

Air Quality Assessment
24 Stone Street, Gravesend, Kent

Client: Stonewater Ltd

Reference: 1170-1r2

Date: 25th November 2015



Report Issue

Report Title: Air Quality Assessment - 24 Stone Street, Gravesend, Kent

Report Reference: 1170-1

Report Version	Issue Date	Issued By	Comments
1	24 th November 2015	Jethro Redmore	Draft for comment
2	25 th November 2015	Jethro Redmore	-

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Executive Summary

Redmore Environmental Ltd was commissioned by Stonewater Ltd to undertake an Air Quality Assessment in support of a residential-led development at 24 Stone Street, Gravesend, Kent.

The proposals comprise redevelopment and extension of 24 Stone Street, Gravesend, to provide 4 one bedroom flats on first and second floors, as well as one commercial unit/office space on the ground floor.

Gravesham Borough Council has raised concerns that the development will result in exposure of future users to poor air quality. Further to this, changes to the road layout in the vicinity of the site have been proposed. These will alter the routes utilised by road traffic and thereby influence the location of vehicle emissions. An Air Quality Assessment was therefore required in order to determine baseline conditions, consider site suitability for the proposed end-use following the implementation of the new road alignment and assess potential impacts as a result of the scheme.

Dispersion modelling was undertaken in order to predict pollutant concentrations across the proposed development site. Results were subsequently verified using data to describe the existing road layout and local air quality monitoring data.

The dispersion modelling assessment indicated that predicted pollution levels were below the relevant air quality standard across all locations proposed for residential usage. Exposure of future occupants to poor air quality is therefore considered unlikely as a result of the proposals.

During the operational phase of the development there is the potential for air quality impacts as a result of traffic exhaust emissions associated with vehicles travelling to and from the site. These were assessed against the relevant screening criteria. Due to the low number of trips anticipated to be produced by the proposals, impacts were not predicted to be significant.

Based on the assessment results, mechanical ventilation is not considered necessary for the development and air quality issues are not considered a constraint to the proposals.

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1.0 INTRODUCTION

1.1 Background

- 1.1.1 Redmore Environmental Ltd was commissioned by Stonewater Ltd to undertake an Air Quality Assessment in support of a residential-led development at 24 Stone Street, Gravesend, Kent.
- 1.1.2 Gravesham Borough Council (GBC) have raised concerns regarding poor air quality at the development location. Further to this, road layout changes are planned in the vicinity of the site. As such, an Air Quality Assessment was necessary in order to consider potential exposure of future residents to elevated pollution levels and investigate the influence of road layout changes on pollutant levels across the site.

1.2 Site Location and Context

- 1.2.1 The site is located off Stone Street, Gravesend, at approximate National Grid Reference (NGR): 564695, 173985. Reference should be made to Figure 1 for a map of the site and surrounding area.
- 1.2.2 The proposals comprise redevelopment of the existing property to provide 4 residential flats on the first and second floors and one commercial unit / office space on the ground floor. Reference should be made to Figure 2 for a map of the proposed building locations.
- 1.2.3 A planning consultation response provided by GBC on the 8th August 2015 highlighted concerns that the proposals will introduce future residents to poor air quality as part of site falls within an Air Quality Management Area (AQMA). This stated:

"Concerns are raised with regard to those units that fall within the AQMA. The applicant may have to install air exchange systems in these units (as could be required by the Environmental Protection team), which may not negate the need for additional measures to ensure that internal temperatures do not become excessive. The applicant should therefore be able to demonstrate how excessive internal temperatures will be avoided."

- 1.2.4 An Air Quality Assessment has therefore been undertaken to address GBC's concerns by considering site suitability for the proposed end use and determine any requirement for mitigation.
- 1.2.5 It should be noted that changes to the Gravesend Town Centre one way system are planned for construction in 2016. These will alter traffic flow within the town centre and therefore influence the locations of vehicle exhaust emissions. Reference should be made to Figure 3 for a detailed map of the new road layout. It is anticipated that the proposed development will be completed by 2017. As such, the Air Quality Assessment has considered emissions associated with the revised alignment to ensure conditions during the first full year of opening are analysed.

2.0 LEGISLATION AND POLICY

2.1 European Directives

2.1.1 European Union (EU) air quality legislation is provided within Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidated previous legislation which was designed to deal with specific pollutants in a consistent manner and provided new Air Quality Limit Values (AQLVs) for particulate matter with an aerodynamic diameter of less than 2.5µm. The consolidated Directives include:

- Directive 99/30/EC - the First Air Quality "Daughter" Directive - sets ambient AQLVs for nitrogen dioxide (NO₂), oxides of nitrogen (NO_x), sulphur dioxide, lead and particulate matter with an aerodynamic diameter of less than 10µm (PM₁₀);
- Directive 2000/69/EC - the Second Air Quality "Daughter" Directive - sets ambient AQLVs for benzene and carbon monoxide; and,
- Directive 2002/3/EC - the Third Air Quality "Daughter" Directive - seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

2.1.2 The fourth daughter Directive was not included within the consolidation and is described as:

- Directive 2004/107/EC - sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 UK Legislation

2.2.1 The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and transpose EU Directive 2008/50/EC into UK law. AQLVs were published in these regulations for 7 pollutants, as well as Target Values for an additional 5 pollutants.

2.2.2 Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for

Environment, Food and Rural Affairs (DEFRA) and published in July 2007¹. The AQS sets out Air Quality Objectives (AQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedences over a specified timescale. These are generally in line with the AQLVs, although the requirements for the determination of compliance vary.

2.2.3 Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration (µg/m ³)	Averaging Period
NO ₂	40	Annual mean
	200	1-hour mean, not to be exceeded on more than 18 occasions per annum

2.2.4 Table 2 summarises the advice provided in DEFRA guidance LAQM.TG(09)² on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007.

² Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

2.3 Local Air Quality Management

- 2.3.1 Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure, as summarised in Table 2, are likely to be exceeded, the LA is required to declare an AQMA. For each AQMA the LA is required to produce an Air Quality Action Plan, the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 National Planning Policy

- 2.4.1 The National Planning Policy Framework³ (NPPF) was published on 27th March 2012 and sets out the Government's core policies and principles with respect to land use planning, including air quality. The document includes the following considerations which are relevant to the proposed development:

"The planning system should contribute to and enhance the natural and local environment by: [...]"

³ National Planning Policy Framework, Department for Communities and Local Government, 2012.

Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability"

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

2.4.2 The implications of the NPPF have been considered throughout this assessment.

2.5 National Planning Practice Guidance

2.5.1 The National Planning Practice Guidance⁴ (NPPG) web-based resource was launched by the Department for Communities and Local Government on 6th March 2014 to support the NPPF and make it more accessible. The air quality pages are summarised under the following headings:

1. Why should planning be concerned about air quality?
2. What is the role of Local Plans with regard to air quality?
3. Are air quality concerns relevant to neighbourhood planning?
4. What information is available about air quality?
5. When could air quality be relevant to a planning decision?
6. Where to start if bringing forward a proposal where air quality could be a concern?
7. How detailed does an air quality assessment need to be?
8. How can an impact on air quality be mitigated?
9. How do considerations about air quality fit into the development management process?

2.5.2 These were reviewed and the relevant guidance considered as necessary throughout the undertaking of this assessment.

⁴ <http://planningguidance.planningportal.gov.uk>.

2.6 **Local Planning Policy**

2.6.1 The GBC Development Plan consists of a number of development planning documents, the most important of which is The Gravesham Core Strategy⁵ (GCS). The GCS was adopted in 2014 and sets out the Council's long term spatial vision for the Borough.

2.6.2 A review of the Core Strategy revealed the following of relevance to this report:

"Policy CS19: Development and Design Principles

5.15.14 New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anticrime standards. The design and construction of new development will incorporate sustainable construction standards and techniques, be adaptable to reflect changing lifestyles, and be resilient to the effects of climate change. This will be achieved through the criteria set out below:

[...]

New development will be located, designed and constructed to:

[...]

avoid adverse environmental impacts from pollution, including noise, air, odour and light pollution, and land contamination; [...]"

2.6.3 The implications of this policy were taken into consideration throughout the undertaking of the assessment.

⁵ Gravesham Local Plan Core Strategy, Gravesham Borough Council, 2014.

3.0 BASELINE

3.1 Introduction

- 3.1.1 Existing air quality conditions in the vicinity of the proposed development site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

3.2 Local Air Quality Management

- 3.2.1 As required by the Environment Act (1995), GBC has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that annual mean concentrations of NO₂ and 24-hour mean concentrations of PM₁₀ are above the relevant AQOs within the council's administrative extents. As such, seven AQMA's have been declared. The closest AQMA to the development has been declared due to exceedences of the annual mean AQO for NO₂ and is described as:

"An area incorporating the entirety of the A226 One-way system in Gravesend."

- 3.2.2 Part of the development is located within the AQMA. As such, there is the potential for the site to be affected by elevated pollutant concentrations. This has been considered throughout the assessment.
- 3.2.3 GBC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs. As such, no further AQMA's have been designated.

3.3 Air Quality Monitoring

- 3.3.1 Monitoring of pollutant concentrations is undertaken by GBC using continuous and periodic methods throughout their area of jurisdiction. Recent results from sites in the vicinity of the development are shown in Table 3. Exceedences of the relevant AQOs are shown in **bold**.

Table 3 Monitoring Results

Monitoring Site		Monitored NO ₂ Concentration (µg/m ³)		
		2011	2012	2013
GR39	Stone Street (post), Gravesend, DA12 1AP	36.0	38.1	40.7
GR40	Somerset Public House, 10 Darnley Road, Gravesend, DA11 0RU	40.0	40.0	48.8
GR61	62 New Road (Pounce), Gravesend, Kent, DA11 0AD	36.0	36.0	40.3
GR118	40 Windmill Street, Gravesend DA12 1BA (Façade)	34.0	34.0	37.1
GR119	Woodville Place (lamp post)	45.0	45.0	50.1
GR122	King & Taylor 10-12 Wrotham Road (façade) DA11	35.0	35.0	37.2

3.3.2 As shown in Table 3, the annual mean AQO for NO₂ was exceeded at a number of diffusion tubes in recent years. As the monitoring sites are positioned within an AQMA, elevated concentrations would be anticipated. Reference should be made to Figure 4 for a map of the survey locations.

3.4 Background Pollutant Concentrations

3.4.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The proposed development site is located in grid square NGR: 564500, 173500. Data for this location was downloaded from the DEFRA website⁶ for the purpose of the assessment and is summarised in Table 4.

Table 4 Background Pollutant Concentration Predictions

Pollutant	Predicted Background Pollutant Concentration (µg/m ³)		
	2013	2015	2017
NO ₂	20.38	19.57	18.45

⁶ <http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011>.

3.4.2 As shown in Table 4, predicted background pollutant concentrations are below the relevant AQO at the development site.

Gravesham Borough Council

4.0 METHODOLOGY

4.1 Introduction

- 4.1.1 The proposed development has the potential to expose future residents to poor air quality and cause adverse impacts due to vehicle exhaust emissions. These issues were assessed in accordance with the following methodology.

4.2 Potential Exposure

- 4.2.1 Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 3.4.2.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.
- 4.2.2 Modelling was undertaken for 2013 to allow verification against recent monitoring results using the existing road layout and for 2017 to represent future concentrations once the development and the new road layout are completed.
- 4.2.3 The proposals include office land use at ground floor level. This is not considered sensitive land use in accordance with the guidance provided within DEFRA guidance LAQM.TG(09)⁷. As such, modelling was undertaken at first and second floors to represent positions of proposed residential use.
- 4.2.4 The model requires input data that details the following parameters:
- Assessment area;
 - Traffic flow data;
 - Vehicle emission factors;
 - Spatial co-ordinates of emissions;
 - Street width;
 - Meteorological data;
 - Roughness length; and,

⁷ Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

- Monin-Obukhov length.

4.2.5 These are detailed in the following Sections.

Assessment Area

4.2.6 Ambient concentrations were predicted over the area NGR: 564650 564750 to 173940, 174040. One Cartesian grid was used within the model to produce data suitable for contour plotting using the Surfer software package.

4.2.7 It should be noted that although the grid only covered the proposed site, road links were extended in order to ensure the impact of all relevant vehicle emissions in the vicinity of the development were considered.

4.2.8 Reference should be made to Figure 6 for a graphical representation of the assessment grid extents.

Traffic Flow Data

4.2.9 Baseline traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition as Heavy Duty Vehicle (HDV) proportion, was obtained from the Department for Transport (DfT)⁸. The DfT web tool enables the user to view and download traffic flows on every link of the 'A' road and motorway network in Great Britain for the years 1999 to 2014. It should be noted that the DfT matrix is referenced in DEFRA guidance LAQM.TG(09)⁹ as being a suitable source of data for air quality assessments and it is therefore considered to provide a reasonable estimate of traffic flows in the vicinity of the site.

