	14,341	598	535	62
5	A71	west of Dalmahoy	14,381	13,690	570	510	61
6	DALMAHOY ROAD	North of A71	1,983	1,888	79	68	11
7	MAIN STREET, RATHO	south of Baird Road	2,938	2,797	117	99	18
8	A71	east of Dalmahoy	16,124	15,350	640	573	67
9	CURRIEHILL ROAD	south of A71	2,531	2,409	100	90	10
10	A71 CALDER ROAD	weast of Curriehill Road	14,903	14,188	591	521	70
11	A71 CALDER ROAD	east of Riccarton Mains	26,286	25,024	1043	931	112
12	A71 CALDER ROAD	west of Wester Hailes	35,465	33,762	1407	1239	167
13	A71 CALDER ROAD	east of Wester Hailes	32,423	30,867	1286	1140	147
14	A71 CALDER ROAD	west of Saughton Road	30,768	29,291	1220	1072	149
15	A71 CALDER ROAD	east of Saughton Road	28,977	27,586	1149	1008	142
16	HARVEST ROAD	North of M8	2,429	2,312	96	82	14
17	A720	North of A71	-	-	-	3565	167
18	A720	South of A71	-	-	-	2815	229
19	M8	M8 west of A720	-	-	-	2571	265
20	A720	north of M8	-	-	-	1569	53

flows on A720 and M8 from DoT figures for 2017 adjusted to year
all other flows are from AECOM TA 2019 adjusted to year

No.	Link	Description	Baseline 2030	2030 1 hour flow	LDV	HGV
1	A71	west of B7031	14,334	597	533	65
2	A71	west of B7015	13,697	571	510	61
3	B7015	east of Camps	4,136	172	150	22
4	A71	west of B7030	17,356	723	648	75
5	A71	west of Dalmahoy	16,571	690	617	74
6	DALMAHOY ROAD	North of A71	2,509	105	90	14
7	MAIN STREET, RATHO	south of Baird Road	3,594	150	127	23
8	A71	east of Dalmahoy	18,696	779	698	81
9	CURRIEHILL ROAD	south of A71	2,903	121	109	12
10	A71 CALDER ROAD	weast of Curriehill Road	17,296	721	636	85
11	A71 CALDER ROAD	east of Riccarton Mains	31,875	1328	1186	143
12	A71 CALDER ROAD	west of Wester Hailes	42,058	1752	1544	208
13	A71 CALDER ROAD	east of Wester Hailes	38,279	1595	1413	182
14	A71 CALDER ROAD	west of Saughton Road	36,294	1512	1328	185
15	A71 CALDER ROAD	east of Saughton Road	34,220	1426	1250	176
16	HARVEST ROAD	North of M8	2,973	124	105	19
17	A720	North of A71	-	-	4142	194
18	A720	South of A71	-	-	3270	266
19	M8	M8 west of A720	-	-	2986	308
20	A720	north of M8	-	-	1823	61

flows on A720 and M8 from DoT figures adjusted for 2030 (1% growth per year)
all other flows are from AECOM TA

No.	Link	Description	Scheme 2030	2030 1 hour flow	LDV	HGV
1	A71	west of B7031	14,934	622	558	65
2	A71	west of B7015	14,298	596	535	61
3	B7015	east of Camps	4,136	172	150	22
4	A71	west of B7030	17,956	748	673	75
5	A71	west of Dalmahoy	17,196	717	643	74
6	DALMAHOY ROAD	North of A71	5,956	248	234	14
7	MAIN STREET, RATHO	south of Baird Road	4,174	174	151	23
8	A71	east of Dalmahoy	21,518	897	816	81
9	CURRIEHILL ROAD	south of A71	3,060	127	115	12
10	A71 CALDER ROAD	weast of Curriehill Road	19,961	832	747	85
11	A71 CALDER ROAD	east of Riccarton Mains	34,540	1439	1297	143
12	A71 CALDER ROAD	west of Wester Hailes	43,884	1828	1620	208
13	A71 CALDER ROAD	east of Wester Hailes	39,896	1662	1481	182
14	A71 CALDER ROAD	west of Saughton Road	37,787	1574	1390	185
15	A71 CALDER ROAD	east of Saughton Road	35,680	1487	1311	176
16	HARVEST ROAD	North of M8	3,553	148	130	19
17	A720	North of A71	-	-	4142	194
18	A720	South of A71	-	-	3270	266
19	M8	M8 west of A720	-	-	2986	308
20	A720	north of M8	-	-	1823	61

flows on A720 and M8 from DoT figures adjusted for 2030 (1% growth per year)
all other flows are from AECOM TA

Visualisation of ADMS-Roads input
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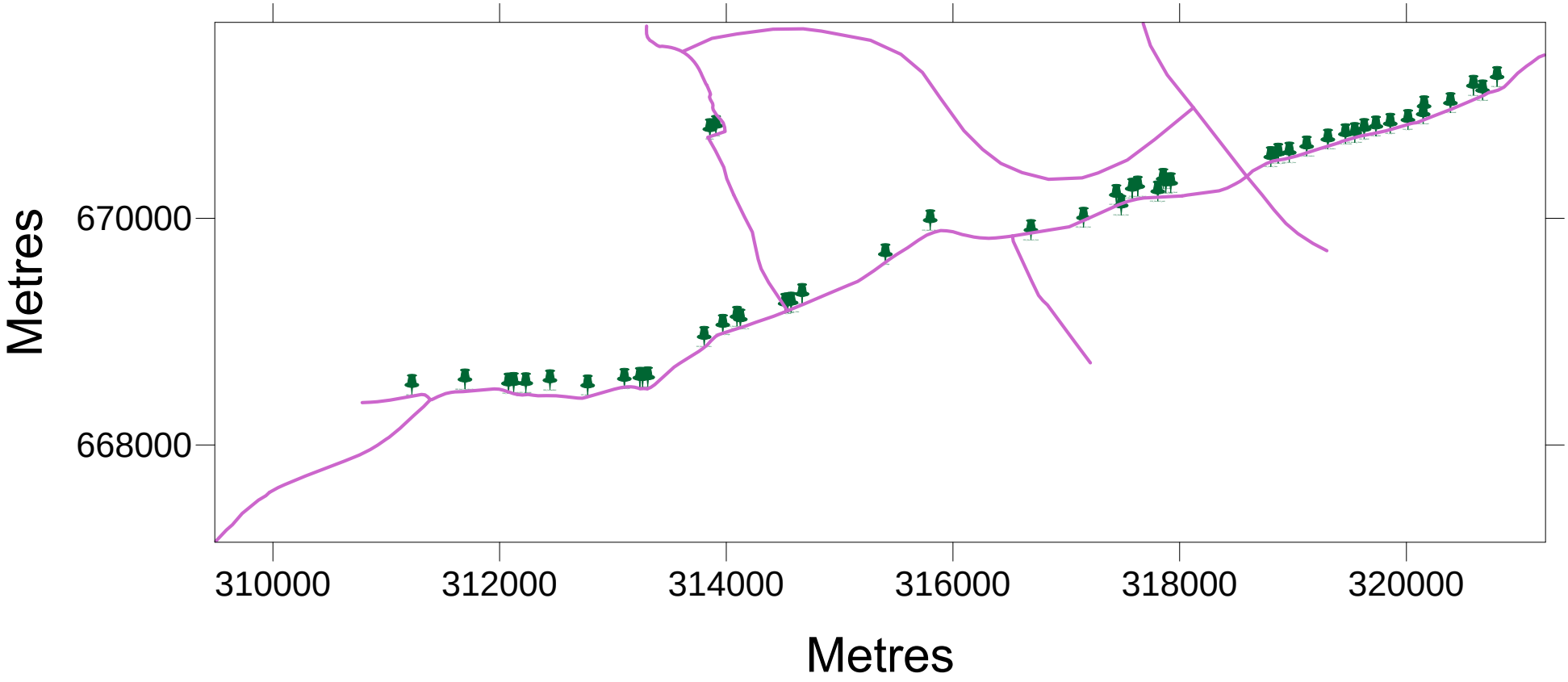


Appendix 4 – Model Outputs

Receptor n	X(m)	Y(m)	Z(m)	Conc | ug/m3 | NOx |<All sources>|-| 1hr	Conc | ug/m3 | PM10 |<All sources>|-| 24hrs	Conc | ug/m3 | PM10 |<All sources>|-| 1hr	Conc | ug/m3 | PM2.5 |<All sources>|-| 1hr	adjusted road NOx	adjusted NO2
DT4a	318894	670493	2.5	22.46	1.89	1.89	1.14	32.8	25.27

where surface roughness is assumed to be 1.0m

Receptor n	X(m)	Y(m)	Z(m)	Conc | ug/m3 | NOx |<All sources>|-| 1hr	Conc | ug/m3 | PM10 |<All sources>|-| 24hrs	Conc | ug/m3 | PM10 |<All sources>|-| 1hr	Conc | ug/m3 | PM2.5 |<All sources>|-| 1hr	adjusted road NOx	adjusted NO2
DT4a	318894	670493	2.5	26.20	2.25	2.25	1.34	38.2	27.65

