Thurrock Flexible Generation Plant

Environmental Statement Volume 6
Appendix 12.8: Further Analysis of Air Quality in Gravesend

Date: February 2020

Environmental Impact Assessment

Environmental Statement

Volume 6

Appendix 12.8

Report Number: OXF10872

Version: Final

Date: February 2020

This report is also downloadable from the Thurrock Flexible Generation Plant website at:
http://www.thurrockpower.co.uk

Prepared by: Kathryn Barker

Checked by: Fiona Prismall

Reviewed by: Jon Pullen

Thurrock Power Ltd

1st Floor

145 Kensington Church Street

London W8 7LP

Table of Contents

List of Tables

List of Figures

Summary

This appendix provides further analysis of predicted NO_2 concentrations in Gravesend.

Qualifications

This appendix has been prepared by Kathryn Barker, a Member of the Institute of Air Quality Management (IAQM) and an Associate Member of the Institution of Environmental Sciences.

It has been checked by Fiona Prismall, a Chartered Environmentalist, Member of the Institution of Environmental Sciences and Fellow of the IAQM. Fiona is the IAQM committee secretary. Fiona was a member of the working groups that produced the IAQM 2014 ‘Guidance on the assessment of dust from demolition and construction’, the Environmental Protection UK & IAQM 2017 ‘Land-use Planning & Development Control: Planning for Air Quality’ guidance and the IAQM 2019 ‘A guide to the assessment of air quality impacts on designated nature conservation sites'.

It has been reviewed by Jon Pullen, a Chartered Scientist, Chartered Chemist, Member of the Royal Society of Chemistry, Member of the Institution of Environmental Sciences and Fellow of the IAQM. Jon sits on the committee of the IAQM and is co-author of the IAQM best practice guidance publications on: odour impact assessments for planning; construction dust assessments; minerals dust impact assessment; and the air quality mitigation. Jon is author of the IEMA Handbook chapter on environmental monitoring and measurement and wrote many of the Environment Agency`s Technical Guidance Notes on source and ambient air quality monitoring.

1. Further Analysis of Air Quality in Gravesend

1.1 Nitrogen Dioxide at West Street in Gravesend

1.1.1 Gravesham Borough Council has designated the entirety of the A226 one-way system in Gravesend as an AQMA due to elevated concentrations of NO_2 from road traffic.

1.1.2 Volume 3 Chapter 12: Air Quality outlines the predicted NO_2 concentrations at a number of receptors in Thurrock and Gravesend with the contribution from Thurrock Flexible Generation Plant. Predicted annual-mean NO_2 concentrations at the facades of modelled receptors are below the AQS objective for NO_2 for all but one receptor. At West Street, Gravesend (receptor 9), the predicted NO_2 concentration exceeds the AQS objective of 40 $\mu g.m^{-3}$ both with and without the proposed development. When the magnitude of change added by the development is considered in the context of the absolute concentration, the impact descriptor at this one descriptor is categorised as 'moderate adverse'.

1.1.3 At West Street, the Predicted Environmental Concentration (PEC) is 106% of the AQAL. This is in large part due to the underlying background Ambient Concentration (AC) which itself exceeds the AQAL.

1.1.4 For the main air quality assessment, no reduction in the background AC was assumed for future years and the predictions were therefore conservative. In reality, background traffic-related NO_2 concentrations in the UK would reduce over time, due to the progressive introduction of improved vehicle technologies and increasingly stringent limits on engine emissions.

1.1.5 For West Street (receptor 9), the AC in the main air quality assessment was based on the average measured concentration between 2013 and 2017[1] at the nearby monitoring location on West Street, coded as GR13. The table and graph below show the measured concentrations at GR13 in the last ten years.

Table 1.1: Annual-mean NO_2 Concentrations at GR13 ($\mu g.m^{-3}$).

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GR13	50	51	48	46	48.2	45.2	42.5	40.0	37.5	44	47.1