4.2.10 Traffic data was unavailable from the DfT for some of the road links relevant to the assessment, as well as to describe flows with the realignment in place. As such, additional information was obtained from an Air Quality Assessment¹⁰ produced by Jacobs for the proposed changes to the Gravesend one-way system. As planning permission has been

⁸ <http://www.dft.gov.uk/traffic-counts/>.

⁹ Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

¹⁰ Gravesend Transport Quarter, New Rathmore Road, Air Quality Assessment, Jacobs, 2013.

granted for the one way system, the report was considered to provide suitable information in lieu of other sources.

- 4.2.11 Road widths were estimated from aerial photography and UK highway design standards. A summary of the traffic data used in the assessment is provided in Table 5.

Table 5 Traffic Data

Link		24-hour AADT Flow		HDV Proportion of Fleet (%)	
		2013	2017	2013	2017
L1	Darnley Road	8,486	5,749	3.00	9.00
L2	Darnley Road	8,486	5,749	3.00	9.00
L3	Pelham Road	8,956	5,472	4.00	7.00
L4	Darnley Road	17,233	14,231	5.00	6.00
L5	Darnley Road	17,233	14,231	5.00	6.00
L6	Darnley Road	17,233	14,231	5.00	6.00
L7	Bath Street	15,258	16,592	5.00	5.00
L8	Overcliffe	13,649	17,190	5.00	4.00
L9	Darnley Street	5,098	5,098	1.00	0.00
L10	Cobham Street	3,240	3,240	1.00	1.00
L11	Rathmore Road	1,769	NA	1.00	NA
L12	Clive Junction	6,072	6,313	4.18	100.00
L13	Clive Junction	6,072	6,313	4.18	100.00
L14	Clive Road	12,144	12,626	4.18	100.00
L15	Clive Road Slow	12,144	12,626	4.18	4.18
L16	Clive Road	12,144	12,626	4.18	4.18
L17	Clive Road Stone Street Corner	12,144	12,626	4.18	4.18
L18	Stone Street	12,144	12,626	4.18	4.18
L19	Stone Street	12,144	12,626	4.18	4.18

Link		24-hour AADT Flow		HDV Proportion of Fleet (%)	
		2013	2017	2013	2017
L20	Wrotham Road	12,144	12,626	4.18	4.18
L21	Woodville Place Junction	6,072	6,313	4.18	4.00
L22	Woodville Place Junction	6,072	6,313	4.18	4.18
L23	Lord Street	12,503	12,999	3.22	3.22
L24	Windmill Street	359	373	3.00	1.00
L25	Windmill Street	3,382	3,669	0.00	1.00
L26	Railway Place	4,737	3,977	1.00	1.00
L27	Stone Street	1,927	1,421	15.00	10.00
L28	Woodville Place	12,144	12,626	4.18	4.00
L29	Stone Street Canyon	12,144	12,626	4.18	4.18
L30	Overcliffe Canyon	13,649	17,190	5.00	4.00
L30	New Rathmore Road	NA	14,315	NA	3.00
L31	New Rathmore Road	NA	14,315	NA	3.00
L32	New Rathmore Road	NA	14,315	NA	3.00

4.2.12 Road parameters are summarised in Table 6.

Table 6 Road Parameters

Link		Road Width (m)	Canyon Height (m)	Average Vehicle Speed (km/h)
L1	Darnley Road	6.4	0.00	40
L2	Darnley Road	10.8	0.00	25
L3	Pelham Road	7.8	0.00	45
L4	Darnley Road	6.1	0.00	40
L5	Darnley Road	6.9	0.00	35
L6	Darnley Road	8.7	0.00	25

Link		Road Width (m)	Canyon Height (m)	Average Vehicle Speed (km/h)
L7	Bath Street	11.0	0.00	40
L8	Overcliffe	25.9	9.50	20
L9	Darnley Street	5.8	0.00	35
L10	Cobham Street	5.4	0.00	35
L11	Rathmore Road	5.3	0.00	35
L12	Clive Junction	10.2	0.00	25
L13	Clive Junction	6.9	0.00	25
L14	Clive Road	7.1	0.00	30
L15	Clive Road Slow	6.6	0.00	25
L16	Clive Road	5.6	0.00	30
L17	Clive Road Stone Street Corner	5.6	0.00	25
L18	Stone Street	5.6	0.00	25
L19	Stone Street	4.7	0.00	30
L20	Wrotham Road	5.6	0.00	35
L21	Woodville Place Junction	3.5	0.00	25
L22	Woodville Place Junction	4.7	0.00	25
L23	Lord Street	24.7	10.50	20
L24	Windmill Street	7.4	0.00	35
L25	Windmill Street	4	0.00	35
L26	Railway Place	4.8	0.00	30
L27	Stone Street	6.7	0.00	25
L28	Woodville Place	12	6.00	20
L29	Stone Street Canyon	18.5	10.00	35
L30	Overcliffe Canyon	9.2	0.00	20
L30	New Rathmore Road	6.9	0.00	25
L31	New Rathmore Road	8.1	0.00	30

Link		Road Width (m)	Canyon Height (m)	Average Vehicle Speed (km/h)
L32	New Rathmore Road	14.1	0.00	25

4.2.13 Some of the roads within the assessment extents are flanked by buildings on either side. These locations were included as street canyons within the model in order to provide consideration of reduced pollutant dispersion in these areas.

4.2.14 Reference should be made to Figure 5 and Figure 6 for graphical representations of road link locations prior and post the one way system road layout changes, respectively.

Emission Factors

4.2.15 Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 6.0.2). This has been produced by DEFRA and incorporates updated COPERT4v10 vehicle emissions factors for NO_x and vehicle fleet information.

4.2.16 There is current uncertainty over NO₂ concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2013 emission factors were utilised in preference to the development opening year in order to provide robust concentration predictions. As predictions for 2013 were verified, it is considered results are a robust indication of worst case concentrations for the future year.

Meteorological Data

4.2.17 Meteorological data used in the assessment was taken from Gravesend meteorological station over the period 1st January 2013 to 31st December 2013 (inclusive). Gravesend meteorological station is located at NGR: 560810,176415, which is approximately 4.6km north-west of the proposed development. DEFRA guidance LAQM.TG(09)¹¹ recommends meteorological stations within 30km of an assessment area as being suitable for detailed modelling.

¹¹ Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

- 4.2.18 All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 7 for a wind rose of the utilised meteorological data.

Roughness Length

- 4.2.19 A roughness length (z_0) of 1.0m was used to describe the modelling extents. This value of z_0 is considered appropriate for the morphology of the area due to the complex urban topography in the vicinity of the site and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.
- 4.2.20 A z_0 of 0.2m was used to describe the meteorological site. This value of z_0 is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'agricultural areas (min)'. A relatively low z_0 was used to take account of the large area of flat land use including grassland and water in the vicinity of the meteorological site.