where surface roughness is assumed to be 1.0m

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx |<All sources>|-| 1hr	Conc |ug/m3 |PM10 |<All sources>|-| 24hrs	Conc |ug/m3 |PM10 |<All sources>|-| 1hr	Conc |ug/m3 |PM2.5| <All sources>|-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	7.05	0.62	0.62	0.37	10.3
2	East Coxydene Farm	311695	668494	1.5	16.56	1.25	1.25	0.75	24.2
3	Wilkieston Village	312125	668463	1.5	25.73	1.93	1.93	1.16	37.5
4	Wilkieston Village	312080	668458	1.5	20.35	1.53	1.53	0.92	29.7
5	Wilkieston Village	312232	668461	1.5	17.74	1.33	1.33	0.80	25.9
6	Orchardfield	312445	668488	1.5	8.38	0.63	0.63	0.38	12.2
7	West Lodge	312778	668442	1.5	19.23	1.44	1.44	0.86	28.1
8	Burnwynd	313102	668500	1.5	22.76	1.71	1.71	1.02	33.2
9	Burnwynd	313238	668509	1.5	23.46	1.78	1.78	1.07	34.2
10	Burnwynd	313263	668506	1.5	27.14	2.06	2.06	1.24	39.6
11	Burnwynd	313308	668514	1.5	19.51	1.58	1.58	0.95	28.5
12	Bridgend Cottages	313806	668870	1.5	24.95	2.24	2.25	1.34	36.4
13	Hatton Bridge	313970	668976	1.5	19.41	1.75	1.75	1.04	28.3
14	Dalmahoy Road Ratho	313856	670702	1.5	10.86	0.74	0.74	0.45	15.8
15	Easter Hatton Mains	314095	669047	1.5	14.16	1.27	1.27	0.76	20.7
16	Easter Hatton Cottages	314125	669025	1.5	18.03	1.62	1.62	0.96	26.3
17	Main Street Ratho	313910	670732	1.5	12.72	0.78	0.79	0.48	18.6
18	Entry Level	314520	669163	1.5	17.75	1.59	1.59	0.95	25.9
19	Entry Level	314542	669167	1.5	14.80	1.32	1.32	0.79	21.6
20	Dalmahoy Gatehouse	314573	669172	1.5	11.98	1.07	1.07	0.64	17.5
21	House	314669	669248	1.5	22.71	2.04	2.05	1.22	33.1
22	Lodge	315404	669599	1.5	22.47	2.02	2.02	1.20	32.8
23	Addiston Mains	315800	669899	1.5	12.54	1.10	1.11	0.66	18.3
24	Research Park	316689	669813	1.5	8.64	0.74	0.74	0.44	12.6
25	Research Park	317152	669921	1.5	9.18	0.79	0.79	0.47	13.4
26	Research Park	317485	670029	1.5	7.94	0.68	0.68	0.41	11.6
27	Wester Row	317442	670122	1.5	26.45	2.33	2.34	1.39	38.6
28	Hermiston Steading	317581	670177	1.5	20.43	1.79	1.79	1.07	29.8
29	Hermiston Steading	317630	670196	1.5	17.30	1.51	1.51	0.90	25.2
30	Long Hermiston	317856	670263	1.5	11.18	0.97	0.97	0.58	16.3
31	Calder Road	317878	670224	1.5	14.97	1.32	1.32	0.79	21.8
32	Calder Road	317921	670226	1.5	15.15	1.33	1.34	0.80	22.1
33	Research Park	317807	670153	1.5	12.52	1.10	1.10	0.65	18.3
34	Calder View	318805	670456	1.5	27.74	2.40	2.40	1.43	40.5
35	Calder View	318870	670486	1.5	32.34	2.77	2.77	1.64	47.2
36	Calder View	318968	670496	1.5	24.37	2.09	2.09	1.24	35.5
37	Calder Gardens	319121	670549	1.5	28.17	2.39	2.39	1.42	41.1
38	Calder Gardens	319308	670611	1.5	30.14	2.55	2.55	1.51	44.0
39	St Nicholas Church	319463	670657	1.5	24.24	2.05	2.05	1.22	35.4
40	Bowling Green	319545	670668	1.5	18.01	1.53	1.53	0.91	26.3
41	Sighthill	319628	670703	1.5	23.74	2.01	2.01	1.19	34.6
42	Sighthill	319732	670726	1.5	24.10	2.04	2.04	1.21	35.2
43	Sighthill	319858	670750	1.5	20.50	1.73	1.73	1.03	29.9
44	Sighthill	320015	670783	1.5	15.76	1.33	1.33	0.79	23.0
45	Parkhead	320150	670834	1.5	20.63	1.73	1.73	1.03	30.1
46	West Drive	320157	670904	1.5	24.49	2.05	2.05	1.22	35.7
47	Parkhead	320390	670933	1.5	23.98	2.01	2.01	1.19	35.0
48	Parkhead	320674	671044	1.5	18.44	1.54	1.54	0.92	26.9
49	Fairbrae	320592	671085	1.5	21.77	1.82	1.82	1.08	31.8
50	Saughton	320801	671163	1.5	24.02	2.00	2.01	1.19	35.0
Max					32.34	2.77	2.77	1.64	47.17

model sensitivity analysis
met data variability
surface roughness = 0.3m

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx |<All sources>|-| 1hr	Conc |ug/m3 |PM10 |<All sources>|-| 24hrs	Conc |ug/m3 |PM10 |<All sources>|-| 1hr	Conc |ug/m3 |PM2.5| <All sources>|-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	8.60	0.75	0.75	0.45	12.5
2	East Coxydene Farm	311695	668494	1.5	19.61	1.52	1.48	0.89	28.6
3	Wilkieston Village	312125	668463	1.5	29.37	2.23	2.20	1.32	42.8
4	Wilkieston Village	312080	668458	1.5	20.45	1.42	1.54	0.92	29.8
5	Wilkieston Village	312232	668461	1.5	20.79	1.57	1.56	0.93	30.3
6	Orchardfield	312445	668488	1.5	10.03	0.77	0.76	0.45	14.6
7	West Lodge	312778	668442	1.5	22.58	1.69	1.69	1.01	32.9
8	Burnwynd	313102	668500	1.5	22.59	1.67	1.70	1.02	33.0
9	Burnwynd	313238	668509	1.5	26.70	2.05	2.02	1.21	38.9
10	Burnwynd	313263	668506	1.5	31.00	2.37	2.36	1.41	45.2
11	Burnwynd	313308	668514	1.5	22.15	1.81	1.81	1.08	32.3
12	Bridgend Cottages	313806	668870	1.5	28.81	2.57	2.60	1.54	42.0
13	Hatton Bridge	313970	668976	1.5	19.59	1.78	1.76	1.05	28.6
14	Dalmahoy Road Ratho	313856	670702	1.5	11.84	0.79	0.81	0.49	17.3
15	Easter Hatton Mains	314095	669047	1.5	16.73	1.52	1.50	0.89	24.4
16	Easter Hatton Cottages	314125	669025	1.5	18.03	1.64	1.62	0.96	26.3
17	Main Street Ratho	313910	670732	1.5	13.03	0.79	0.81	0.50	19.0
18	Entry Level	314520	669163	1.5	17.73	1.60	1.59	0.94	25.9
19	Entry Level	314542	669167	1.5	14.72	1.33	1.32	0.78	21.5
20	Dalmahoy Gatehouse	314573	669172	1.5	11.97	1.08	1.07	0.64	17.5
21	House	314669	669248	1.5	26.22	2.36	2.37	1.41	38.2
22	Lodge	315404	669599	1.5	22.81	2.08	2.05	1.22	33.3
23	Addiston Mains	315800	669899	1.5	14.98	1.33	1.33	0.79	21.8
24	Research Park	316689	669813	1.5	8.80	0.72	0.76	0.45	12.8
25	Research Park	317152	669921	1.5	9.10	0.76	0.78	0.47	13.3
26	Research Park	317485	670029	1.5	7.97	0.65	0.68	0.41	11.6
27	Wester Row	317442	670122	1.5	29.76	2.60	2.64	1.57	43.4
28	Hermiston Steading	317581	670177	1.5	23.08	2.03	2.04	1.21	33.7
29	Hermiston Steading	317630	670196	1.5	19.55	1.72	1.72	1.03	28.5
30	Long Hermiston	317856	670263	1.5	12.54	1.10	1.10	0.65	18.3
31	Calder Road	317878	670224	1.5	16.96	1.50	1.50	0.89	24.7
32	Calder Road	317921	670226	1.5	17.19	1.51	1.52	0.91	25.1
33	Research Park	317807	670153	1.5	12.69	1.07	1.12	0.67	18.5
34	Calder View	318805	670456	1.5	28.95	2.60	2.52	1.49	42.2
35	Calder View	318870	670486	1.5	33.23	2.90	2.85	1.69	48.5
36	Calder View	318968	670496	1.5	24.99	2.19	2.15	1.27	36.5
37	Calder Gardens	319121	670549	1.5	28.49	2.48	2.42	1.44	41.6
38	Calder Gardens	319308	670611	1.5	30.21	2.62	2.56	1.52	44.1
39	St Nicholas Church	319463	670657	1.5	24.43	2.13	2.07	1.23	35.6
40	Bowling Green	319545	670668	1.5	18.24	1.60	1.55	0.92	26.6
41	Sighthill	319628	670703	1.5	23.80	2.06	2.02	1.20	34.7
42	Sighthill	319732	670726	1.5	24.02	2.07	2.03	1.21	35.0
43	Sighthill	319858	670750	1.5	20.35	1.76	1.72	1.02	29.7
44	Sighthill	320015	670783	1.5	15.77	1.37	1.33	0.79	23.0
45	Parkhead	320150	670834	1.5	20.43	1.77	1.72	1.02	29.8
46	West Drive	320157	670904	1.5	29.19	2.51	2.45	1.45	42.6
47	Parkhead	320390	670933	1.5	23.73	2.05	1.99	1.18	34.6
48	Parkhead	320674	671044	1.5	18.21	1.60	1.52	0.91	26.6
49	Fairbrae	320592	671085	1.5	26.17	2.25	2.19	1.30	38.2
50	Saughton	320801	671163	1.5	28.51	2.44	2.38	1.41	41.6
Max					33.23	2.90	2.85	1.69	48.47

model sensitivity analysis
met data variability
surface roughness = 0.3m

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx |<All sources>|-| 1hr	Conc |ug/m3 |PM10 |<All sources>|-| 24hrs	Conc |ug/m3 |PM10 |<All sources>|-| 1hr	Conc |ug/m3 |PM2.5| <All sources>|-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	7.09	0.62	0.62	0.37	10.3
2	East Coxydene Farm	311695	668494	1.5	17.37	1.31	1.31	0.79	25.3
3	Wilkieston Village	312125	668463	1.5	27.32	2.05	2.05	1.23	39.8
4	Wilkieston Village	312080	668458	1.5	17.18	1.29	1.29	0.77	25.1
5	Wilkieston Village	312232	668461	1.5	18.62	1.39	1.39	0.84	27.2
6	Orchardfield	312445	668488	1.5	8.74	0.66	0.66	0.39	12.8
7	West Lodge	312778	668442	1.5	19.65	1.47	1.47	0.88	28.7
8	Burnwynd	313102	668500	1.5	20.35	1.53	1.53	0.92	29.7
9	Burnwynd	313238	668509	1.5	24.52	1.85	1.85	1.11	35.8
10	Burnwynd	313263	668506	1.5	28.30	2.14	2.14	1.28	41.3
11	Burnwynd	313308	668514	1.5	19.80	1.59	1.59	0.95	28.9
12	Bridgend Cottages	313806	668870	1.5	24.37	2.20	2.20	1.31	35.5
13	Hatton Bridge	313970	668976	1.5	18.18	1.63	1.64	0.97	26.5
14	Dalmahoy Road Ratho	313856	670702	1.5	10.63	0.73	0.73	0.44	15.5
15	Easter Hatton Mains	314095	669047	1.5	14.41	1.29	1.29	0.77	21.0
16	Easter Hatton Cottages	314125	669025	1.5	16.67	1.50	1.50	0.89	24.3
17	Main Street Ratho	313910	670732	1.5	11.76	0.73	0.73	0.45	17.2
18	Entry Level	314520	669163	1.5	16.45	1.47	1.47	0.88	24.0
19	Entry Level	314542	669167	1.5	13.66	1.22	1.22	0.73	19.9
20	Dalmahoy Gatehouse	314573	669172	1.5	11.06	0.99	0.99	0.59	16.1
21	House	314669	669248	1.5	22.82	2.06	2.06	1.22	33.3
22	Lodge	315404	669599	1.5	21.78	1.96	1.96	1.17	31.8
23	Addiston Mains	315800	669899	1.5	12.46	1.10	1.10	0.66	18.2
24	Research Park	316689	669813	1.5	7.58	0.65	0.65	0.39	11.1
25	Research Park	317152	669921	1.5	8.24	0.71	0.71	0.42	12.0
26	Research Park	317485	670029	1.5	7.13	0.61	0.61	0.36	10.4
27	Wester Row	317442	670122	1.5	26.00	2.30	2.30	1.37	37.9
28	Hermiston Steading	317581	670177	1.5	20.37	1.79	1.79	1.07	29.7
29	Hermiston Steading	317630	670196	1.5	17.26	1.51	1.51	0.90	25.2
30	Long Hermiston	317856	670263	1.5	10.85	0.94	0.94	0.56	15.8
31	Calder Road	317878	670224	1.5	14.86	1.31	1.31	0.78	21.7
32	Calder Road	317921	670226	1.5	14.97	1.32	1.32	0.79	21.8
33	Research Park	317807	670153	1.5	10.98	0.96	0.96	0.57	16.0
34	Calder View	318805	670456	1.5	26.90	2.34	2.34	1.39	39.2
35	Calder View	318870	670486	1.5	30.28	2.60	2.60	1.54	44.2
36	Calder View	318968	670496	1.5	22.86	1.96	1.97	1.17	33.4
37	Calder Gardens	319121	670549	1.5	26.34	2.24	2.24	1.33	38.4
38	Calder Gardens	319308	670611	1.5	28.03	2.37	2.37	1.41	40.9
39	St Nicholas Church	319463	670657	1.5	22.59	1.91	1.92	1.14	33.0
40	Bowling Green	319545	670668	1.5	16.71	1.42	1.42	0.84	24.4
41	Sighthill	319628	670703	1.5	21.68	1.83	1.84	1.09	31.6
42	Sighthill	319732	670726	1.5	21.92	1.85	1.85	1.10	32.0
43	Sighthill	319858	670750	1.5	18.77	1.59	1.59	0.94	27.4
44	Sighthill	320015	670783	1.5	14.50	1.22	1.22	0.73	21.2
45	Parkhead	320150	670834	1.5	19.11	1.60	1.60	0.95	27.9
46	West Drive	320157	670904	1.5	25.10	2.10	2.10	1.25	36.6
47	Parkhead	320390	670933	1.5	22.43	1.88	1.88	1.12	32.7
48	Parkhead	320674	671044	1.5	17.40	1.45	1.46	0.87	25.4
49	Fairbrae	320592	671085	1.5	22.32	1.87	1.87	1.11	32.6
50	Saughton	320801	671163	1.5	24.48	2.04	2.05	1.22	35.7
Max					30.28	2.60	2.60	1.54	44.18

