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NHS Wales

NVCC ENABLING WORKS

Air Quality Monitoring Quarterly Report



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Air Quality Monitoring Quarterly Report

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70066877

OUR REF. NO. 001

DATE: SEPTEMBER 2023

WSP

The Forum
Barnfield Road
Exeter, Devon
EX1 1QR

Phone: +44 1392 229 700

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Quarterly Report			
Date	15/09/2023			
Prepared by	Caroline Odbert			
Signature				
Checked by	Peter Walsh			
Signature	<i>P. S. Walsh</i>			
Authorised by	Peter Walsh			
Signature	<i>P. S. Walsh</i>			
Project number	70066877			
Report number	Q006			
File reference	\\uk.wspgroup.com\central data\Projects\700668xx\70066877 - nVCC Enabling Works\03 WIP\Air Quality\Reports\Reports\Quarterly Reports			

CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	3
2. MONITORING METHODOLOGY	3
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2.1. MONITORING TECHNIQUES	3
2.2. AIR QUALITY OBJECTIVES AND STANDARDS	5
2.3. DEFRA AIR QUALITY INDEX	6
3. MONITORING RESULTS	7
<hr/>	
3.1. NO ₂ DIFFUSION TUBES	7
3.2. ZEPHYR CONTINUOUS MONITOR	8
3.3. DM11	11
4. SUMMARY	12
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APPENDICES

APPENDIX A MONITORING LOCATIONS

EXECUTIVE SUMMARY

WSP has been commissioned by NHS Wales to undertake air quality monitoring to meet Cardiff Councils (CC) Pre-commencement planning condition 11 in relation to the Temporary Construction Access Route for the Construction of the Approved Velindre Cancer Centre, Cardiff, CF14 7XB.

During construction works there is the potential for air quality impacts from the generation of dust and particulate matter, which could lead to dust soiling and human health impacts at relevant sensitive receptors. There is also the potential for increases in pollutant emissions from construction vehicles using the local road network.

This report provides a summary of the monitoring data for the period between 21st April and 19th July 2023. Defra's Air Quality Index¹ has been used to provide a useful indication of the levels of air pollution (See Figure 2-1 in main report). The index is divided into four bands (low (green), moderate (yellow/orange), high (red), very high (purple)). Summary tables of the monitored concentrations is provided below, the background colour assigned to each of the cells corresponds to Defra's Air Quality Index. All concentrations were low and below the relevant Air Quality Objectives.

Summary of Average Monitored Diffusion Tube Nitrogen Dioxide (NO₂) Concentrations, 21st April 2023 to 19th July 2023

Monitor Type	Location	NO ₂ Concentration (µg/m ³)
		Annual Average (annualised and bias-adjusted to 2022)
Diffusion Tube	Vel 1: Lamppost 15, Park Road	22.2
	Vel 2: Lamppost 17, Corner of Park Road and Park Avenue	21.7
	Vel 3: Lamppost 25, Pendwyallt Road opposite Lon Y Celyn	18.8
	Vel 4: Lamppost 1, Hollybush Inn	20.7
	Vel 5: Lamppost 7, Pendywyallt Road opposite No. 32	28.8
	Vel 6: Coryton Junior School	11.9
	Vel 8: Coryton Junior School – side entrance	13.7

¹ <https://uk-air.defra.gov.uk/air-pollution/daq>

Summary of Monitored Zephyr Nitrogen Dioxide (NO₂) Concentrations, 21st April 2023 to 19th July 2023

Monitor Type	Location	NO ₂ Concentration (µg/m ³)	
		Average	Maximum
Zephyr Monitors	Lamppost 1, Z1381 Hollybush Inn	9.1	59.2
	Lamppost 15, Z942 Park Road	15.2	50.2

Summary of Monitored Zephyr Particulate Matter (PM₁₀ and PM_{2.5}) Concentrations, 21st April 2023 to 19th July 2023

Monitor Type	Location	PM ₁₀ Concentrations (µg/m ³)			PM _{2.5} Concentrations (µg/m ³)	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
Zephyr Monitors	Lamppost 1, Z1381 Hollybush Inn	8.4	37.9	26.6	5.7	23.3
	Lamppost 15, Z942 Park Road	10.2	34.9	25.5	7.0	23.6

Summary of Monitored DM11 Pro Particulate Matter (PM₁₀ and PM_{2.5}) Concentrations, 21st April 2023 to 19th July 2023

Monitor Type	Location	PM ₁₀ Concentrations (µg/m ³)			PM _{2.5} Concentrations (µg/m ³)	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
DM11 Pro Monitors	19 Park Road	13.9	27.0	19.8	13.3	26.7
	On-Site	15.4	91.9*	23.9	13.7	27.0

*Note that background colour applied is based on bandings which are classed for a 24-hour running mean PM₁₀ concentration not an hourly PM₁₀ concentration band.