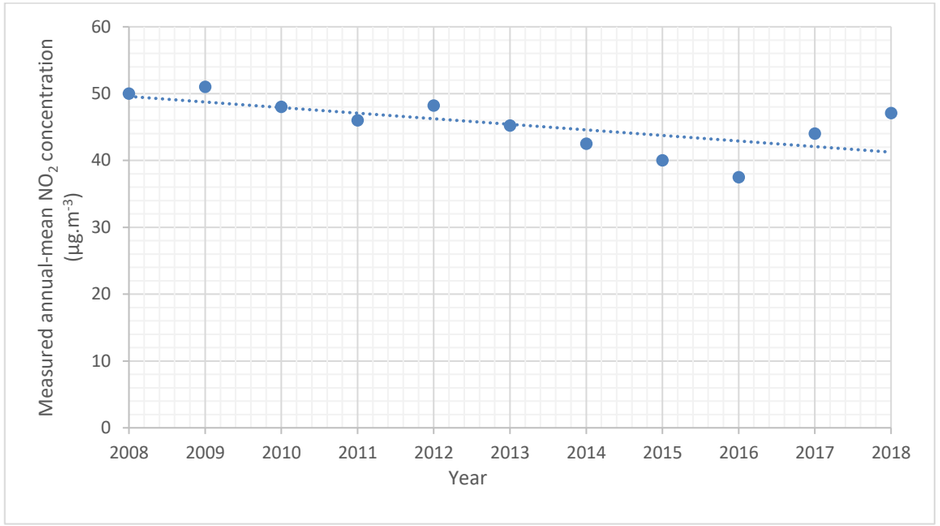

Figure 1.1: Annual-mean NO_2 Concentrations at GR13 ($\mu g.m^{-3}$).

1.1.6 The measured results show that at this location there is an overall downwards trend in NO_2 concentrations (notwithstanding the increases seen in 2017 and 2018). Therefore, adopting a value of 41.8 $\mu g.m^{-3}$ for the AC (the five-year average value from 2013-2017) is likely to be a conservative assumption for the opening year of 2022 and, in reality, the AC in the opening year is likely to be lower. However, the further, more detailed analysis in this appendix does not rely on this downward trend.

1.1.7 This appendix provides a further, more detailed analysis of air quality in the centre of Gravesend and predicts the annual-mean NO_2 concentrations in the opening year of the development, 2022 and future years, 2025 and 2030. As a quality-control check on the performance of the atmospheric dispersion model used for the predictions, modelling of traffic-related emissions has been undertaken for 2018 to allow a direct comparison with monitored concentrations for the same year.

[1] Monitoring data for 2018 for locations in Thurrock was not available at the time of assessment. Therefore, the AC for receptors in Gravesham are based on the average between 2013 and 2017 rather than 2014 to 2018 for consistency.

1.2 Model Comparison – 2018

1.2.1 Monitoring of NO_2 using diffusion tubes is undertaken by Gravesham Borough Council (GBC) at various locations in the centre of Gravesend. This study has predicted the annual-mean NO_2 concentrations at 22 of the Gravesham Council monitoring locations in 2018, to test how well the model is performing. Traffic data from the Department for Transport (DfT) website for 2018 was used in the roads modelling. The baseline concentrations used are the same as (or the nearest/most representative) the baseline concentrations used by GBC in its 2019 Annual Status Report, Table C.2 – Fall-off Distance Correction (GBC, 2019). Figure 1.2 shows the monitoring locations in Gravesend and the modelled road links.