model sensitivity analysis
met data variability
surface roughness = 0.3m

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx |<All sources>|-| 1hr	Conc |ug/m3 |PM10 |<All sources>|-| 24hrs	Conc |ug/m3 |PM10 |<All sources>|-| 1hr	Conc |ug/m3 |PM2.5| <All sources>|-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	8.33	0.73	0.73	0.44	12.1
2	East Coxydene Farm	311695	668494	1.5	19.56	1.48	1.48	0.89	28.5
3	Wilkieston Village	312125	668463	1.5	30.00	2.25	2.25	1.35	43.8
4	Wilkieston Village	312080	668458	1.5	21.75	1.63	1.63	0.98	31.7
5	Wilkieston Village	312232	668461	1.5	20.79	1.56	1.56	0.93	30.3
6	Orchardfield	312445	668488	1.5	10.09	0.76	0.76	0.46	14.7
7	West Lodge	312778	668442	1.5	22.26	1.66	1.66	1.00	32.5
8	Burnwynd	313102	668500	1.5	24.62	1.85	1.85	1.11	35.9
9	Burnwynd	313238	668509	1.5	27.09	2.05	2.05	1.23	39.5
10	Burnwynd	313263	668506	1.5	31.20	2.36	2.37	1.42	45.5
11	Burnwynd	313308	668514	1.5	22.26	1.80	1.80	1.08	32.5
12	Bridgend Cottages	313806	668870	1.5	28.12	2.54	2.54	1.51	41.0
13	Hatton Bridge	313970	668976	1.5	21.27	1.92	1.91	1.14	31.0
14	Dalmahoy Road Ratho	313856	670702	1.5	12.35	0.84	0.84	0.51	18.0
15	Easter Hatton Mains	314095	669047	1.5	16.36	1.47	1.47	0.87	23.9
16	Easter Hatton Cottages	314125	669025	1.5	19.66	1.77	1.77	1.05	28.7
17	Main Street Ratho	313910	670732	1.5	13.93	0.86	0.86	0.53	20.3
18	Entry Level	314520	669163	1.5	19.33	1.73	1.73	1.03	28.2
19	Entry Level	314542	669167	1.5	16.14	1.44	1.44	0.86	23.5
20	Dalmahoy Gatehouse	314573	669172	1.5	13.11	1.17	1.17	0.70	19.1
21	House	314669	669248	1.5	25.80	2.33	2.33	1.38	37.6
22	Lodge	315404	669599	1.5	24.70	2.22	2.22	1.32	36.0
23	Addiston Mains	315800	669899	1.5	14.56	1.29	1.29	0.77	21.2
24	Research Park	316689	669813	1.5	9.36	0.81	0.81	0.48	13.7
25	Research Park	317152	669921	1.5	10.05	0.86	0.86	0.52	14.7
26	Research Park	317485	670029	1.5	8.85	0.75	0.75	0.45	12.9
27	Wester Row	317442	670122	1.5	30.07	2.65	2.65	1.58	43.9
28	Hermiston Steading	317581	670177	1.5	23.53	2.07	2.07	1.23	34.3
29	Hermiston Steading	317630	670196	1.5	20.11	1.76	1.76	1.05	29.3
30	Long Hermiston	317856	670263	1.5	13.18	1.14	1.14	0.68	19.2
31	Calder Road	317878	670224	1.5	17.49	1.54	1.54	0.92	25.5
32	Calder Road	317921	670226	1.5	17.62	1.55	1.55	0.93	25.7
33	Research Park	317807	670153	1.5	13.83	1.21	1.21	0.72	20.2
34	Calder View	318805	670456	1.5	32.11	2.79	2.79	1.66	46.8
35	Calder View	318870	670486	1.5	36.71	3.15	3.15	1.87	53.5
36	Calder View	318968	670496	1.5	27.88	2.39	2.39	1.42	40.7
37	Calder Gardens	319121	670549	1.5	31.83	2.71	2.71	1.61	46.4
38	Calder Gardens	319308	670611	1.5	33.77	2.86	2.86	1.70	49.3
39	St Nicholas Church	319463	670657	1.5	27.22	2.31	2.31	1.37	39.7
40	Bowling Green	319545	670668	1.5	20.39	1.73	1.73	1.03	29.7
41	Sighthill	319628	670703	1.5	26.46	2.24	2.24	1.33	38.6
42	Sighthill	319732	670726	1.5	26.82	2.27	2.27	1.35	39.1
43	Sighthill	319858	670750	1.5	22.89	1.94	1.94	1.15	33.4
44	Sighthill	320015	670783	1.5	17.70	1.49	1.49	0.89	25.8
45	Parkhead	320150	670834	1.5	23.00	1.93	1.93	1.15	33.6
46	West Drive	320157	670904	1.5	28.99	2.43	2.43	1.44	42.3
47	Parkhead	320390	670933	1.5	26.70	2.24	2.24	1.33	38.9
48	Parkhead	320674	671044	1.5	20.67	1.73	1.73	1.03	30.1
49	Fairbrae	320592	671085	1.5	25.92	2.17	2.17	1.29	37.8
50	Saughton	320801	671163	1.5	28.34	2.37	2.37	1.41	41.3
Max					36.71	3.15	3.15	1.87	53.55

model sensitivity analysis
met data variability
surface roughness = 0.3m

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx |<All sources>|-| 1hr	Conc |ug/m3 |PM10 |<All sources>|-| 24hrs	Conc |ug/m3 |PM10 |<All sources>|-| 1hr	Conc |ug/m3 |PM2.5| <All sources>|-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	6.84	0.61	0.61	0.36	10.0
2	East Coxydene Farm	311695	668494	1.5	17.63	1.33	1.33	0.80	25.7
3	Wilkieston Village	312125	668463	1.5	28.07	2.10	2.10	1.26	40.9
4	Wilkieston Village	312080	668458	1.5	15.43	1.16	1.16	0.70	22.5
5	Wilkieston Village	312232	668461	1.5	18.87	1.41	1.41	0.85	27.5
6	Orchardfield	312445	668488	1.5	8.88	0.67	0.67	0.40	12.9
7	West Lodge	312778	668442	1.5	19.45	1.45	1.45	0.87	28.4
8	Burnwynd	313102	668500	1.5	19.51	1.46	1.46	0.88	28.5
9	Burnwynd	313238	668509	1.5	25.02	1.88	1.88	1.13	36.5
10	Burnwynd	313263	668506	1.5	28.70	2.16	2.16	1.30	41.9
11	Burnwynd	313308	668514	1.5	20.05	1.60	1.59	0.95	29.2
12	Bridgend Cottages	313806	668870	1.5	23.66	2.14	2.13	1.27	34.5
13	Hatton Bridge	313970	668976	1.5	18.03	1.63	1.62	0.97	26.3
14	Dalmahoy Road Ratho	313856	670702	1.5	10.06	0.69	0.69	0.42	14.7
15	Easter Hatton Mains	314095	669047	1.5	14.17	1.28	1.27	0.76	20.7
16	Easter Hatton Cottages	314125	669025	1.5	16.41	1.48	1.48	0.88	23.9
17	Main Street Ratho	313910	670732	1.5	11.15	0.69	0.68	0.42	16.3
18	Entry Level	314520	669163	1.5	16.16	1.45	1.45	0.86	23.6
19	Entry Level	314542	669167	1.5	13.28	1.19	1.19	0.71	19.4
20	Dalmahoy Gatehouse	314573	669172	1.5	10.73	0.96	0.96	0.57	15.6
21	House	314669	669248	1.5	22.52	2.04	2.03	1.21	32.8
22	Lodge	315404	669599	1.5	22.03	1.99	1.99	1.18	32.1
23	Addiston Mains	315800	669899	1.5	11.89	1.06	1.06	0.63	17.3
24	Research Park	316689	669813	1.5	6.71	0.58	0.58	0.35	9.8
25	Research Park	317152	669921	1.5	7.61	0.66	0.65	0.39	11.1
26	Research Park	317485	670029	1.5	6.61	0.56	0.56	0.34	9.6
27	Wester Row	317442	670122	1.5	25.52	2.26	2.26	1.35	37.2
28	Hermiston Steading	317581	670177	1.5	20.11	1.77	1.77	1.06	29.3
29	Hermiston Steading	317630	670196	1.5	17.04	1.49	1.49	0.89	24.9
30	Long Hermiston	317856	670263	1.5	10.63	0.92	0.92	0.55	15.5
31	Calder Road	317878	670224	1.5	14.64	1.29	1.29	0.77	21.4
32	Calder Road	317921	670226	1.5	14.70	1.30	1.29	0.77	21.4
33	Research Park	317807	670153	1.5	10.19	0.89	0.89	0.53	14.9
34	Calder View	318805	670456	1.5	27.63	2.41	2.41	1.43	40.3
35	Calder View	318870	670486	1.5	30.45	2.63	2.62	1.56	44.4
36	Calder View	318968	670496	1.5	22.91	1.98	1.97	1.17	33.4
37	Calder Gardens	319121	670549	1.5	26.49	2.26	2.26	1.34	38.6
38	Calder Gardens	319308	670611	1.5	28.09	2.38	2.38	1.41	41.0
39	St Nicholas Church	319463	670657	1.5	22.85	1.94	1.94	1.15	33.3
40	Bowling Green	319545	670668	1.5	16.81	1.43	1.43	0.85	24.5
41	Sighthill	319628	670703	1.5	21.55	1.83	1.83	1.08	31.4
42	Sighthill	319732	670726	1.5	21.65	1.84	1.83	1.09	31.6
43	Sighthill	319858	670750	1.5	18.62	1.58	1.58	0.94	27.2
44	Sighthill	320015	670783	1.5	14.47	1.23	1.22	0.73	21.1
45	Parkhead	320150	670834	1.5	19.23	1.62	1.62	0.96	28.0
46	West Drive	320157	670904	1.5	25.42	2.13	2.13	1.27	37.1
47	Parkhead	320390	670933	1.5	22.66	1.90	1.90	1.13	33.0
48	Parkhead	320674	671044	1.5	17.80	1.49	1.49	0.89	26.0
49	Fairbrae	320592	671085	1.5	22.50	1.88	1.88	1.12	32.8
50	Saughton	320801	671163	1.5	24.91	2.08	2.08	1.24	36.3
Max					30.45	2.63	2.62	1.56	44.41