Monin-Obukhov Length

- 4.2.21 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used to describe the development location. This value is considered appropriate for the nature of the modelling extents and is suggested within ADMS-Roads as being suitable for 'mixed urban/industrial'.
- 4.2.22 A minimum Monin-Obukhov length of 10m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-Roads as being suitable for 'small towns <50,000'.

Background Concentrations

- 4.2.23 An annual mean concentration of 21.6 $\mu\text{g}/\text{m}^3$ was used in the assessment to represent existing NO₂ levels throughout the dispersion modelling extents without the contribution from road vehicles. This value was obtained from the GR75 - Gravesend Cemetery monitoring site as the diffusion tube is located away from road emission sources. This background concentration is higher than values obtained from the DEFRA mapping study

for the grid square containing the proposals, as shown in Table 4, and is therefore considered to provide an appropriately robust assessment.

- 4.2.24 Similarly to emission factors, background concentrations from 2013 were utilised in preference to the development opening year. This provided a robust assessment and is likely to overestimate pollutant concentrations during the operation of the proposal.

NO_x to NO₂ Conversion

- 4.2.25 Predicted annual mean NO_x concentrations were converted to NO₂ concentrations using the spreadsheet (version 4.1) provided by DEFRA, which is the method detailed within DEFRA guidance LAQM.TG(09)¹².

Verification

- 4.2.26 The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and,
- Uncertainties associated with monitoring data, including locations.

- 4.2.27 Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

- 4.2.28 For the purpose of the assessment model verification was undertaken for 2013 using traffic data, meteorological data and monitoring results from this year.

- 4.2.29 GBC undertook diffusion tube monitoring of NO₂ concentrations at five locations within the modelling extents during 2013. Results were obtained and the road contribution to total NO_x concentration calculated following the methodology contained within DEFRA

¹² Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

guidance LAQM.TG(09)¹³. The monitored annual mean NO₂ concentrations and calculated road NO_x concentrations are summarised in Table 7.

Table 7 Verification - Monitoring Results

Monitoring Location		Monitored NO ₂ Concentration (µg/m ³)	Calculated Road NO _x Concentration (µg/m ³)
GR39	Stone Street (post), Gravesend, DA12 1AP	40.7	32.94
GR40	Somerset Public House, 10 Darnley Road, Gravesend, DA11 0RU	48.8	54.31
GR60	62 New Road (Pounce), Gravesend, Kent, DA11 0AD	40.3	31.95
GR118	40 Windmill Street, Gravesend DA12 1BA (Façade)	37.1	24.21
GR119	Woodville Place (lamp post)	50.1	57.97
GR122	King & Taylor 10-12 Wrotham Road (façade) DA11	37.2	24.45

4.2.30 The annual mean road NO_x concentrations predicted from the dispersion model and the calculated 2013 road NO_x monitoring results are summarised in Table 8.

Table 8 Verification - Modelling Results

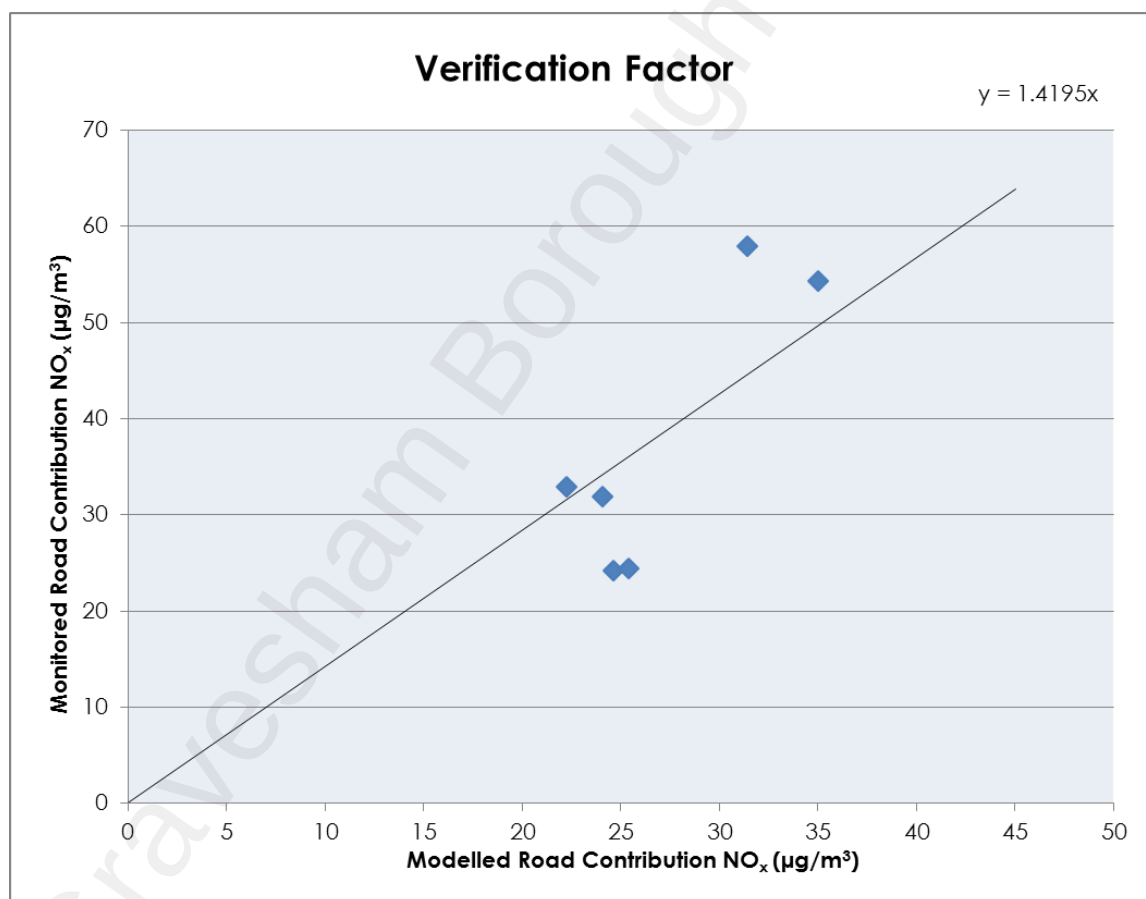
Monitoring Location		Calculated Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)
GR39	Stone Street (post), Gravesend, DA12 1AP	32.94	22.23
GR40	Somerset Public House, 10 Darnley Road, Gravesend, DA11 0RU	54.31	35.01
GR60	62 New Road (Pounce), Gravesend, Kent, DA11 0AD	31.95	24.05
GR118	40 Windmill Street, Gravesend DA12 1BA (Façade)	24.21	24.65
GR119	Woodville Place (lamp post)	57.97	31.39

¹³ Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009.