1. INTRODUCTION

- 1.1.1. WSP has been commissioned by NHS Wales to undertake air quality monitoring to meet Cardiff Councils (CC) Pre-commencement planning condition 11 in relation to the Temporary Construction Access Route for the Construction of the Approved Velindre Cancer Centre, Whitchurch Hospital, Park Road, Whitchurch, Cardiff, CF14 7XB.
- 1.1.2. Condition 11 (CC Reference: 20/01110/MJR) states that:
- “Prior to commencement of the development hereby approved details of an air monitoring unit and its location shall be submitted to and approved in writing with the Local Planning Authority. The monitoring unit shall be implemented in accordance with the approved details and remain operational until cessation of the development. Data from the air monitoring unit shall be provided to the Local Planning Authority on request.*
- Reason: To monitor air quality in accordance with Policy EN13 of the adopted Cardiff Local Plan (2006-2026).’*
- 1.1.3. During construction works there is the potential for air quality impacts from the generation of dust and particulate matter, which could lead to dust soiling and human health impacts at relevant sensitive receptors. There is also the potential for increases in pollutant emissions from construction vehicles using the local road network.
- 1.1.4. In order to discharge the pre-commencement planning condition 11, on behalf of NHS Wales, WSP is carrying out monitoring in the study area using Nitrogen Dioxide (NO₂) diffusion tubes and using Zephyr and DM11 Pro continuous monitors. The air quality monitoring within the study area is being undertaken to ensure that dust and vehicle exhaust emissions from construction traffic are monitored and effectively managed. This report provides a summary of the monitoring data for the period between 21st April and 19th July 2023.

2. MONITORING METHODOLOGY

2.1. MONITORING TECHNIQUES

DIFFUSION TUBE MONITORING

- 2.1.1. The diffusion tubes are passive samplers which are used to measure ambient concentrations of NO₂. The tubes are designed to provide an indication of longer-term average NO₂ concentrations and are useful in identifying areas of high concentrations in relation to road traffic emissions. They are not suitable for identifying short-term pollution events. In order to compare how well the diffusion tubes are performing against a reference method (i.e. a continuous analyser), three tubes have been co-located with the Castle Street continuous monitoring site.
- 2.1.2. The diffusion tubes have been located at 7 locations on accessible points along the main road network and where possible at relevant receptors (e.g. school) to assess any changes in NO₂ concentrations at those locations as a result of the construction traffic (see Table 2-1 and Figure in Appendix A). The tubes are changed over typically every 4 weeks and are then sent to Gradko Laboratories for analysis.

Table 2-1 - Diffusion Tube Monitoring Locations

Tube ID	Location	X (m)	Y (m)
Vel 1	Lamppost 15, Park Road	314782	180711
Vel 2	Lamppost 17, Corner of Park Road and Park Avenue	314723	180758
Vel 3	Lamppost 25, Pendwyallt Road opposite Lon Y Celyn	314537	180951
Vel 4	Lamppost 1, Hollybush Inn	314520	180993
Vel 5	Lamppost 7, Pendywyallt Road opposite No. 32	314348	181128
Vel 6	Coryton Junior School	314321	181107
Vel 8	Coryton Junior School – side entrance	314291	181157

CONTINUOUS MONITORS

- 2.1.3. Concentrations of Particulate Matter (PM₁₀ and PM_{2.5}) and NO₂ are being continuously monitored at four locations within the study area (See Table 2-2 and Figure in Appendix A). There is a Zephyr monitor (NO₂, PM₁₀ and PM_{2.5}) located close to the Hollybush Estate site and one located on Park Road, closer to the construction site entrance. There is a DM11 Pro monitor (PM₁₀ and PM_{2.5}) located on Park Road close to the construction site entrance and also a DM11 Pro located on-site.
- 2.1.1. The Zephyr and DM11 Pro are able to detect localised pollution events and fluctuations in the concentrations and can send alerts to the project team when concentrations go above a certain threshold. The Zephyr continuous monitoring devices are supplied by Earthsense and the DM11 Pro by Air Quality Monitors, data from each of the monitors is uploaded onto a cloud system/website where it can be viewed and downloaded by specific individuals.