model sensitivity analysis
met data variability
surface roughness = 0.3m

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx|<All sources>|-| 1hr	Conc |ug/m3 |PM10|<All sources>|-| 24hrs	Conc |ug/m3 |PM10|<All sources>|-| 1hr	Conc |ug/m3 |PM2.5|<All sources>|-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	8.33	0.73	0.73	0.44	12.1
2	East Coxydene Farm	311695	668494	1.5	19.56	1.48	1.48	0.89	28.5
3	Wilkieston Village	312125	668463	1.5	30.00	2.25	2.25	1.35	43.8
4	Wilkieston Village	312080	668458	1.5	21.75	1.63	1.63	0.98	31.7
5	Wilkieston Village	312232	668461	1.5	20.79	1.56	1.56	0.93	30.3
6	Orchardfield	312445	668488	1.5	10.09	0.76	0.76	0.46	14.7
7	West Lodge	312778	668442	1.5	22.26	1.66	1.66	1.00	32.5
8	Burnwynd	313102	668500	1.5	24.62	1.85	1.85	1.11	35.9
9	Burnwynd	313238	668509	1.5	27.09	2.05	2.05	1.23	39.5
10	Burnwynd	313263	668506	1.5	31.20	2.36	2.37	1.42	45.5
11	Burnwynd	313308	668514	1.5	22.26	1.80	1.80	1.08	32.5
12	Bridgend Cottages	313806	668870	1.5	28.12	2.54	2.54	1.51	41.0
13	Hatton Bridge	313970	668976	1.5	21.27	1.92	1.91	1.14	31.0
14	Dalmahoy Road Ratho	313856	670702	1.5	12.35	0.84	0.84	0.51	18.0
15	Easter Hatton Mains	314095	669047	1.5	16.36	1.47	1.47	0.87	23.9
16	Easter Hatton Cottages	314125	669025	1.5	19.66	1.77	1.77	1.05	28.7
17	Main Street Ratho	313910	670732	1.5	13.93	0.86	0.86	0.53	20.3
18	Entry Level	314520	669163	1.5	19.33	1.73	1.73	1.03	28.2
19	Entry Level	314542	669167	1.5	16.14	1.44	1.44	0.86	23.5
20	Dalmahoy Gatehouse	314573	669172	1.5	13.11	1.17	1.17	0.70	19.1
21	House	314669	669248	1.5	25.80	2.33	2.33	1.38	37.6
22	Lodge	315404	669599	1.5	24.70	2.22	2.22	1.32	36.0
23	Addiston Mains	315800	669899	1.5	14.56	1.29	1.29	0.77	21.2
24	Research Park	316689	669813	1.5	9.36	0.81	0.81	0.48	13.7
25	Research Park	317152	669921	1.5	10.05	0.86	0.86	0.52	14.7
26	Research Park	317485	670029	1.5	8.85	0.75	0.75	0.45	12.9
27	Wester Row	317442	670122	1.5	30.07	2.65	2.65	1.58	43.9
28	Hermiston Steading	317581	670177	1.5	23.53	2.07	2.07	1.23	34.3
29	Hermiston Steading	317630	670196	1.5	20.11	1.76	1.76	1.05	29.3
30	Long Hermiston	317856	670263	1.5	13.18	1.14	1.14	0.68	19.2
31	Calder Road	317878	670224	1.5	17.49	1.54	1.54	0.92	25.5
32	Calder Road	317921	670226	1.5	17.62	1.55	1.55	0.93	25.7
33	Research Park	317807	670153	1.5	13.83	1.21	1.21	0.72	20.2
34	Calder View	318805	670456	1.5	32.11	2.79	2.79	1.66	46.8
35	Calder View	318870	670486	1.5	36.71	3.15	3.15	1.87	53.5
36	Calder View	318968	670496	1.5	27.88	2.39	2.39	1.42	40.7
37	Calder Gardens	319121	670549	1.5	31.83	2.71	2.71	1.61	46.4
38	Calder Gardens	319308	670611	1.5	33.77	2.86	2.86	1.70	49.3
39	St Nicholas Church	319463	670657	1.5	27.22	2.31	2.31	1.37	39.7
40	Bowling Green	319545	670668	1.5	20.39	1.73	1.73	1.03	29.7
41	Sighthill	319628	670703	1.5	26.46	2.24	2.24	1.33	38.6
42	Sighthill	319732	670726	1.5	26.82	2.27	2.27	1.35	39.1
43	Sighthill	319858	670750	1.5	22.89	1.94	1.94	1.15	33.4
44	Sighthill	320015	670783	1.5	17.70	1.49	1.49	0.89	25.8
45	Parkhead	320150	670834	1.5	23.00	1.93	1.93	1.15	33.6
46	West Drive	320157	670904	1.5	28.99	2.43	2.43	1.44	42.3
47	Parkhead	320390	670933	1.5	26.70	2.24	2.24	1.33	38.9
48	Parkhead	320674	671044	1.5	20.67	1.73	1.73	1.03	30.1
49	Fairbrae	320592	671085	1.5	25.92	2.17	2.17	1.29	37.8
50	Saughton	320801	671163	1.5	28.34	2.37	2.37	1.41	41.3
Max					36.71	3.15	3.15	1.87	53.55

model sensitivity analysis
surface roughness
met data Gogar 2016

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc | ug/m3 |NOx |<All sources> |-| 1hr	Conc | ug/m3 |PM10 |<All sources> |-| 24hrs	Conc | ug/m3 |PM10 |<All sources> |-| 1hr	Conc | ug/m3 |PM2.5| <All sources> |-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	8.22	0.72	0.72	0.43	12.0
2	East Coxydene Farm	311695	668494	1.5	19.24	1.45	1.45	0.87	28.1
3	Wilkieston Village	312125	668463	1.5	30.85	2.31	2.31	1.39	45.0
4	Wilkieston Village	312080	668458	1.5	22.17	1.67	1.66	1.00	32.3
5	Wilkieston Village	312232	668461	1.5	20.72	1.55	1.55	0.93	30.2
6	Orchardfield	312445	668488	1.5	9.77	0.74	0.74	0.44	14.3
7	West Lodge	312778	668442	1.5	22.10	1.65	1.65	0.99	32.2
8	Burnwynd	313102	668500	1.5	25.12	1.88	1.88	1.13	36.6
9	Burnwynd	313238	668509	1.5	27.40	2.07	2.07	1.24	40.0
10	Burnwynd	313263	668506	1.5	31.85	2.41	2.41	1.45	46.5
11	Burnwynd	313308	668514	1.5	22.00	1.79	1.79	1.07	32.1
12	Bridgend Cottages	313806	668870	1.5	28.41	2.56	2.56	1.52	41.4
13	Hatton Bridge	313970	668976	1.5	21.45	1.93	1.93	1.15	31.3
14	Dalmahoy Road Ratho	313856	670702	1.5	12.66	0.86	0.86	0.53	18.5
15	Easter Hatton Mains	314095	669047	1.5	16.07	1.44	1.44	0.86	23.4
16	Easter Hatton Cottages	314125	669025	1.5	19.86	1.79	1.79	1.06	29.0
17	Main Street Ratho	313910	670732	1.5	14.25	0.88	0.88	0.54	20.8
18	Entry Level	314520	669163	1.5	19.42	1.74	1.74	1.04	28.3
19	Entry Level	314542	669167	1.5	16.10	1.44	1.44	0.86	23.5
20	Dalmahoy Gatehouse	314573	669172	1.5	13.02	1.16	1.16	0.69	19.0
21	House	314669	669248	1.5	25.70	2.32	2.32	1.38	37.5
22	Lodge	315404	669599	1.5	24.80	2.23	2.23	1.33	36.2
23	Addiston Mains	315800	669899	1.5	14.22	1.26	1.26	0.75	20.7
24	Research Park	316689	669813	1.5	9.11	0.79	0.79	0.47	13.3
25	Research Park	317152	669921	1.5	9.83	0.84	0.84	0.51	14.3
26	Research Park	317485	670029	1.5	8.59	0.73	0.73	0.44	12.5
27	Wester Row	317442	670122	1.5	29.89	2.64	2.64	1.57	43.6
28	Hermiston Steading	317581	670177	1.5	23.15	2.03	2.03	1.21	33.8
29	Hermiston Steading	317630	670196	1.5	19.66	1.72	1.72	1.03	28.7
30	Long Hermiston	317856	670263	1.5	12.73	1.10	1.10	0.66	18.6
31	Calder Road	317878	670224	1.5	16.99	1.49	1.49	0.89	24.8
32	Calder Road	317921	670226	1.5	17.10	1.51	1.51	0.90	25.0
33	Research Park	317807	670153	1.5	13.48	1.18	1.18	0.70	19.7
34	Calder View	318805	670456	1.5	31.23	2.71	2.71	1.61	45.6
35	Calder View	318870	670486	1.5	35.99	3.09	3.09	1.83	52.5
36	Calder View	318968	670496	1.5	27.25	2.34	2.34	1.39	39.8
37	Calder Gardens	319121	670549	1.5	31.32	2.66	2.66	1.58	45.7
38	Calder Gardens	319308	670611	1.5	33.40	2.83	2.83	1.68	48.7
39	St Nicholas Church	319463	670657	1.5	26.68	2.26	2.26	1.34	38.9
40	Bowling Green	319545	670668	1.5	19.84	1.69	1.69	1.00	28.9
41	Sighthill	319628	670703	1.5	25.99	2.20	2.20	1.31	37.9
42	Sighthill	319732	670726	1.5	26.42	2.23	2.23	1.33	38.5
43	Sighthill	319858	670750	1.5	22.49	1.90	1.90	1.13	32.8
44	Sighthill	320015	670783	1.5	17.26	1.46	1.46	0.87	25.2
45	Parkhead	320150	670834	1.5	22.68	1.90	1.90	1.13	33.1
46	West Drive	320157	670904	1.5	28.23	2.37	2.37	1.41	41.2
47	Parkhead	320390	670933	1.5	26.39	2.21	2.21	1.31	38.5
48	Parkhead	320674	671044	1.5	20.30	1.70	1.70	1.01	29.6
49	Fairbrae	320592	671085	1.5	25.20	2.11	2.11	1.25	36.8
50	Saughton	320801	671163	1.5	27.52	2.30	2.30	1.37	40.1
Max					35.99	3.09	3.09	1.83	52.50