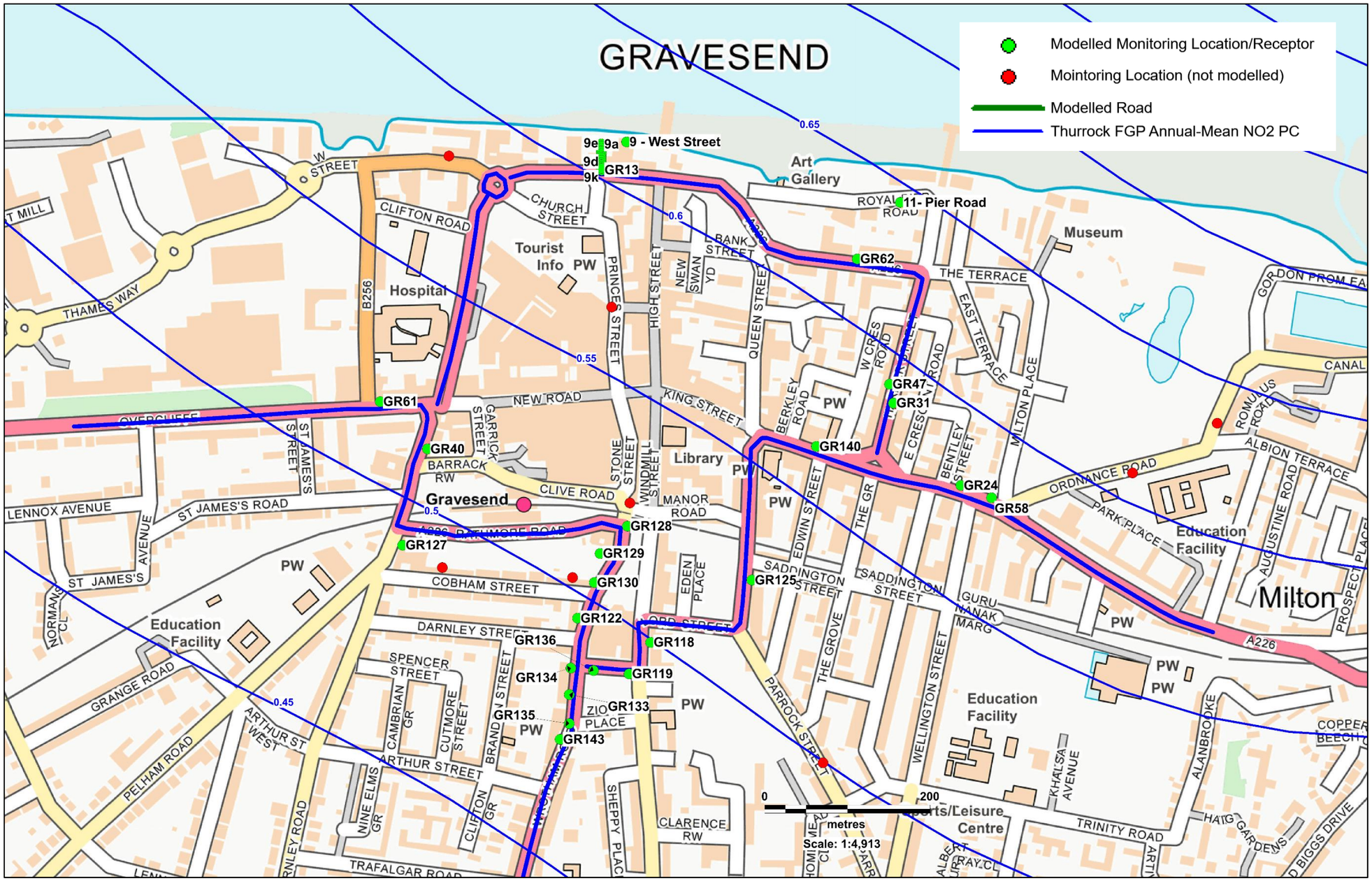

Figure 1.2: Modelled Monitoring Locations/Receptors and Modelled Road Links

1.2.2 The modelled and monitored concentrations have been compared in Table 1.2.

Table 1.2: Comparison of Modelled and Monitored Concentrations (µg.m^{-3}) in Gravesend

Receptor ID	Receptor Name	Monitoring Location Height (m)	Modelled		Monitored		Ratio
			NOx Road Contribution (µg.m^{-3})	Total NO_2 (µg.m^{-3})	NOx Road Contribution (µg.m^{-3})	Monitored/Modelled NOx Road Contribution	Monitored/ Modelled NOx Road Contribution
1	GR13	2.85	7.3	32.7	39.5	47.1	5.4
2	GR62	2.8	6.7	32.4	3.2	30.7	0.5
3	GR47	2.5	20.0	37.8	37.4	45.4	1.9
4	GR31	2.7	21.3	38.4	31.6	42.9	1.5
5	GR24	2.5	8.3	32.3	37.4	45.4	4.5
6	GR58	2.7	8.4	32.3	19.6	37.6	2.3
7	GR140	2.44	9.4	33.7	18.9	38.1	2.0
8	GR125	2.4	8.6	33.3	6.1	32.1	0.7
9	GR118	2.4	9.4	24.8	30.5	34.8	3.3
10	GR119	2.5	9.7	25.0	75.8	53.4	7.8
11	GR136	2.7	11.7	25.9	40.8	39.3	3.5
12	GR143	1.97	10.4	25.3	34.6	36.6	3.3
13	GR135	2.6	27.9	33.6	53.9	44.8	1.9
14	GR133	1.9	12.9	26.5	33.9	36.3	2.6
15	GR134	2	11.2	25.7	26.2	32.8	2.3
16	GR122	2.5	8.4	24.3	33.4	36.1	4.0
17	GR130	2.2	10.9	25.5	21.4	30.6	2.0
18	GR129	2.5	7.1	23.7	15.6	27.8	2.2
19	GR128	2.4	10.2	25.2	22.1	30.9	2.2
20	GR127	2.5	3.2	30.7	2.0	30.1	0.6
21	GR40	2.5	8.0	33.0	35.0	45.2	4.4
22	GR61	3	6.3	32.2	13.2	35.5	2.1

1.2.3 At most of the locations, the modelled concentrations for 2018 underpredicted the concentrations that were measured by the monitors. To correct for this, the ratio between the modelled and monitored NOx road contribution has been calculated for each monitoring location. This ratio has been used as an adjustment factor for the predicted concentrations in future years.