Table 2-2 - Continuous Monitor Locations

Monitor ID	Location	X (m)	Y (m)
Zephyr	Z1381	Lamppost 1, Hollybush Inn	314520
	Z942	Lamppost 15, Park Road	314782
DM11 Pro	332	19 Park Road	314887
	333	On-Site	314533

2.2. AIR QUALITY OBJECTIVES AND STANDARDS

- 2.2.1. The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)². The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation³.
- 2.2.2. The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.
- 2.2.3. The air quality objectives are policy-based targets set by the Government, which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e., a limited number of permitted exceedances of the standard over a given period.
- 2.2.4. The relevant standards and objectives for this monitoring programme are given in below.

Table 2-3 – Relevant Air Quality Objectives and Standards

Pollutant	Concentration ($\mu\text{g}/\text{m}^3$)	Duration	Exceedances Allowed
Nitrogen Dioxide	200	1-hour mean	18
	40	Annual mean	-
Particulate matter (PM_{10})	40	Annual mean	-
	50	24-hour mean	35
Particulate matter ($\text{PM}_{2.5}$) *	20	Annual mean	-

* Local Authorities are required to work towards reducing emissions/concentrations of particulate matter within their administrative area, however, there is no statutory objective given in the AQS for $\text{PM}_{2.5}$ at this time, only a framework.

- 2.2.5. The UK Government published its Environmental Targets (Fine Particulate Matter) (England) Regulations on 30th January 2023⁴. The regulations include a long-term target annual mean $\text{PM}_{2.5}$ concentration of $10\mu\text{g}/\text{m}^3$ and an exposure reduction target of 35% when compared to 2018 levels, both to be met by 2040. There is also an interim $\text{PM}_{2.5}$ target, which is to be met by the end of January 2028, of $12\mu\text{g}/\text{m}^3$ as an annual mean concentration and a 22% reduction in exposure when compared to 2018 levels.

² Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)

³ The UK formally left the EU on 31st January 2020 and new air quality legislation for the UK will be brought forward in due course.

⁴ Environmental Targets (Fine Particulate Matter) (England) Regulations 2023

2.3. DEFRA AIR QUALITY INDEX

- 2.3.1. A summary of available monitored concentrations for the period 21st April to 19th July 2023 are provided in Section 3. In addition, to the monitored concentrations, reference is also made to Defra's Air Quality Index⁵ which provides a useful indication of the levels of air pollution. The index is divided into four bands (low, moderate, high, very high), and the index is numbered from 1 to 10 within these bands (Figure 2-1). The bandings are based on hourly mean concentrations, however, can be used in relation to the diffusion tube monitoring results to provide an indication of the levels of air pollution.

Nitrogen Dioxide										
Based on the hourly mean concentration.										
Index	1	2	3	4	5	6	7	8	9	10
Band	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	Very High
µg/m ³	0-67	68-134	135-200	201-267	268-334	335-400	401-467	468-534	535-600	601 or more

PM₁₀ Particles										
Based on the daily mean concentration for historical data, latest 24 hour running mean for the current day.										
Index	1	2	3	4	5	6	7	8	9	10
Band	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	Very High
µg/m ³	0-16	17-33	34-50	51-58	59-66	67-75	76-83	84-91	92-100	101 or more

PM_{2.5} Particles										
Based on the daily mean concentration for historical data, latest 24 hour running mean for the current day.										
Index	1	2	3	4	5	6	7	8	9	10
Band	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	Very High
µgm ⁻³	0-11	12-23	24-35	36-41	42-47	48-53	54-58	59-64	65-70	71 or more

Figure 2-1 – Defra Air Quality Index

⁵ <https://uk-air.defra.gov.uk/air-pollution/daq>

3. MONITORING RESULTS

3.1. NO₂ DIFFUSION TUBES

- 3.1.1. The results of the monitoring completed across the study area between 21st April and 19th July 2023 are provided in Table 3-1 below. The background colour assigned to each of the results corresponds to Defra's Air Quality Index.
- 3.1.2. The raw monthly monitored concentrations were below the annual mean objective of 40µg/m³ for each of the monitoring periods. Once annualised and bias adjusted the results are well below the annual mean objective.
- 3.1.3. As with the previous monitoring reports, monitored concentrations were highest overall at the Vel 5 diffusion tube site which is located at Lamppost 7, Pendywyallt Road opposite No. 32. This location is closer to the roadside than residential premises, or nearby footpaths, and will be impacted from emissions from vehicle exhausts. Concentrations will be lower at the nearby residential properties which are set further back from the roadside. Monitored concentrations were lowest at the Vel 6 and Vel 8 diffusion tube sites which are located within and next to the Coryton Junior School and considered representative of background concentrations.