Monitoring Location		Calculated Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)
GR122	King & Taylor 10-12 Wrotham Road (façade) DA11	24.45	25.40

4.2.31 The monitored and modelled road NO_x contribution concentrations were graphed and the equation of the trendline based on linear progression through zero calculated. This indicated that a verification factor of 1.4195 was required to be applied to all modelling results, as shown in Graph 1.

Graph 1 Verification



4.3 Operational Phase Road Traffic Assessment

4.3.1 The development has the potential to impact on existing air quality as a result of road traffic exhaust emissions associated with vehicles travelling to and from the site. A screening assessment was therefore undertaken using the criteria contained within the

Highways Agency 'Design Manual for Roads and Bridges' (DMRB)¹⁴ and Institute of Air Quality Management (IAQM) 'Land-Use Planning & Development Control: Planning for Air Quality'¹⁵ guidance documents to determine the potential for trips generated by the development to affect local air quality.

4.3.2 The DMRB¹⁶ provides the following criteria for determination of road links potentially affected by changes in traffic flow:

- Daily AADT flows change by 1,000 or more;
- Daily HDV AADT flows change by 200 or more;
- Daily average speed changes by 10km/hr or more; or,
- Peak hour speed changes by 20km/hr or more.

4.3.3 The IAQM 'Land-Use Planning & Development Control: Planning for Air Quality' guidance¹⁷ document provides the following criteria to help establish when an assessment of potential impacts on the local area is likely to be considered necessary:

- A change of Light Duty Vehicle (LDV) flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- A change of HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- Realignment of roads where the change is 5m or more and the road is within an AQMA; or,
- Introduction of a new junction or removal of an existing junction near to relevant receptors.

4.3.4 Should these criteria not be met, then the DMRB¹⁸ and IAQM guidance¹⁹ documents consider air quality impacts associated with a scheme to be **negligible** and no further assessment is required.

¹⁴ Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

¹⁵ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2015.

¹⁶ Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

¹⁷ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2015.

¹⁸ Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

¹⁹ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2015.

- 4.3.5 Should screening of the relevant data indicate that any of the above criteria are met, then potential impacts at sensitive receptor locations can be assessed by calculating the change in pollutant concentrations as a result of the proposed development. The significance of predicted impacts can then be determined in accordance with the methodology outlined in the IAQM guidance²⁰.

²⁰

Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2015.

5.0 ASSESSMENT

5.1 Predicted Concentrations at the Development Site

- 5.1.1 The proposed development has the potential to cause exposure of future residents to elevated pollution levels. Dispersion modelling was therefore undertaken with the inputs described in Section 4.0 to quantify air quality conditions across the site. Reference should be made to Figure 8 for a graphical representation of the results.
- 5.1.2 It should be noted that offices will be provided on the ground floor. This land use is not considered a location of relevant exposure for annual mean AQOs, as shown in Table 2. As such, concentrations have only been considered at first and second floor levels, which will be occupied by residential units.
- 5.1.3 As shown in Figure 8, annual mean NO₂ concentrations were predicted to be below the AQO of 40µg/m³ at all locations across first floor level. The maximum predicted concentration at the building façade was 30.17µg/m³.
- 5.1.4 Concentrations were not predicted above first floor as levels reduce with height. As such, values would be lower than those shown in Figure 8.
- 5.1.5 Based on the assessment results, exposure of residents to exceedences of the AQO is considered unlikely as a result of the proposed development. As such, mitigation in the form of air-exchange systems or mechanical ventilation is not deemed necessary at the site.

5.2 Potential Development Impacts

- 5.2.1 Any additional vehicle movements associated with the development will generate exhaust emissions on the local and regional road networks. Anticipated trip generation from the site was not available to inform the assessment. However, as the proposals only include provision of 4 residential units and there is no parking associated with the site, it is anticipated that the additional number of vehicle movements is likely to be minimal.
- 5.2.2 Based on the above information, the development is not anticipated to result in a change in AADT flows of more than 1,000, produce over 200 HDV movements per day or

significantly affect average speeds on the local road network. Additionally, it is considered unlikely that the development will result in a change of LDV flows of more than 100 AADT, the proposals do not include road realignment or the introduction of a junction and there will not be a requirement for more than 25 HDV deliveries per day. As such, potential air quality impacts associated with operational phase road vehicle exhaust emissions are predicted to be **negligible**, in accordance with the DMRB²¹ and IAQM²² screening criteria shown in Section 4.13.

²¹ Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

²² Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2015.

6.0 CONCLUSION

- 6.1.1 Redmore Environmental Ltd was commissioned by Stonewater Ltd to undertake an Air Quality Assessment in support of a residential development at 24 Stone Street, Gravesend, Kent.
- 6.1.2 GBC has raised concerns regarding poor air quality at the development location. Further to this, road layout changes are planned in the vicinity of the site. As such, an Air Quality Assessment was necessary in order to consider potential exposure of future residents to elevated pollution levels and investigate the influence of the highway realignment on air quality across the site.
- 6.1.3 Dispersion modelling was undertaken using ADMS-Roads in order to predict pollutant concentrations across the development. Results were subsequently verified using monitoring data obtained from GBC.
- 6.1.4 The results of the dispersion modelling assessment indicated that predicted annual mean NO₂ concentrations were below the relevant AQO across all locations of proposed residential use. Exposure of future inhabitants to poor air quality is therefore considered unlikely as a result of the proposals.
- 6.1.5 During the operational phase of the development there is the potential for air quality impacts as a result of traffic exhaust emissions associated with vehicles travelling to and from the site. These were assessed against the screening criteria provided within the DMRB²³ and IAQM²⁴ guidance documents. Due to the low number of trips anticipated to be produced by the proposals, **negligible** impacts were predicted.
- 6.1.6 Based on the assessment results, mechanical ventilation is not considered necessary for the development and air quality issues are not considered a constraint to the proposals.