1.3 Predicted Concentrations – 2022, 2025 and 2030

Gravesham Monitoring Locations

1.3.1 Annual-mean NO_2 concentrations at the breathing height of sensitive receptors (as opposed to the heights of the monitoring locations) have been modelled in the opening year of the Thurrock Flexible Generation Plant, 2022, and the future years of 2025 and 2030. The modelled road NOx contribution has been multiplied by the individual adjustment factors outlined in Table 1.2 and converted to NO_2 using Defra's NOx to NO_2 calculator. The process contributions (PCs) from the Thurrock Flexible Generation Plant stack emissions and the other cumulative developments for West Street (receptor 9) (0.6 µg.m^{-3} and 0.5 µg.m^{-3} respectively) have been added to the predicted concentrations for all monitors to derive a cumulative PEC.

1.3.2 Table 1.3 shows the cumulative PEC for each modelled location. Figure 1.2 shows the modelled locations and the Thurrock Flexible Generation Plant PC from stack emissions.

Table 1.3: Long-term Predicted NO_2 Concentrations (µg.m^{-3}) in Gravesend – Gravesham Monitoring Locations

Receptor ID	Receptor Name	Sensitive Receptor Breathing Height (m)	2022		2025		2030	
			Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})	Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})	Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})
1	GR13	1.5	48.4	49.5	43.8	44.9	38.8	39.9
2	GR62	1.5	32.3	33.4	31.5	32.6	30.6	31.8
3	GR47	1.5	40.5	41.7	37.5	38.7	34.3	35.4
4	GR31	1.5	39.2	40.3	36.5	37.6	33.6	34.7
5	GR24	4.5	35.8	36.9	33.9	35.0	31.9	33.0
6	GR58	1.5	36.9	38.0	34.8	35.9	32.5	33.6

Receptor ID	Receptor Name	Sensitive Receptor Breathing Height (m)	2022		2025		2030	
			Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})	Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})	Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})
7	GR140	4.5	32.8	34.0	31.9	33.1	30.9	32.1
8	GR125	1.5	32.7	33.8	31.8	32.9	30.8	32.0
9	GR118	1.5	31.9	33.0	29.0	30.2	25.9	27.0
10	GR119	1.5	51.0	52.2	44.1	45.2	36.1	37.2
11	GR136	1.5	39.0	40.1	34.6	35.7	29.6	30.8
12	GR143	1.5	33.2	34.3	30.1	31.2	26.6	27.7
13	GR135	1.5	39.6	40.7	35.1	36.2	30.0	31.1
14	GR133	1.5	32.9	34.0	29.8	31.0	26.4	27.6
15	GR134	1.5	30.1	31.2	27.7	28.8	25.0	26.1
16	GR122	1.5	33.5	34.6	30.3	31.4	26.8	27.9
17	GR130	1.5	28.7	29.8	26.6	27.7	24.3	25.4
18	GR129	1.5	26.1	27.2	24.6	25.7	23.0	24.1
19	GR128	1.5	29.1	30.2	26.9	28.0	24.5	25.6
20	GR127	1.5	30.3	31.5	30.0	31.1	29.7	30.8
21	GR40	4.5	36.3	37.4	34.5	35.6	32.6	33.7
22	GR61	1.5	35.1	36.3	33.6	34.7	32.0	33.1

Note: Cells in grey show where the AQAL is predicted to be exceeded.

1.3.3 In 2022 it is predicted that there will be six locations where the annual-mean NO_2 concentration exceeds the AQAL, GR13, GR47, GR31, GR119, GR136, GR135.

1.3.4 GR119 and GR136 are not considered to be representative locations for sensitive receptors: the nearest residential receptors are closer to monitoring locations GR134 and GR118 where the predicted cumulative PECs are 31.2 and 33.0 µg.m^{-3} respectively. On that basis, the predicted concentrations at GR119 and GR136 are not considered further.

1.3.5 Aside from GR119, GR13 has the highest predicted cumulative PEC of 49.5 µg.m^{-3}. This is likely to be due in part to the location of the diffusion tube. The diffusion tube is located approximately 2 m from the kerb and 0.08 m from relevant exposure. The screenshot below taken from Google Streetview shows the location on the zebra crossing post.