Table 3-1 - Summary of NO₂ Diffusion Tube Concentrations between 21st April to 19th July 2023

Sampling Location	NO ₂ Concentration (µg/m ³)			
	Monthly concentrations			Annual Average (annualised and bias-adjusted for 2022)
	From: 21/04/2023 To: 24/05/2023	From: 24/05/2023 To: 21/06/2023	From: 21/06/2023 To: 19/07/2023	
Vel 1	21.8	20.9	15.4	22.2
Vel 2	20.7	14.3	20.2	21.7
Vel 3	-	17.7	12.5	18.8
Vel 4	20.4	15.0	16.9	20.7
Vel 5	29.5	24.2	25.1	28.8
Vel 6	11.4	7.6	7.0	11.9
Vel 8	13.3	10.2	6.9	13.7

* Results have been annualised following the methodology in LAQM.TG (22)⁶, a local bias adjustment factor was used. The annualization process used a combination of urban background, urban centre (UC) and roadside (RS) sites. Although it is not ideal to use UC and RS sites, they have been used due to being only available sites with sufficient data capture.

⁶ Defra (2022) Local Air Quality Management Technical Guidance (TG22) Sept 2022.

3.2. ZEPHYR CONTINUOUS MONITOR

Data Capture

- 3.2.1. The cartridge for the Hollybush Inn Zephyr (Z1381) was replaced at the beginning of May and this monitor began recording again on the 6th May 2023, data capture at this site for the monitoring period 21st April to 19th July 2023 was 83.3%. The Park Road Zephyr (Z942) had 100% data capture during this monitoring period for all pollutants.

Nitrogen Dioxide

- 3.2.2. Figure 3-1 shows the NO₂ data monitored at each of the Zephyr continuous monitors for the monitoring period and a summary of the monitored concentrations is provided in Table 3-1.
- 3.2.3. Average NO₂ concentrations across the monitoring period at both the monitoring sites were well below the air quality objective of 40µg/m³. There were also no exceedances of the one-hour objective (200µg/m³) at either of the sites.