²³ Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

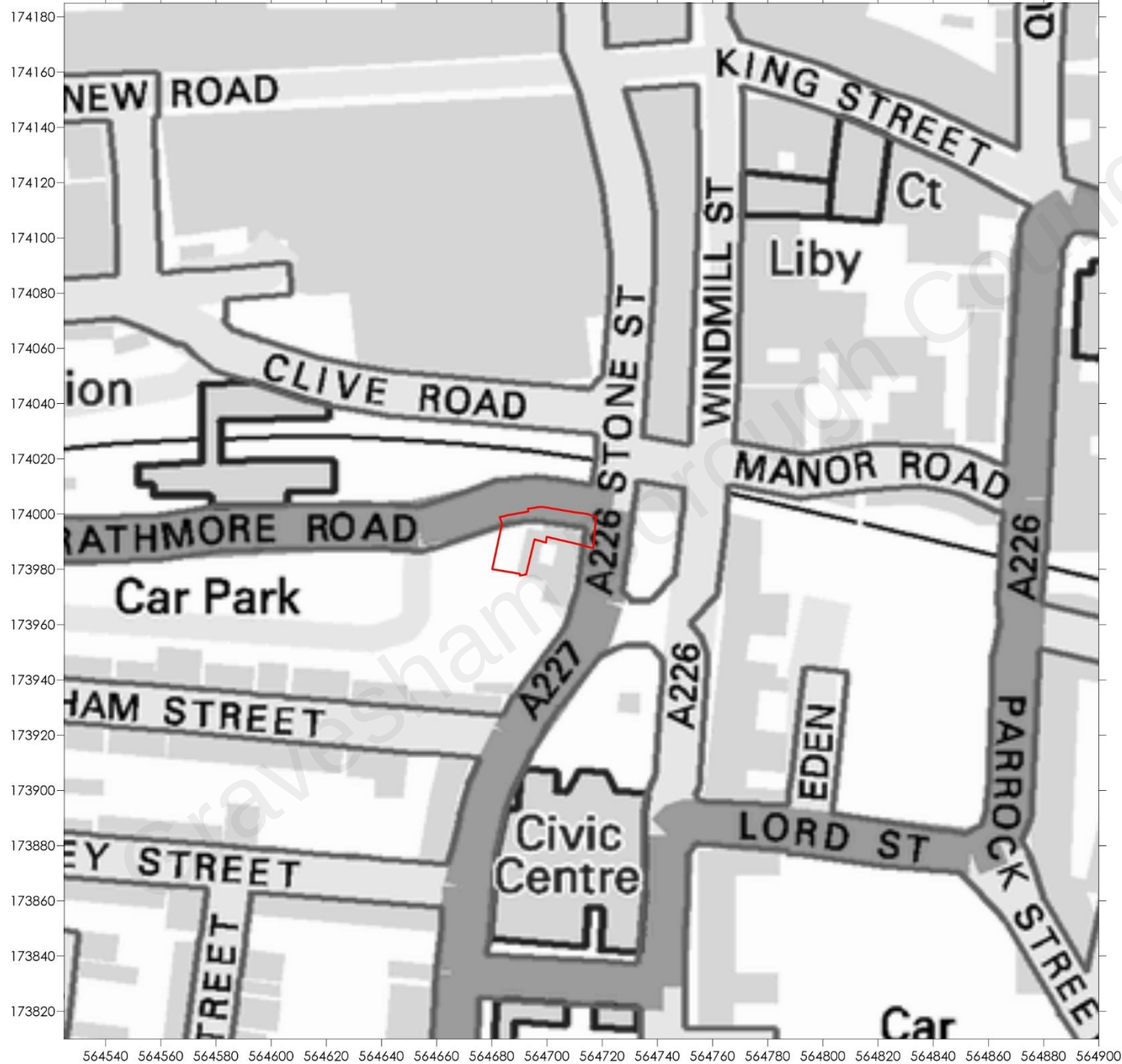
²⁴ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2015.

7.0 **ABBREVIATIONS**

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EU	European Union
GBC	Gravesham Borough Council
GCS	Gravesham Core Strategy
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LA	Local Authority
LAQM	Local Air Quality Management
LDV	Light Duty Vehicle
NGR	National Grid Reference
NPPF	National Planning Policy Framework
NPPG	National Planning Policy Guidance
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10µm
Z ₀	Roughness length