Figure 1.3: GR13 Monitoring Location

1.3.6 The location is likely to experience higher levels of NO_2 than other areas on this road because the traffic will slow down before and accelerate after the zebra crossing. Dispersion at this location is also partially impeded by the building directly next to the diffusion tube. Monitor GR62 located on the same road approximately 330 m to the east has a cumulative PEC of 33.4 µg.m^{-3} which indicates that predicted concentrations on other more open parts of West Street are lower. It is likely that the area around GR13 is a hotspot and so elevated NO_2 concentrations are only expected to affect a small number of sensitive receptors in the immediate area. This is based on measured concentrations in 2018 which were the highest measured at GR13 since 2012 and prior to 2017 had been steadily decreasing each year.

1.3.7 To determine how quickly the NO_2 concentrations are predicted to decrease with increased distance from the road, a transect of points at varying distances from the road at GR13 have been modelled. The results are discussed later in this appendix.

1.3.8 The monitors in Harmer Street, GR47 and GR31, are in a street canyon which will have contributed to the elevated NO_2 concentrations measured. Modelling shows that by 2025 the cumulative PEC will not exceed the AQAL.

1.3.9 GR135 is located in a street canyon on Wrotham Road close to a small number of residential properties. It is located approximately 20 m from GR143 which is also in a street canyon but where the predicted PEC in 2022 is only 34.3 µg.m^{-3}. This indicates that the elevated NO_2 concentrations measured at GR135 in 2018 are likely to be confined to very few receptors. Modelling shows that by 2025 the cumulative PEC will not exceed the AQAL.

Transect

1.3.10 A transect of points at varying distances from the road at GR13 have been modelled to predict how quickly the NO_2 concentrations would decrease with increased distance from the road. The results are presented in Table 1.4.

Table 1.4: Long-term Predicted NO_2 Concentrations (µg.m^{-3}) in Gravesend – Transect from GR13, West Street

Transect ID	Distance from Kerb (m)	2022		2025		2030	
		Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})	Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})	Predicted NO_2 Concentration without Thurrock FGP (µg.m^{-3})	Cumulative PEC (µg.m^{-3})
A	34	34.0	35.1	32.5	33.7	31.0	32.1
B	31	34.3	35.4	32.8	33.9	31.1	32.3
C	28	35.5	36.7	33.9	35.1	32.2	33.4
D	25	36.1	37.2	34.3	35.5	32.5	33.6
E	22	35.8	37.0	33.9	35.0	31.9	33.0
F	19	36.5	37.7	34.5	35.6	32.3	33.4
G	17	38.0	39.1	35.8	36.9	33.4	34.6
H	14	39.0	40.1	36.5	37.7	33.9	35.1
I	11	39.5	40.6	36.7	37.8	33.7	34.9
J	8	41.0	42.1	37.8	39.0	34.5	35.6
K	6	43.5	44.6	40.0	41.1	36.2	37.4
L	4	45.5	46.6	41.6	42.7	37.3	38.4
GR13	2	48.4	49.5	43.8	44.9	38.8	39.9

1.3.11 In 2022 and 2025 the cumulative PEC is expected to exceed the AQAL within 14 m and 6 m of the kerb respectively. By 2030 the cumulative PEC is not predicted to exceed the AQAL at GR13. This illustrates that only receptors adjacent to West Street are likely to experience NO_2 concentrations that exceed the AQAL.

Gravesham Air Quality Action Plan

1.3.12 GBC's 2019 Annual Status Report (GBC, 2019) includes a number of actions to improve air quality in the borough.

"*The following actions are considered to be key future priorities in ensuring reductions continue:*

- *Locate new mixed use development in areas with best access to services and facilities which minimise the need to travel, particularly by car;*
- *Improve the local economy to reduce the need for out-commuting. This can also have an impact on air quality;*
- *Support and where possible provide alternatives to help support a modal shift away from car based transport, e.g. improve public transport including bus, train, cycling and walking provision, and increase the use of water based transport; and*
- *Ameliorate the implications of additional traffic for air quality."*

1.3.13 With these actions in place the future NO_2 concentrations are likely to be lower than those presented in this appendix.

1.4 Conclusions

1.4.1 This appendix highlights that by 2022 there are a few small areas where the annual-mean NO_2 concentrations are predicted to exceed the AQAL of 40 µg.m^{-3}. These areas are likely to be restricted to a few sensitive receptors that are adjacent to the road on West Street (GR13) and Harmer Street (GR47 and GR31).

1.4.2 By 2025 only receptors adjacent to West Street are predicted to experience NO_2 concentrations that exceed the AQAL.

1.4.3 By 2030 NO_2 concentrations are expected to be below the AQAL at all receptors within Gravesham.

2. References

Gravesham Borough Council, 2019, Annual Status Report 2019.