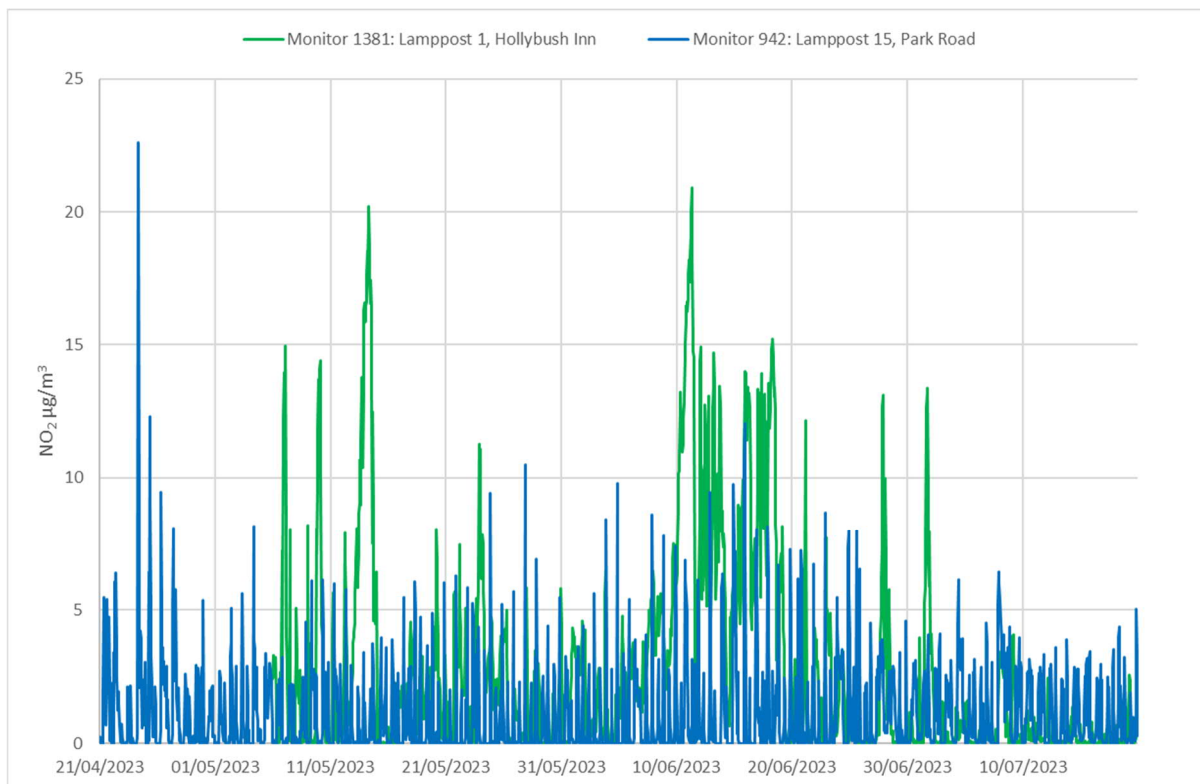


Figure 3-1 - Monitored Zephyr NO₂ Concentrations (µg/m³)

Table 3-2 - Summary of NO₂ Concentrations (21st April to 19th July 2023)

Monitor	Location	NO ₂ Concentration Summary	
		Average of Hourly Concentrations	Maximum Hourly Concentration
Z1381	Lamppost 1, Hollybush Inn	9.1	59.2
Z942	Lamppost 15, Park Road	15.2	50.2

Particulate Matter (PM₁₀ and PM_{2.5})

- 3.2.4. Figure 3-2 and Figure 3-3 respectively, show the PM₁₀ and PM_{2.5} data monitored at each of the Zephyr continuous monitors for the monitoring period.
- 3.2.5. Average concentrations of PM₁₀ and PM_{2.5} at both the continuous monitors are below the respective annual mean objectives of 40µg/m³ and 20µg/m³ during the monitoring period. In addition, there were no 24-hour mean concentrations above 50µg/m³. Average concentrations of PM_{2.5} were also below the target concentration of 10µg/m³.
- 3.2.6. Overall, the PM₁₀ and PM_{2.5} concentrations follow a similar trend at both monitor locations, there were several peaks in both PM₁₀ and PM_{2.5} monitored at both sample locations. Given the peaks were recorded at both sites, it suggests more of a regional influence driving the spike in ambient PM₁₀ and PM_{2.5} and the peaks in concentrations only lasted for a short period of time.