model sensitivity analysis
surface roughness
met data Gogar 2016

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx|<All sources>|-| 1hr	Conc |ug/m3 |PM10|<All sources>|-| 24hrs	Conc |ug/m3 |PM10|<All sources>|-| 1hr	Conc |ug/m3 |PM2.5|<All sources>|-| 1hr	adjusted road NOx
1	Coxydene	311227	668446	1.5	7.49E+00	6.59E-01	6.59E-01	3.92E-01	10.9
2	East Coxydene Farm	311695	668494	1.5	1.75E+01	1.32E+00	1.32E+00	7.94E-01	25.6
3	Wilkieston Village	312125	668463	1.5	2.88E+01	2.16E+00	2.16E+00	1.29E+00	42.0
4	Wilkieston Village	312080	668458	1.5	2.06E+01	1.54E+00	1.54E+00	9.25E-01	30.0
5	Wilkieston Village	312232	668461	1.5	1.90E+01	1.42E+00	1.42E+00	8.52E-01	27.7
6	Orchardfield	312445	668488	1.5	8.89E+00	6.69E-01	6.69E-01	4.02E-01	13.0
7	West Lodge	312778	668442	1.5	2.02E+01	1.51E+00	1.51E+00	9.07E-01	29.5
8	Burnwynd	313102	668500	1.5	2.33E+01	1.75E+00	1.75E+00	1.05E+00	34.0
9	Burnwynd	313238	668509	1.5	2.53E+01	1.91E+00	1.91E+00	1.14E+00	36.9
10	Burnwynd	313263	668506	1.5	2.96E+01	2.24E+00	2.24E+00	1.34E+00	43.2
11	Burnwynd	313308	668514	1.5	2.00E+01	1.63E+00	1.63E+00	9.75E-01	29.2
12	Bridgend Cottages	313806	668870	1.5	2.64E+01	2.38E+00	2.38E+00	1.41E+00	38.5
13	Hatton Bridge	313970	668976	1.5	1.98E+01	1.78E+00	1.78E+00	1.06E+00	28.8
14	Dalmahoy Road Ratho	313856	670702	1.5	1.17E+01	7.99E-01	8.00E-01	4.86E-01	17.1
15	Easter Hatton Mains	314095	669047	1.5	1.46E+01	1.31E+00	1.31E+00	7.82E-01	21.3
16	Easter Hatton Cottages	314125	669025	1.5	1.83E+01	1.65E+00	1.65E+00	9.81E-01	26.7
17	Main Street Ratho	313910	670732	1.5	1.32E+01	8.12E-01	8.12E-01	4.99E-01	19.3
18	Entry Level	314520	669163	1.5	1.79E+01	1.60E+00	1.60E+00	9.54E-01	26.1
19	Entry Level	314542	669167	1.5	1.48E+01	1.32E+00	1.32E+00	7.87E-01	21.6
20	Dalmahoy Gatehouse	314573	669172	1.5	1.20E+01	1.07E+00	1.07E+00	6.36E-01	17.5
21	House	314669	669248	1.5	2.36E+01	2.13E+00	2.13E+00	1.26E+00	34.4
22	Lodge	315404	669599	1.5	2.28E+01	2.05E+00	2.05E+00	1.22E+00	33.3
23	Addiston Mains	315800	669899	1.5	1.30E+01	1.15E+00	1.15E+00	6.86E-01	18.9
24	Research Park	316689	669813	1.5	8.33E+00	7.18E-01	7.18E-01	4.30E-01	12.2
25	Research Park	317152	669921	1.5	9.03E+00	7.75E-01	7.75E-01	4.64E-01	13.2
26	Research Park	317485	670029	1.5	7.82E+00	6.66E-01	6.66E-01	3.99E-01	11.4
27	Wester Row	317442	670122	1.5	2.74E+01	2.42E+00	2.42E+00	1.44E+00	40.0
28	Hermiston Steading	317581	670177	1.5	2.11E+01	1.86E+00	1.86E+00	1.11E+00	30.8
29	Hermiston Steading	317630	670196	1.5	1.80E+01	1.57E+00	1.57E+00	9.36E-01	26.2
30	Long Hermiston	317856	670263	1.5	1.16E+01	1.00E+00	1.00E+00	5.98E-01	16.9
31	Calder Road	317878	670224	1.5	1.55E+01	1.36E+00	1.36E+00	8.11E-01	22.6
32	Calder Road	317921	670226	1.5	1.56E+01	1.37E+00	1.37E+00	8.17E-01	22.7
33	Research Park	317807	670153	1.5	1.23E+01	1.07E+00	1.07E+00	6.41E-01	17.9
34	Calder View	318805	670456	1.5	2.86E+01	2.48E+00	2.48E+00	1.47E+00	41.7
35	Calder View	318870	670486	1.5	3.29E+01	2.82E+00	2.82E+00	1.68E+00	48.0
36	Calder View	318968	670496	1.5	2.50E+01	2.15E+00	2.15E+00	1.27E+00	36.5
37	Calder Gardens	319121	670549	1.5	2.87E+01	2.44E+00	2.44E+00	1.45E+00	41.9
38	Calder Gardens	319308	670611	1.5	3.06E+01	2.59E+00	2.59E+00	1.54E+00	44.6
39	St Nicholas Church	319463	670657	1.5	2.44E+01	2.07E+00	2.07E+00	1.23E+00	35.6
40	Bowling Green	319545	670668	1.5	1.81E+01	1.54E+00	1.54E+00	9.13E-01	26.4
41	Sighthill	319628	670703	1.5	2.37E+01	2.01E+00	2.01E+00	1.19E+00	34.6
42	Sighthill	319732	670726	1.5	2.42E+01	2.04E+00	2.04E+00	1.21E+00	35.2
43	Sighthill	319858	670750	1.5	2.06E+01	1.74E+00	1.74E+00	1.03E+00	30.1
44	Sighthill	320015	670783	1.5	1.58E+01	1.33E+00	1.33E+00	7.92E-01	23.0
45	Parkhead	320150	670834	1.5	2.08E+01	1.75E+00	1.75E+00	1.04E+00	30.4
46	West Drive	320157	670904	1.5	2.57E+01	2.15E+00	2.15E+00	1.28E+00	37.5
47	Parkhead	320390	670933	1.5	2.42E+01	2.03E+00	2.03E+00	1.20E+00	35.3
48	Parkhead	320674	671044	1.5	1.86E+01	1.56E+00	1.56E+00	9.26E-01	27.2
49	Fairbrae	320592	671085	1.5	2.30E+01	1.92E+00	1.92E+00	1.14E+00	33.5
50	Saughton	320801	671163	1.5	2.50E+01	2.09E+00	2.09E+00	1.24E+00	36.4
Max					32.91	2.82	2.82	1.68	48.01

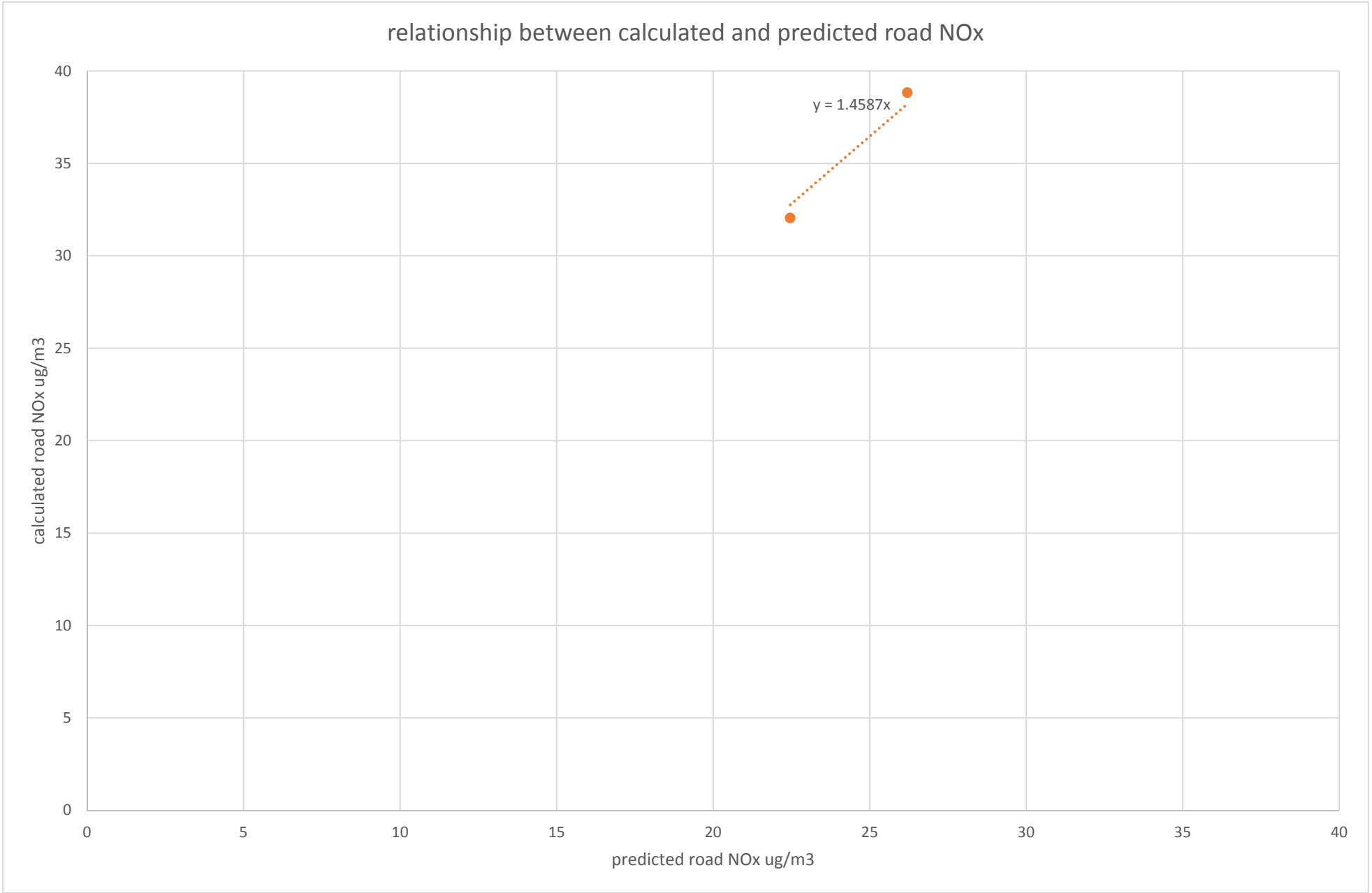
model sensitivity analysis
surface roughness
met data Gogar 2016