Figures

Gravesham Borough Council



Legend



Site Boundary

Title

Figure 1 - Site Location Plan

Project

Air Quality Assessment
24 Stone Street, Gravesend, Kent

Project Reference

1170-1

Client

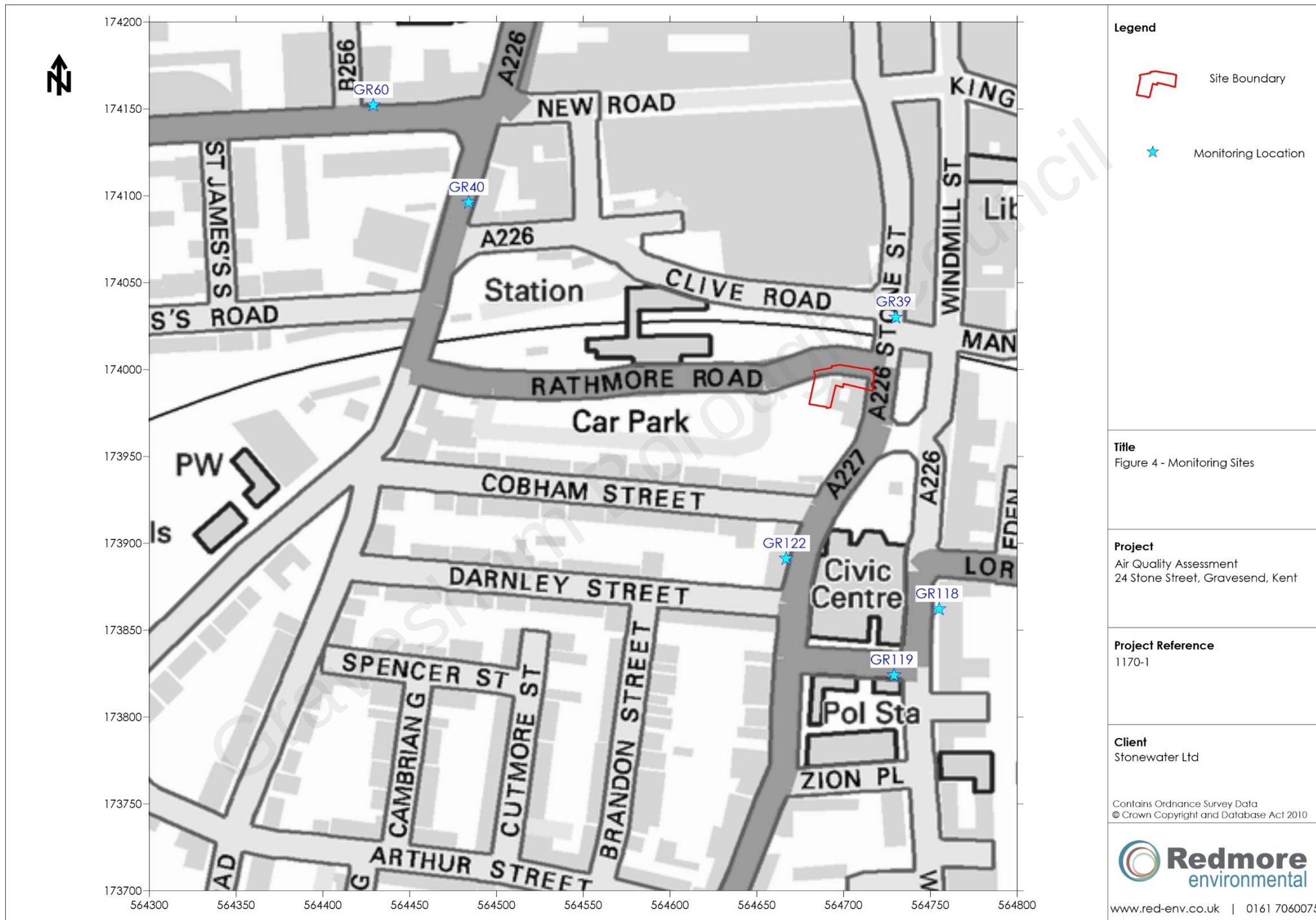
Stonewater Ltd

Contains Ordnance Survey Data
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Legend

- Site Boundary
- Monitoring Location

Title
Figure 4 - Monitoring Sites

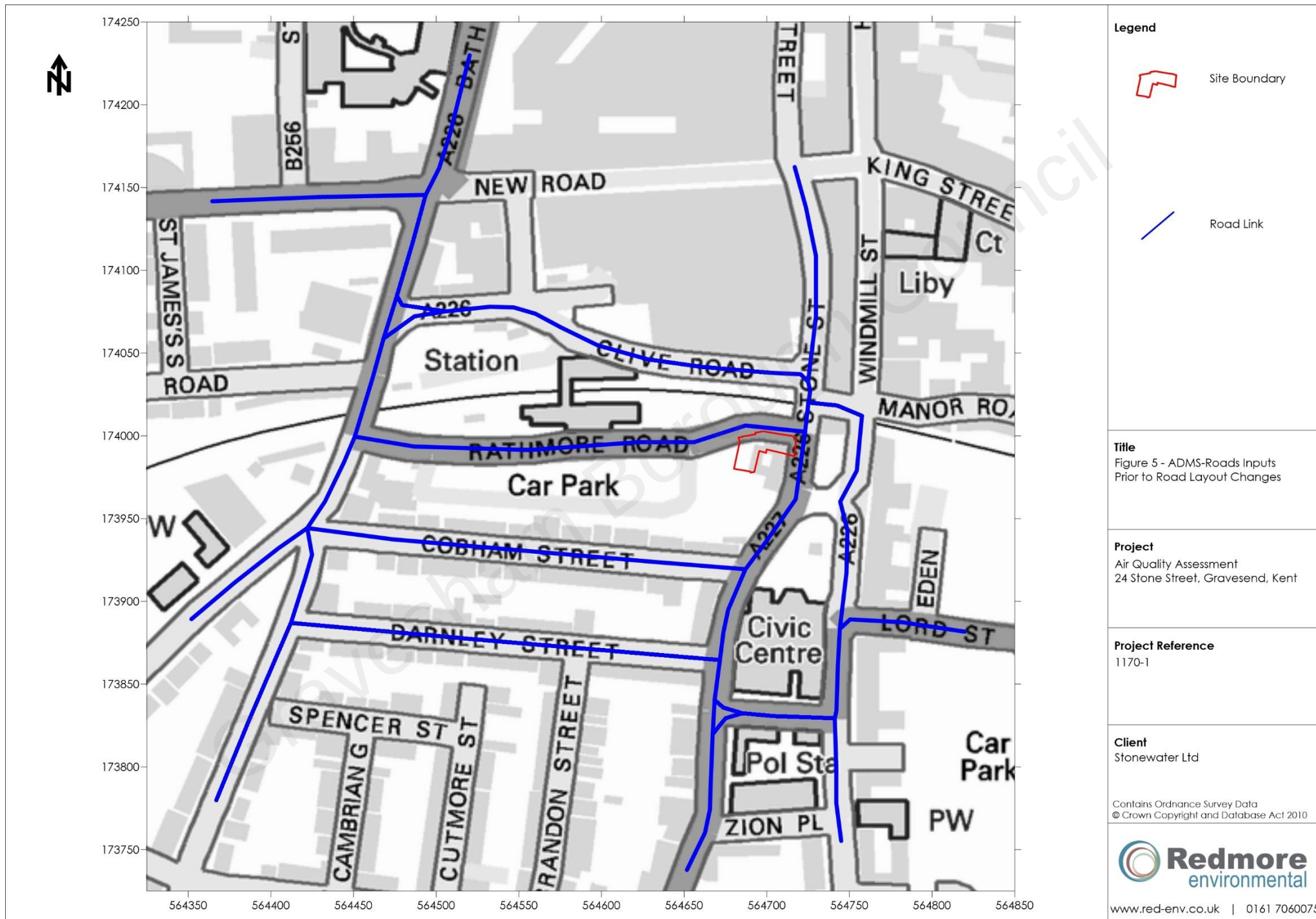
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Air Quality Assessment
24 Stone Street, Gravesend, Kent