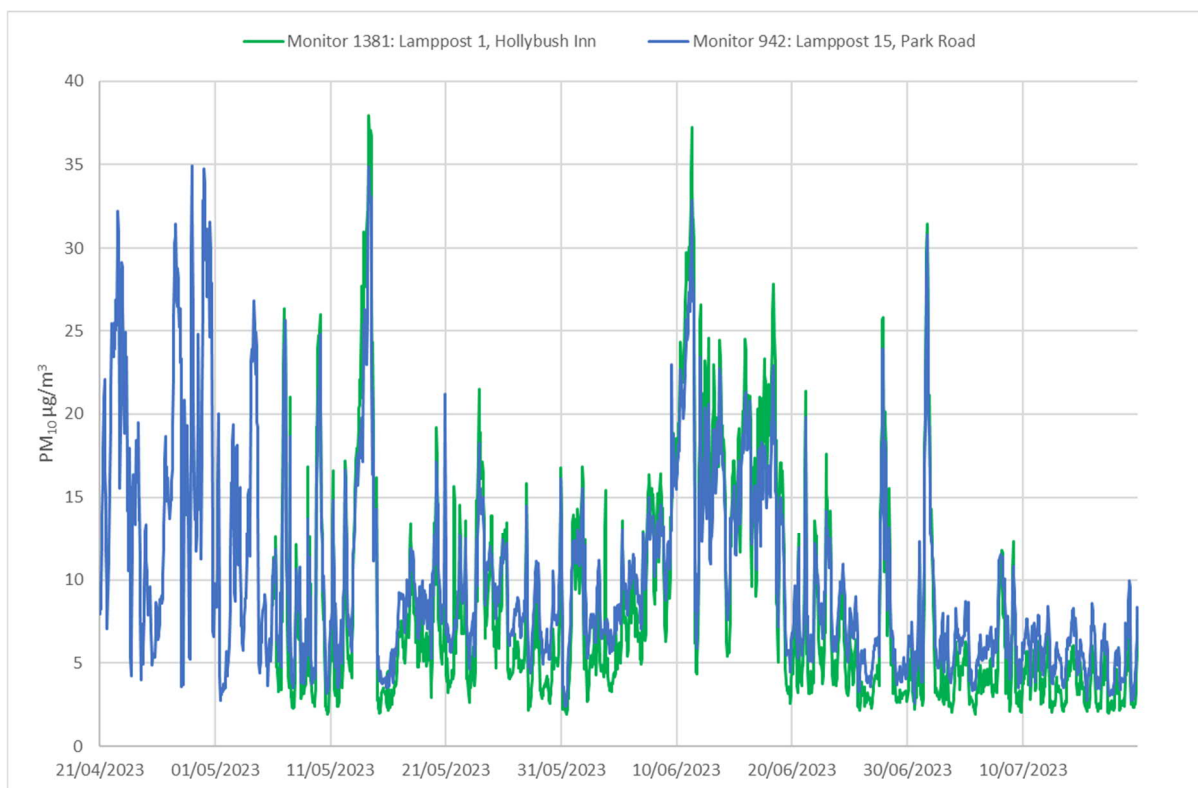


Figure 3-2 - Monitored Zephyr PM₁₀ Concentrations (µg/m³)

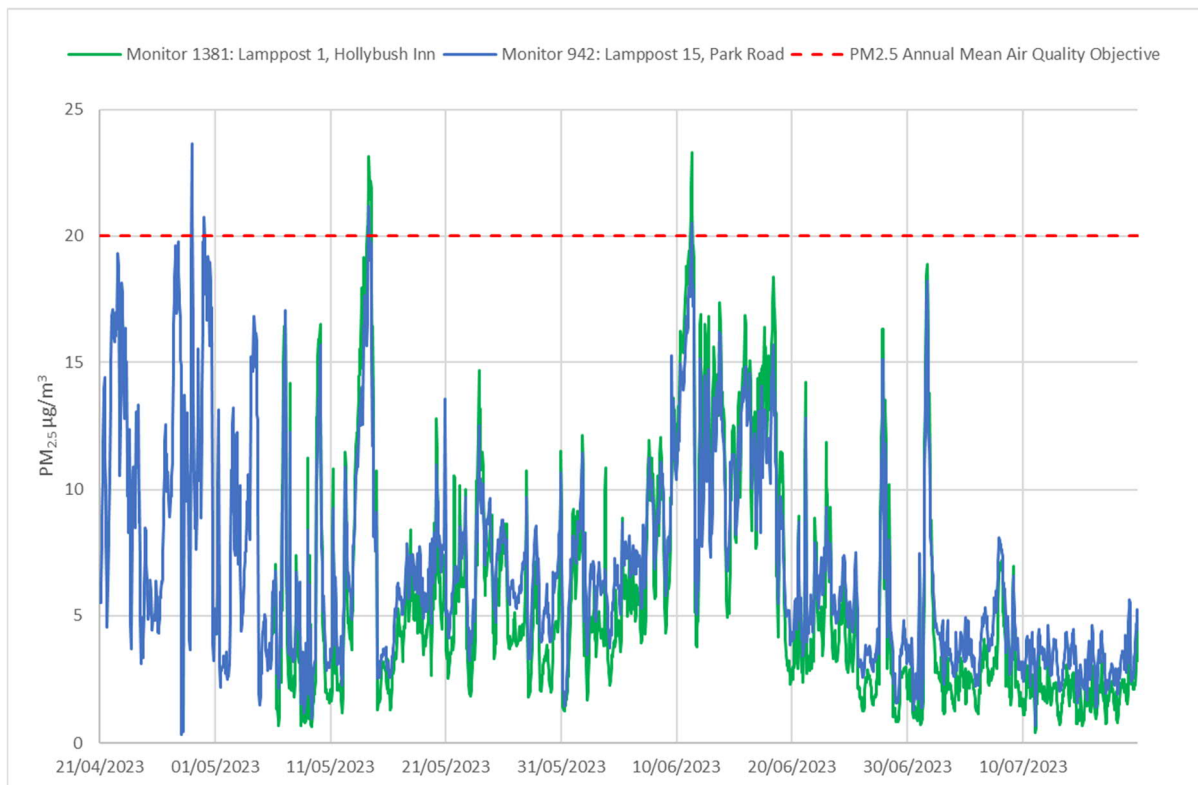


Figure 3-3 - Monitored Zephyr PM_{2.5} Concentrations (µg/m³)