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx|<All sources>|-| 1hr	Conc|ug/m3 |PM10|<All sources>|-| 24hrs	Conc|ug/m3 |PM10|<All sources>|-| 1hr	Conc|ug/m3 |PM2.5|<All sources>|-| 1hr	adjusted road NOx	adjusted NO2
1	Coxydene	311227	668446	1.5	8.22	0.72	0.72	0.43	12.0	14.82
2	East Coxydene Farm	311695	668494	1.5	19.24	1.45	1.45	0.87	28.1	22.88
3	Wilkieston Village	312125	668463	1.5	30.85	2.31	2.31	1.39	45.0	30.73
4	Wilkieston Village	312080	668458	1.5	22.17	1.67	1.66	1.00	32.3	24.92
5	Wilkieston Village	312232	668461	1.5	20.72	1.55	1.55	0.93	30.2	23.91
6	Orchardfield	312445	668488	1.5	9.77	0.74	0.74	0.44	14.3	15.99
7	West Lodge	312778	668442	1.5	22.10	1.65	1.65	0.99	32.2	24.87
8	Burnwynd	313102	668500	1.5	25.12	1.88	1.88	1.13	36.6	26.93
9	Burnwynd	313238	668509	1.5	27.40	2.07	2.07	1.24	40.0	28.46
10	Burnwynd	313263	668506	1.5	31.85	2.41	2.41	1.45	46.5	31.38
11	Burnwynd	313308	668514	1.5	22.00	1.79	1.79	1.07	32.1	24.8
12	Bridgend Cottages	313806	668870	1.5	28.41	2.56	2.56	1.52	41.4	29.13
13	Hatton Bridge	313970	668976	1.5	21.45	1.93	1.93	1.15	31.3	24.42
14	Dalmahoy Road Ratho	313856	670702	1.5	12.66	0.86	0.86	0.53	18.5	18.14
15	Easter Hatton Mains	314095	669047	1.5	16.07	1.44	1.44	0.86	23.4	20.62
16	Easter Hatton Cottages	314125	669025	1.5	19.86	1.79	1.79	1.06	29.0	23.31
17	Main Street Ratho	313910	670732	1.5	14.25	0.88	0.88	0.54	20.8	19.31
18	Entry Level	314520	669163	1.5	19.42	1.74	1.74	1.04	28.3	23
19	Entry Level	314542	669167	1.5	16.10	1.44	1.44	0.86	23.5	20.65
20	Dalmahoy Gatehouse	314573	669172	1.5	13.02	1.16	1.16	0.69	19.0	18.4
21	House	314669	669248	1.5	25.70	2.32	2.32	1.38	37.5	27.32
22	Lodge	315404	669599	1.5	24.80	2.23	2.23	1.33	36.2	26.72
23	Addiston Mains	315800	669899	1.5	14.22	1.26	1.26	0.75	20.7	19.28
24	Research Park	316689	669813	1.5	9.11	0.79	0.79	0.47	13.3	15.49
25	Research Park	317152	669921	1.5	9.83	0.84	0.84	0.51	14.3	16.03
26	Research Park	317485	670029	1.5	8.59	0.73	0.73	0.44	12.5	15.09
27	Wester Row	317442	670122	1.5	29.89	2.64	2.64	1.57	43.6	30.1
28	Hermiston Steading	317581	670177	1.5	23.15	2.03	2.03	1.21	33.8	25.59
29	Hermiston Steading	317630	670196	1.5	19.66	1.72	1.72	1.03	28.7	23.17
30	Long Hermiston	317856	670263	1.5	12.73	1.10	1.10	0.66	18.6	18.19
31	Calder Road	317878	670224	1.5	16.99	1.49	1.49	0.89	24.8	21.28
32	Calder Road	317921	670226	1.5	17.10	1.51	1.51	0.90	25.0	21.36
33	Research Park	317807	670153	1.5	13.48	1.18	1.18	0.70	19.7	18.74
34	Calder View	318805	670456	1.5	31.23	2.71	2.71	1.61	45.6	30.97
35	Calder View	318870	670486	1.5	35.99	3.09	3.09	1.83	52.5	34.01
36	Calder View	318968	670496	1.5	27.25	2.34	2.34	1.39	39.8	28.36
37	Calder Gardens	319121	670549	1.5	31.32	2.66	2.66	1.58	45.7	31.03
38	Calder Gardens	319308	670611	1.5	33.40	2.83	2.83	1.68	48.7	32.37
39	St Nicholas Church	319463	670657	1.5	26.68	2.26	2.26	1.34	38.9	27.98
40	Bowling Green	319545	670668	1.5	19.84	1.69	1.69	1.00	28.9	23.3
41	Sighthill	319628	670703	1.5	25.99	2.20	2.20	1.31	37.9	27.52
42	Sighthill	319732	670726	1.5	26.42	2.23	2.23	1.33	38.5	27.81
43	Sighthill	319858	670750	1.5	22.49	1.90	1.90	1.13	32.8	25.14
44	Sighthill	320015	670783	1.5	17.26	1.46	1.46	0.87	25.2	21.47
45	Parkhead	320150	670834	1.5	22.68	1.90	1.90	1.13	33.1	25.27
46	West Drive	320157	670904	1.5	28.23	2.37	2.37	1.41	41.2	29.01
47	Parkhead	320390	670933	1.5	26.39	2.21	2.21	1.31	38.5	27.79
48	Parkhead	320674	671044	1.5	20.30	1.70	1.70	1.01	29.6	23.62
49	Fairbrae	320592	671085	1.5	25.20	2.11	2.11	1.25	36.8	26.99
50	Saughton	320801	671163	1.5	27.52	2.30	2.30	1.37	40.1	28.54
Max					35.99	3.09	3.09	1.83	52.50	

baseline 2030
surface roughness = 0.5m
met data Gogar 2016

No.	Receptor name	X(m)	Y(m)	Z(m)	Conc |ug/m3 |NOx|<All sources>|-| 1hr	Conc|ug/m3 |PM10|<All sources>|-| 24hrs	Conc|ug/m3 |PM10|<All sources>|-| 1hr	Conc|ug/m3 |PM2.5|<All sources>|-| 1hr	adjusted road NOx	adjusted NO2
1	Coxydene	311227	668446	1.5	8.31	0.73	0.73	0.44	12.1	14.88
2	East Coxydene Farm	311695	668494	1.5	19.62	1.49	1.49	0.89	28.6	23.14
3	Wilkieston Village	312125	668463	1.5	31.44	2.37	2.37	1.42	45.9	31.11
4	Wilkieston Village	312080	668458	1.5	22.60	1.70	1.70	1.02	33.0	25.21
5	Wilkieston Village	312232	668461	1.5	21.14	1.59	1.59	0.95	30.8	24.2
6	Orchardfield	312445	668488	1.5	9.99	0.76	0.76	0.45	14.6	16.15
7	West Lodge	312778	668442	1.5	22.55	1.69	1.70	1.02	32.9	25.18
8	Burnwynd	313102	668500	1.5	25.64	1.93	1.93	1.16	37.4	27.28
9	Burnwynd	313238	668509	1.5	27.96	2.12	2.12	1.27	40.8	28.83
10	Burnwynd	313263	668506	1.5	32.50	2.47	2.47	1.48	47.4	31.79
11	Burnwynd	313308	668514	1.5	22.48	1.83	1.83	1.09	32.8	25.13
12	Bridgend Cottages	313806	668870	1.5	29.08	2.63	2.63	1.56	42.4	29.57
13	Hatton Bridge	313970	668976	1.5	21.99	1.99	1.99	1.18	32.1	24.8
14	Dalmahoy Road Ratho	313856	670702	1.5	13.46	0.94	0.94	0.57	19.6	18.72
15	Easter Hatton Mains	314095	669047	1.5	16.51	1.49	1.49	0.88	24.1	20.94
16	Easter Hatton Cottages	314125	669025	1.5	20.39	1.84	1.84	1.09	29.7	23.69
17	Main Street Ratho	313910	670732	1.5	15.12	0.95	0.95	0.58	22.1	19.94
18	Entry Level	314520	669163	1.5	20.54	1.85	1.85	1.10	30.0	23.79
19	Entry Level	314542	669167	1.5	17.29	1.56	1.56	0.92	25.2	21.5
20	Dalmahoy Gatehouse	314573	669172	1.5	14.14	1.27	1.27	0.76	20.6	19.22
21	House	314669	669248	1.5	27.98	2.54	2.54	1.51	40.8	28.85
22	Lodge	315404	669599	1.5	26.99	2.45	2.45	1.46	39.4	28.19
23	Addiston Mains	315800	669899	1.5	15.35	1.37	1.37	0.82	22.4	20.1
24	Research Park	316689	669813	1.5	9.66	0.84	0.84	0.50	14.1	15.91
25	Research Park	317152	669921	1.5	10.41	0.90	0.90	0.54	15.2	16.46
26	Research Park	317485	670029	1.5	8.99	0.77	0.77	0.46	13.1	15.4
27	Wester Row	317442	670122	1.5	32.06	2.85	2.85	1.70	46.8	31.51
28	Hermiston Steading	317581	670177	1.5	24.72	2.19	2.19	1.30	36.1	26.66
29	Hermiston Steading	317630	670196	1.5	20.93	1.84	1.84	1.10	30.5	24.06
30	Long Hermiston	317856	670263	1.5	13.36	1.16	1.16	0.70	19.5	18.66
31	Calder Road	317878	670224	1.5	18.04	1.60	1.60	0.95	26.3	22.03
32	Calder Road	317921	670226	1.5	18.14	1.61	1.61	0.96	26.5	22.1
33	Research Park	317807	670153	1.5	14.27	1.26	1.26	0.75	20.8	19.32
34	Calder View	318805	670456	1.5	31.80	2.77	2.77	1.64	46.4	31.34
35	Calder View	318870	670486	1.5	36.70	3.16	3.16	1.88	53.5	34.46
36	Calder View	318968	670496	1.5	27.79	2.39	2.39	1.42	40.5	28.72
37	Calder Gardens	319121	670549	1.5	31.99	2.73	2.73	1.62	46.7	31.46
38	Calder Gardens	319308	670611	1.5	34.14	2.90	2.90	1.72	49.8	32.84
39	St Nicholas Church	319463	670657	1.5	27.27	2.32	2.32	1.38	39.8	28.38
40	Bowling Green	319545	670668	1.5	20.28	1.73	1.73	1.03	29.6	23.61
41	Sighthill	319628	670703	1.5	26.58	2.26	2.26	1.34	38.8	27.91
42	Sighthill	319732	670726	1.5	27.03	2.30	2.29	1.36	39.4	28.21
43	Sighthill	319858	670750	1.5	23.01	1.95	1.95	1.16	33.6	25.5
44	Sighthill	320015	670783	1.5	17.65	1.50	1.50	0.89	25.7	21.75
45	Parkhead	320150	670834	1.5	23.18	1.95	1.95	1.16	33.8	25.61
46	West Drive	320157	670904	1.5	28.84	2.43	2.43	1.44	42.1	29.41
47	Parkhead	320390	670933	1.5	26.99	2.27	2.27	1.35	39.4	28.18
48	Parkhead	320674	671044	1.5	20.76	1.75	1.75	1.04	30.3	23.94
49	Fairbrae	320592	671085	1.5	25.74	2.16	2.16	1.28	37.6	27.35
50	Saughton	320801	671163	1.5	28.12	2.36	2.36	1.40	41.0	28.94
Max					36.70	3.16	3.16	1.88	53.54	34.46