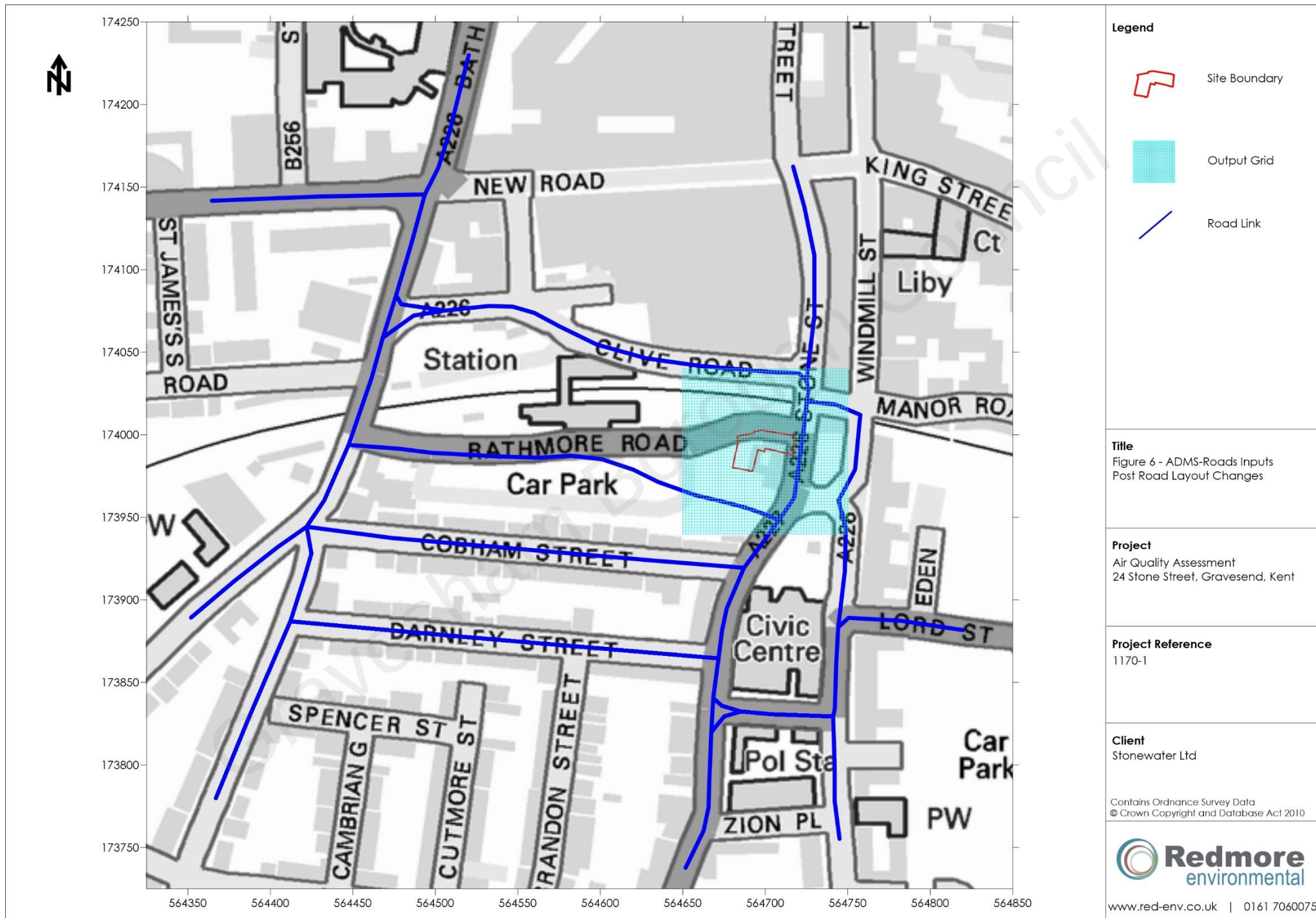
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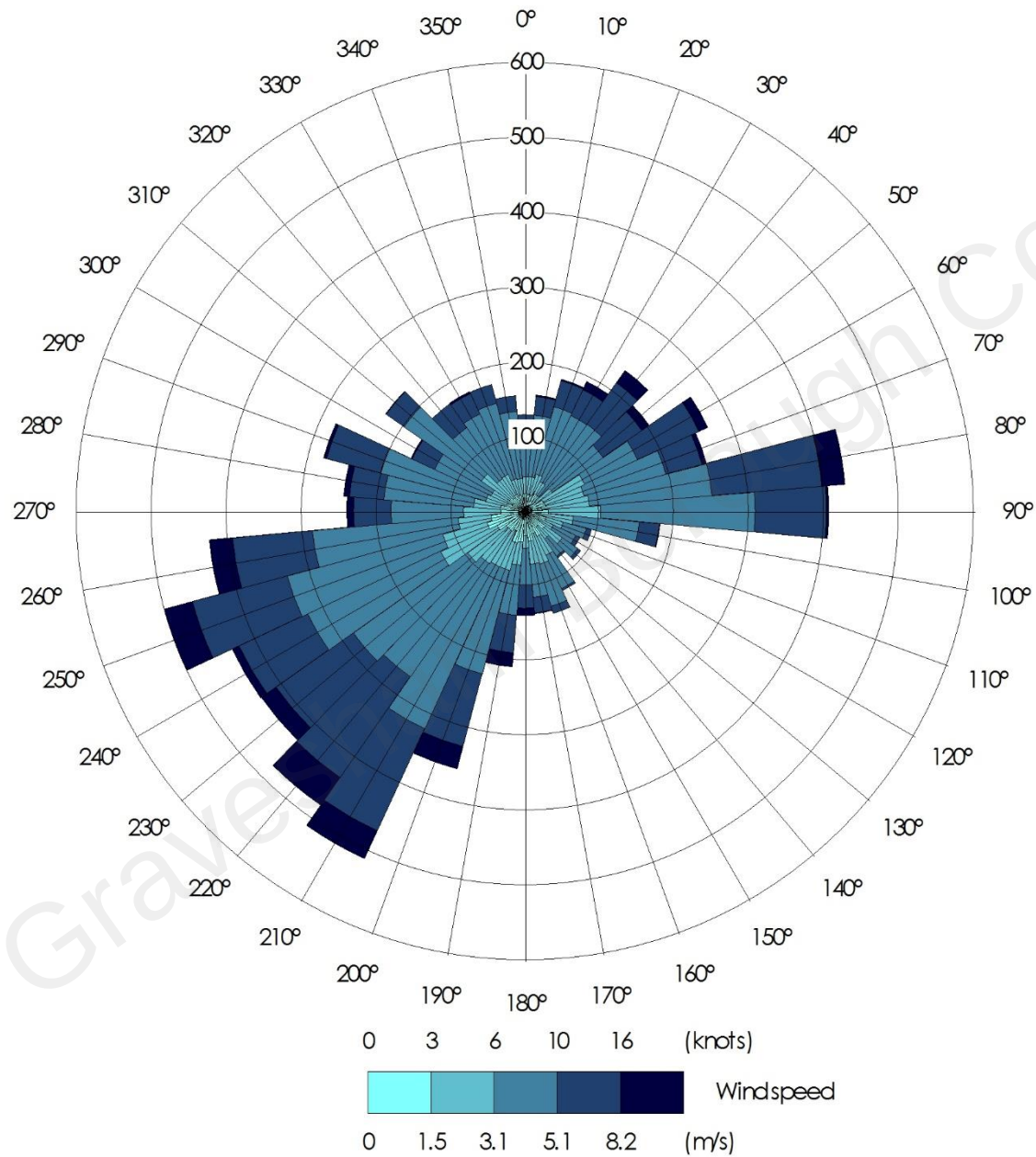
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Legend

Title

Figure 7 - Wind Rose of 2013
Gravesend Meteorological Data

Project

Air Quality Assessment
24 Stone Street, Gravesend, Kent

Project Reference

1170-1

Client

Stonewater Ltd