Table 3-3 - Summary of PM₁₀ and PM_{2.5} Concentrations (21st April to 19th July 2023)

Monitor	Location	PM ₁₀ Concentrations (µg/m ³)			PM _{2.5} Concentrations (µg/m ³)	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
Z1381	Lamppost 1, Hollybush Inn	8.4	37.9	26.6	5.7	23.3
Z942	Lamppost 15, Park Road	10.2	34.9	25.5	7.0	23.6

3.3. DM11

Data Capture

- 3.3.1. Both the Park Road and On-Site DM11 Pro monitors had 100% data capture during this monitoring period for all pollutants.

Particulate Matter (PM₁₀ and PM_{2.5})

- 3.3.2. Figure 3-2 and Figure 3-3 respectively, show the PM₁₀ and PM_{2.5} data monitored at the DM11 Pro monitors for the period 21st April to 19th July 2023. A summary of the monitored concentrations is provided in Table 3-3.
- 3.3.3. Average concentrations of PM₁₀ and PM_{2.5} at the continuous monitor are below the respective annual mean objectives of 40µg/m³ and 20µg/m³ during the monitoring period. In addition, there were no 24-hour mean PM₁₀ concentrations above 50µg/m³. Average concentrations of PM_{2.5} were above the target concentrations of 10µg/m³.
- 3.3.4. Concentrations at both sites follow a similar trend, however, concentrations at the On-site monitor are slightly higher than those at Park Road and have experienced several high concentration peaks in the hourly data. This is most likely due to the location of the monitor closer to the site works and access.

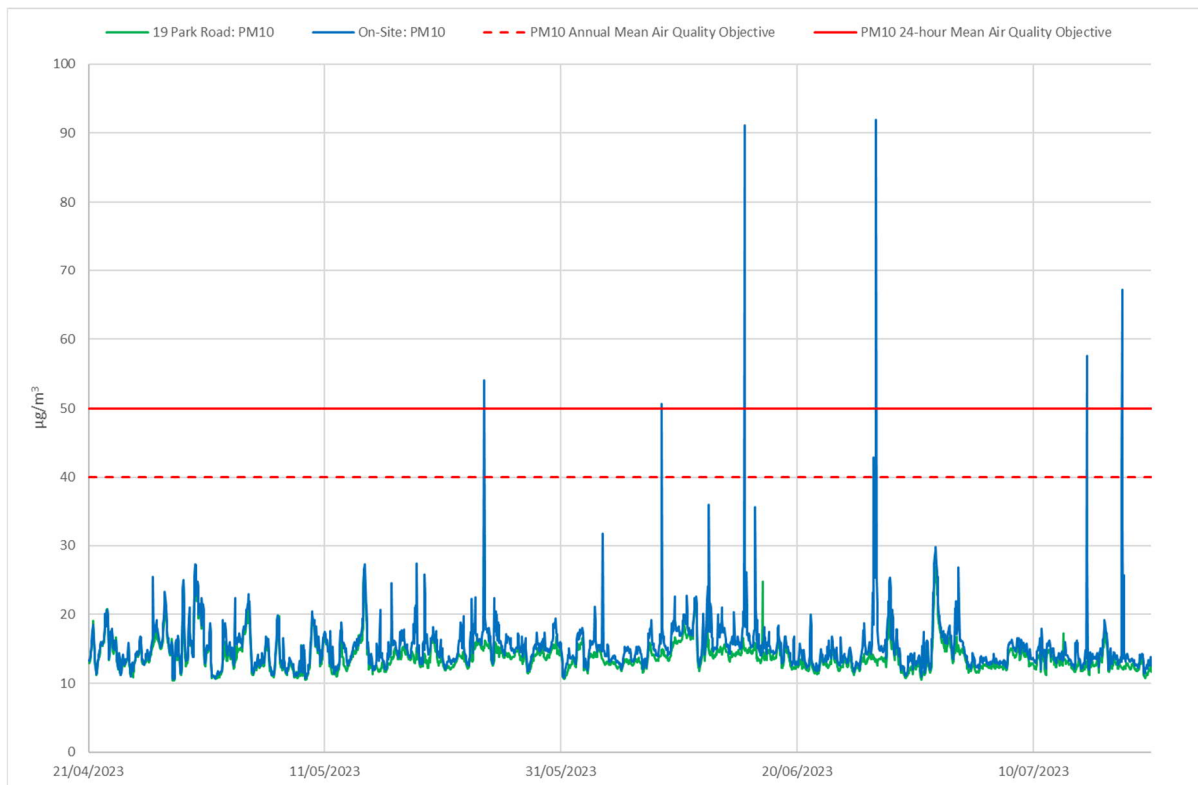


Figure 3-4 - Monitored DM11 Particulate Matter Concentrations (PM₁₀) (µg/m³)