scheme 2030
surface roughness = 0.5m
met data Gogar 2016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calculated road NOx ug/m3
predicted road NOx ug/m3
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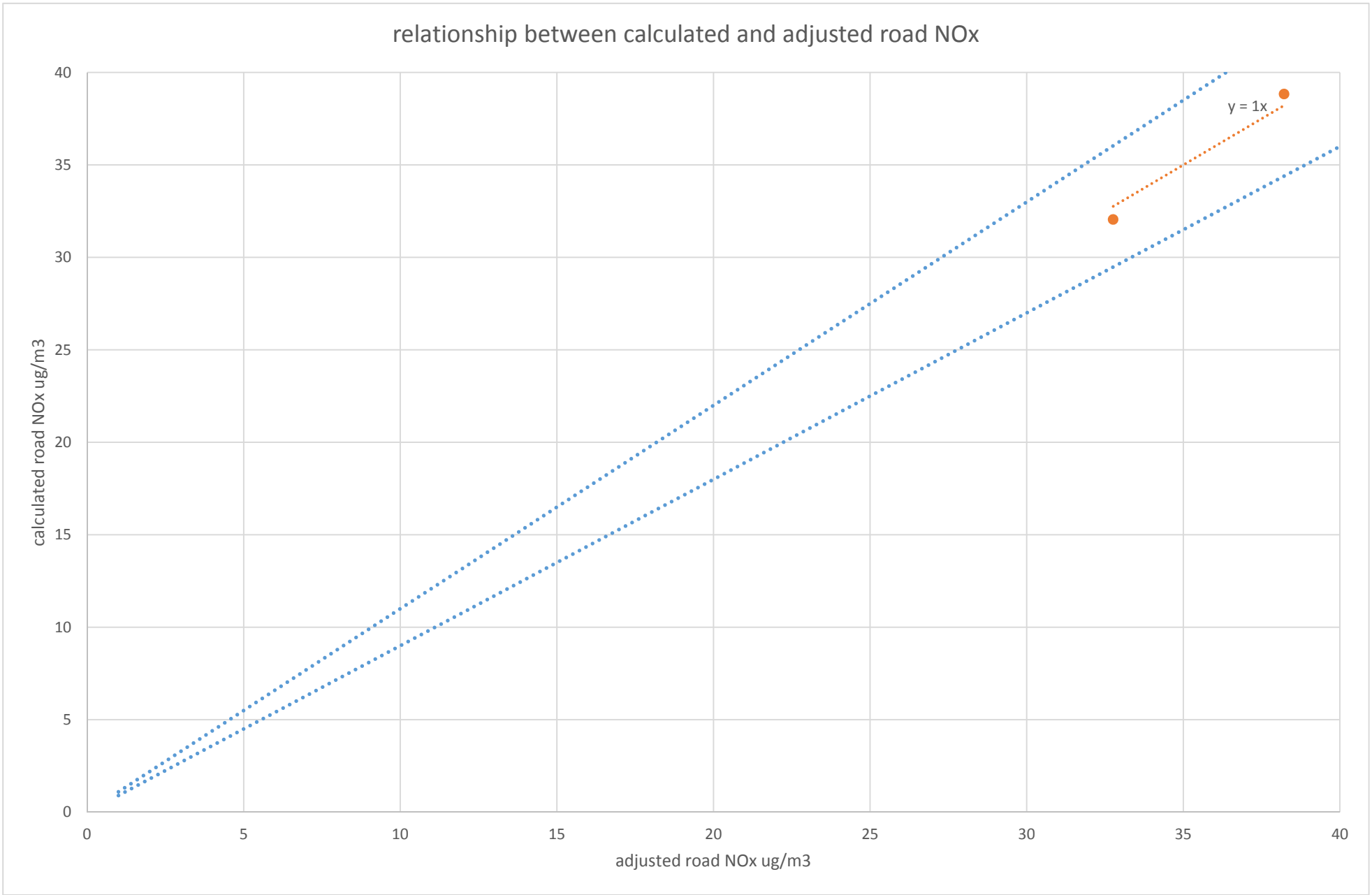
5
10
15
20
25
30
35
40


relationship between calculated and adjusted road NOx
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calculated road NOx ug/m3
adjusted road NOx ug/m3
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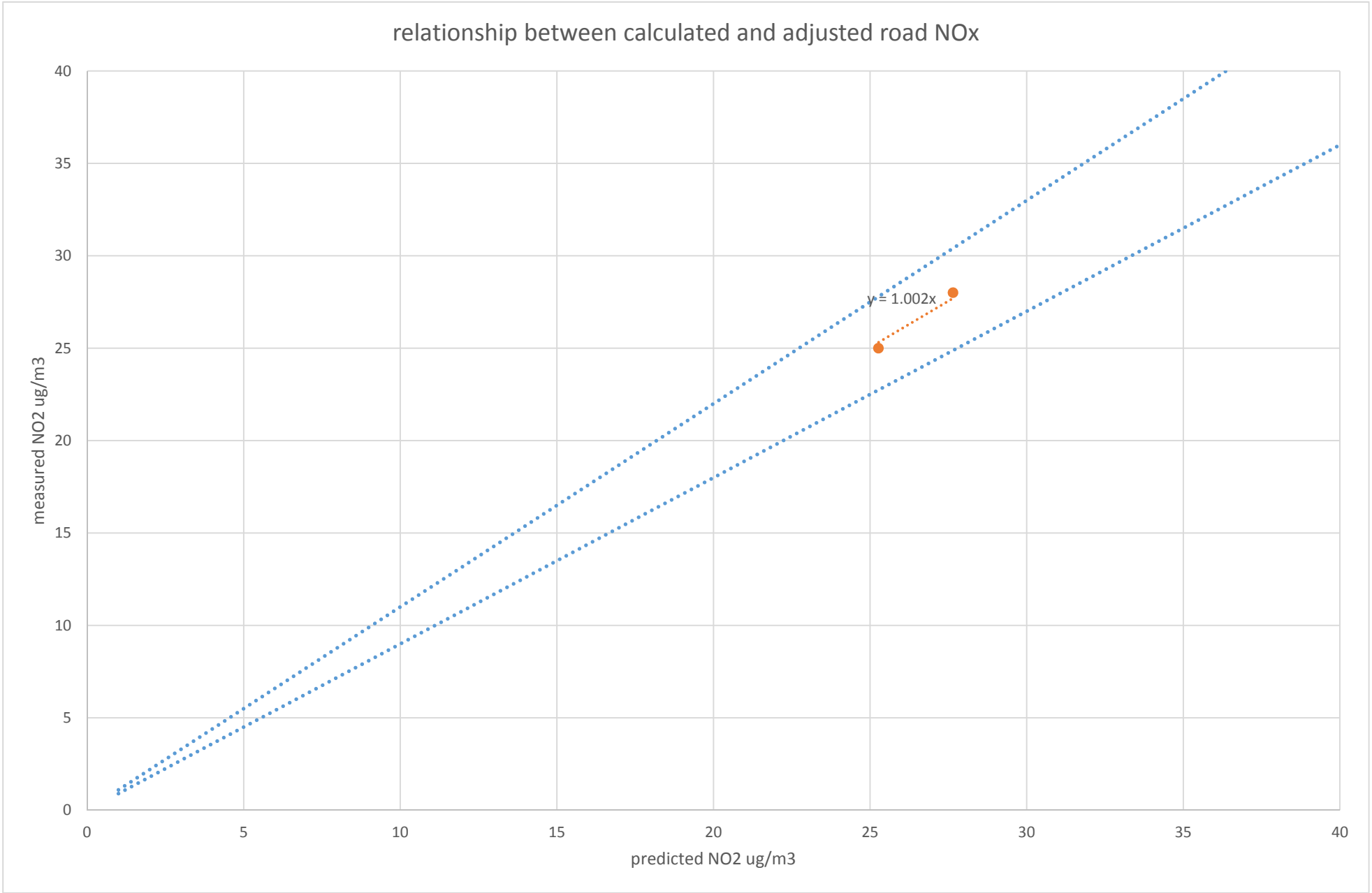
5
10
15
20
25
30
35
40


relationship between calculated and adjusted road NOx
y = 1.002x
measured NO2 ug/m3
predicted NO2 ug/m3
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5
10
15
20
25
30
35
40

Local Authority:	Edinburgh City of					Year:	2015		
						Traffic Mix:	All other urban UK traffic		
Receptor ID	Easting,m	Northing, m	Road increment NO_x $\mu g\ m^{-3}$	Background $\mu g\ m^{-3}$		Fraction emitted as NO_2 (fNO2)	Total NO_2 $\mu g\ m^{-3}$	Road NO_2 $\mu g\ m^{-3}$	Notes
				NO_x	NO_2				
DT4a	318894	670493	32.80	12.3	8.6	0.267939709	25.27	16.67	

					Traffic Mix:	All other urban UK traffic
Site ID	**Diffusion tube NO_2, µg m^{-3}**	**Background**	**µg m^{-3}**	**Road NO_x, µg m^{-3}**	**Fraction emitted as NO_2 (fNO2)**	**Notes**
	µg m^{-3}	**NO_x**	**NO_2**			
DT4a	25	12.3	8.6	32.05	0.267939709	background based on nearest grid point 318500,667500

Local Authority:	Edinburgh City of					Year:	2016		
						Traffic Mix:	All other urban UK traffic		
Receptor ID	Easting,m	Northing, m	Road increment NO_x µg m^{-3}	Background µg m^{-3}		Fraction emitted as NO_2 (fNO2)	Total NO_2 µg m^{-3}	Road NO_2 µg m^{-3}	Notes
				NO_x	NO_2				
DT4a	318894	670493	38.20	11.9	8.4	0.269920718	27.65	19.25	

					Traffic Mix:	All other urban UK traffic
Site ID	Diffusion tube NO_2, µg m^{-3}	Background µg m^{-3}		Road NO_x, µg m^{-3}	Fraction emitted as NO_2 (fNO2)	Notes
	µg m^{-3}	NO_x	NO_2			
DT4a	28	11.9	8.4	38.83	0.269920718	background based on nearest grid point 318500, 667500

Local Authority:	Edinburgh City of					Year:	2016		
						Traffic Mix:	All other urban UK traffic		
Receptor ID	Easting,m	Northing, m	Road increment NO_x $\mu g\ m^{-3}$	Background $\mu g\ m^{-3}$		Fraction emitted as NO_2 (fNO2)	Total NO_2 $\mu g\ m^{-3}$	Road NO_2 $\mu g\ m^{-3}$	Notes
				NO_x	NO_2				
1	311226.97	668445.75	11.99	11.9	8.4	0.269920718	14.82	6.42	
2	311695.38	668494.06	28.07166041	11.9	8.4	0.269920718	22.88	14.48	
3	312125.44	668462.81	45.00249957	11.9	8.4	0.269920718	30.73	22.33	
4	312079.5	668458.12	32.34535967	11.9	8.4	0.269920718	24.92	16.52	
5	312231.5	668461.06	30.22543096	11.9	8.4	0.269920718	23.91	15.51	
6	312444.78	668487.56	14.25670656	11.9	8.4	0.269920718	15.99	7.59	
7	312778.22	668441.62	32.24325067	11.9	8.4	0.269920718	24.87	16.47	
8	313101.69	668499.94	36.63714681	11.9	8.4	0.269920718	26.93	18.53	
9	313238.38	668508.75	39.96808826	11.9	8.4	0.269920718	28.46	20.06	
10	313262.53	668505.81	46.46324175	11.9	8.4	0.269920718	31.38	22.98	
11	313307.88	668513.5	32.09446327	11.9	8.4	0.269920718	24.8	16.4	
12	313805.56	668870.12	41.44093765	11.9	8.4	0.269920718	29.13	20.73	
13	313970.25	668976	31.28298846	11.9	8.4	0.269920718	24.42	16.02	
14	313855.88	670702.25	18.46976766	11.9	8.4	0.269920718	18.14	9.74	
15	314094.84	669047.19	23.44014204	11.9	8.4	0.269920718	20.62	12.22	
16	314124.69	669024.88	28.96759395	11.9	8.4	0.269920718	23.31	14.91	
17	313909.84	670731.56	20.79114284	11.9	8.4	0.269920718	19.31	10.91	
18	314520.47	669163	28.33043379	11.9	8.4	0.269920718	23	14.6	
19	314541.59	669166.62	23.49046719	11.9	8.4	0.269920718	20.65	12.25	
20	314572.66	669172.38	18.98687681	11.9	8.4	0.269920718	18.4	10	
21	314669.47	669248.06	37.49194501	11.9	8.4	0.269920718	27.32	18.92	
22	315404.47	669599.12	36.17663522	11.9	8.4	0.269920718	26.72	18.32	
23	315799.75	669898.5	20.7441727	11.9	8.4	0.269920718	19.28	10.88	
24	316688.69	669812.75	13.29589004	11.9	8.4	0.269920718	15.49	7.09	
25	317152	669920.62	14.34145703	11.9	8.4	0.269920718	16.03	7.63	
26	317485.22	670028.56	12.52499627	11.9	8.4	0.269920718	15.09	6.69	
27	317441.84	670121.88	43.6049191	11.9	8.4	0.269920718	30.1	21.7	
28	317581.38	670177.06	33.77065544	11.9	8.4	0.269920718	25.59	17.19	
29	317630.38	670195.88	28.68314745	11.9	8.4	0.269920718	23.17	14.77	
30	317855.69	670263.31	18.56604186	11.9	8.4	0.269920718	18.19	9.79	
31	317878.31	670223.69	24.78520931	11.9	8.4	0.269920718	21.28	12.88	
32	317921.19	670226.06	24.95091763	11.9	8.4	0.269920718	21.36	12.96	
33	317807.12	670153	19.66371361	11.9	8.4	0.269920718	18.74	10.34	
34	318804.94	670456.06	45.55607622	11.9	8.4	0.269920718	30.97	22.57	
35	318869.97	670486.25	52.49934235	11.9	8.4	0.269920718	34.01	25.61	
36	318968	670496.12	39.75132544	11.9	8.4	0.269920718	28.36	19.96	
37	319121.19	670548.94	45.68239964	11.9	8.4	0.269920718	31.03	22.63	
38	319307.84	670611.12	48.71678738	11.9	8.4	0.269920718	32.37	23.97	
39	319463.38	670657.31	38.91563621	11.9	8.4	0.269920718	27.98	19.58	
40	319545.38	670668.19	28.94512997	11.9	8.4	0.269920718	23.3	14.9	
41	319628.34	670703.06	37.91175887	11.9	8.4	0.269920718	27.52	19.12	
42	319732.03	670725.69	38.54162553	11.9	8.4	0.269920718	27.81	19.41	
43	319858.34	670749.69	32.81141432	11.9	8.4	0.269920718	25.14	16.74	
44	320014.81	670782.69	25.17745374	11.9	8.4	0.269920718	21.47	13.07	
45	320149.62	670834.06	33.07937751	11.9	8.4	0.269920718	25.27	16.87	
46	320157.16	670903.81	41.17735056	11.9	8.4	0.269920718	29.01	20.61	
47	320390	670932.56	38.49888562	11.9	8.4	0.269920718	27.79	19.39	
48	320673.72	671043.81	29.61467327	11.9	8.4	0.269920718	23.62	15.22	
49	320592.19	671084.81	36.76055283	11.9	8.4	0.269920718	26.99	18.59	
50	320800.53	671162.56	40.13875616	11.9	8.4	0.269920718	28.54	20.14	

Local Authority:	Edinburgh City of					Year:	2016		
						Traffic Mix:	All other urban UK traffic		
Receptor ID	Easting,m	Northing, m	Road increment NO_x $\mu g\ m^{-3}$	Background $\mu g\ m^{-3}$		Fraction emitted as NO_2 (fNO2)	Total NO_2 $\mu g\ m^{-3}$	Road NO_2 $\mu g\ m^{-3}$	Notes
				NO_x	NO_2				
1	311226.97	668445.75	12.12	11.9	8.4	0.269920718	14.88	6.48	
2	311695.38	668494.06	28.61342159	11.9	8.4	0.269920718	23.14	14.74	
3	312125.44	668462.81	45.8586106	11.9	8.4	0.269920718	31.11	22.71	
4	312079.5	668458.12	32.96180629	11.9	8.4	0.269920718	25.21	16.81	
5	312231.5	668461.06	30.8354593	11.9	8.4	0.269920718	24.2	15.8	
6	312444.78	668487.56	14.56714709	11.9	8.4	0.269920718	16.15	7.75	
7	312778.22	668441.62	32.89587305	11.9	8.4	0.269920718	25.18	16.78	
8	313101.69	668499.94	37.39640016	11.9	8.4	0.269920718	27.28	18.88	
9	313238.38	668508.75	40.78583548	11.9	8.4	0.269920718	28.83	20.43	
10	313262.53	668505.81	47.40643717	11.9	8.4	0.269920718	31.79	23.39	
11	313307.88	668513.5	32.78705403	11.9	8.4	0.269920718	25.13	16.73	
12	313805.56	668870.12	42.41928774	11.9	8.4	0.269920718	29.57	21.17	
13	313970.25	668976	32.08352302	11.9	8.4	0.269920718	24.8	16.4	
14	313855.88	670702.25	19.63191395	11.9	8.4	0.269920718	18.72	10.32	
15	314094.84	669047.19	24.08284526	11.9	8.4	0.269920718	20.94	12.54	
16	314124.69	669024.88	29.74960302	11.9	8.4	0.269920718	23.69	15.29	
17	313909.84	670731.56	22.06035771	11.9	8.4	0.269920718	19.94	11.54	
18	314520.47	669163	29.96403192	11.9	8.4	0.269920718	23.79	15.39	
19	314541.59	669166.62	25.22748715	11.9	8.4	0.269920718	21.5	13.1	
20	314572.66	669172.38	20.62674735	11.9	8.4	0.269920718	19.22	10.82	
21	314669.47	669248.06	40.81515535	11.9	8.4	0.269920718	28.85	20.45	
22	315404.47	669599.12	39.36797908	11.9	8.4	0.269920718	28.19	19.79	
23	315799.75	669898.5	22.38900282	11.9	8.4	0.269920718	20.1	11.7	
24	316688.69	669812.75	14.09731441	11.9	8.4	0.269920718	15.91	7.51	
25	317152	669920.62	15.17806524	11.9	8.4	0.269920718	16.46	8.06	
26	317485.22	670028.56	13.11690755	11.9	8.4	0.269920718	15.4	7	
27	317441.84	670121.88	46.76140003	11.9	8.4	0.269920718	31.51	23.11	
28	317581.38	670177.06	36.05920987	11.9	8.4	0.269920718	26.66	18.26	
29	317630.38	670195.88	30.53029926	11.9	8.4	0.269920718	24.06	15.66	
30	317855.69	670263.31	19.4940668	11.9	8.4	0.269920718	18.66	10.26	
31	317878.31	670223.69	26.31159299	11.9	8.4	0.269920718	22.03	13.63	
32	317921.19	670226.06	26.46198496	11.9	8.4	0.269920718	22.1	13.7	
33	317807.12	670153	20.81448204	11.9	8.4	0.269920718	19.32	10.92	
34	318804.94	670456.06	46.38359673	11.9	8.4	0.269920718	31.34	22.94	
35	318869.97	670486.25	53.53997893	11.9	8.4	0.269920718	34.46	26.06	
36	318968	670496.12	40.53537669	11.9	8.4	0.269920718	28.72	20.32	
37	319121.19	670548.94	46.65870755	11.9	8.4	0.269920718	31.46	23.06	
38	319307.84	670611.12	49.80220605	11.9	8.4	0.269920718	32.84	24.44	
39	319463.38	670657.31	39.78327097	11.9	8.4	0.269920718	28.38	19.98	
40	319545.38	670668.19	29.58374883	11.9	8.4	0.269920718	23.61	15.21	
41	319628.34	670703.06	38.76947447	11.9	8.4	0.269920718	27.91	19.51	
42	319732.03	670725.69	39.42326381	11.9	8.4	0.269920718	28.21	19.81	
43	319858.34	670749.69	33.5661457	11.9	8.4	0.269920718	25.5	17.1	
44	320014.81	670782.69	25.7475137	11.9	8.4	0.269920718	21.75	13.35	
45	320149.62	670834.06	33.81835493	11.9	8.4	0.269920718	25.61	17.21	
46	320157.16	670903.81	42.06336494	11.9	8.4	0.269920718	29.41	21.01	
47	320390	670932.56	39.3630195	11.9	8.4	0.269920718	28.18	19.78	
48	320673.72	671043.81	30.2840707	11.9	8.4	0.269920718	23.94	15.54	
49	320592.19	671084.81	37.55393976	11.9	8.4	0.269920718	27.35	18.95	
50	320800.53	671162.56	41.02477054	11.9	8.4	0.269920718	28.94	20.54	