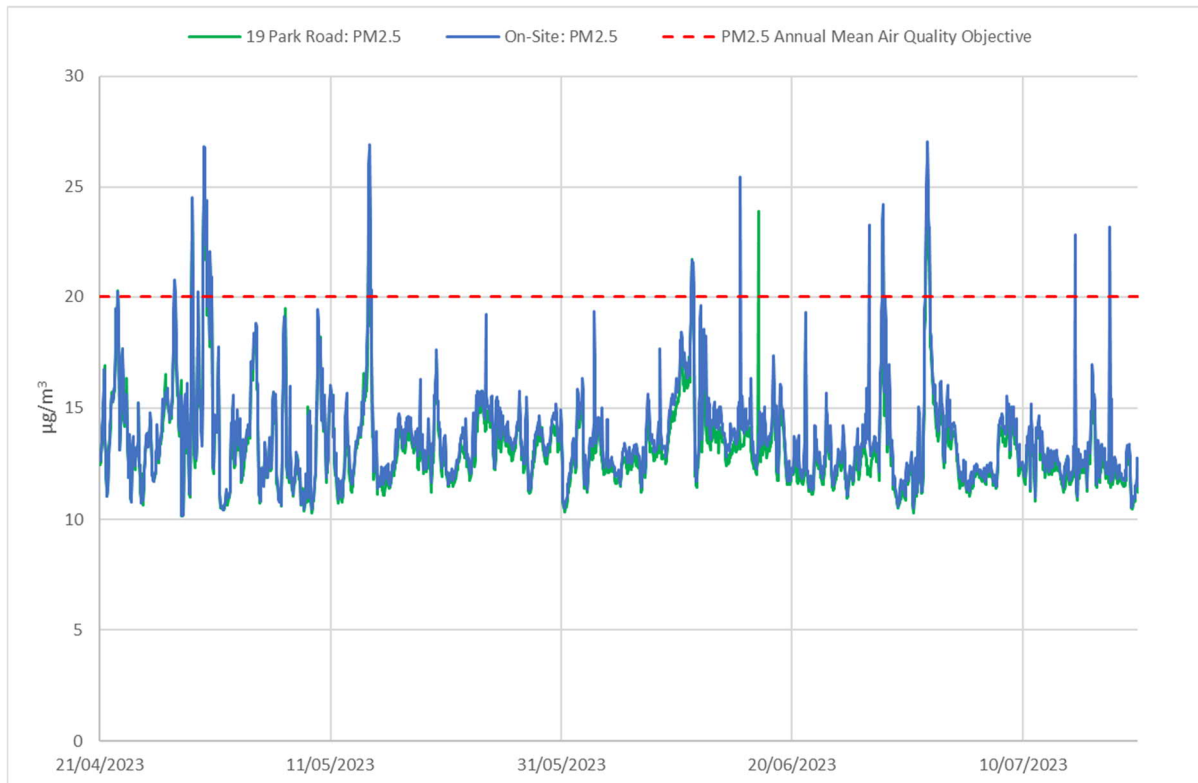


Figure 3-5 - Monitored DM11 Particulate Matter Concentrations (PM_{2.5}) (µg/m³)

Table 3-4 - Summary of PM₁₀ and PM_{2.5} Concentrations (21st April to 19th July 2023)

Monitor	Location	PM ₁₀ Concentrations (µg/m ³)			PM _{2.5} Concentrations (µg/m ³)	
		Average Hourly Concentration	Maximum Hourly Concentration	Maximum 24-hour mean	Average	Maximum
332	19 Park Road	13.9	27.0	19.8	13.3	26.7
333	On-Site	15.4	31.9*	23.9	13.7	27.0

*Note that background colour applied is based on bandings which are classed for a 24-hour running mean PM₁₀ concentration not an hourly PM₁₀ concentration band.

4. SUMMARY

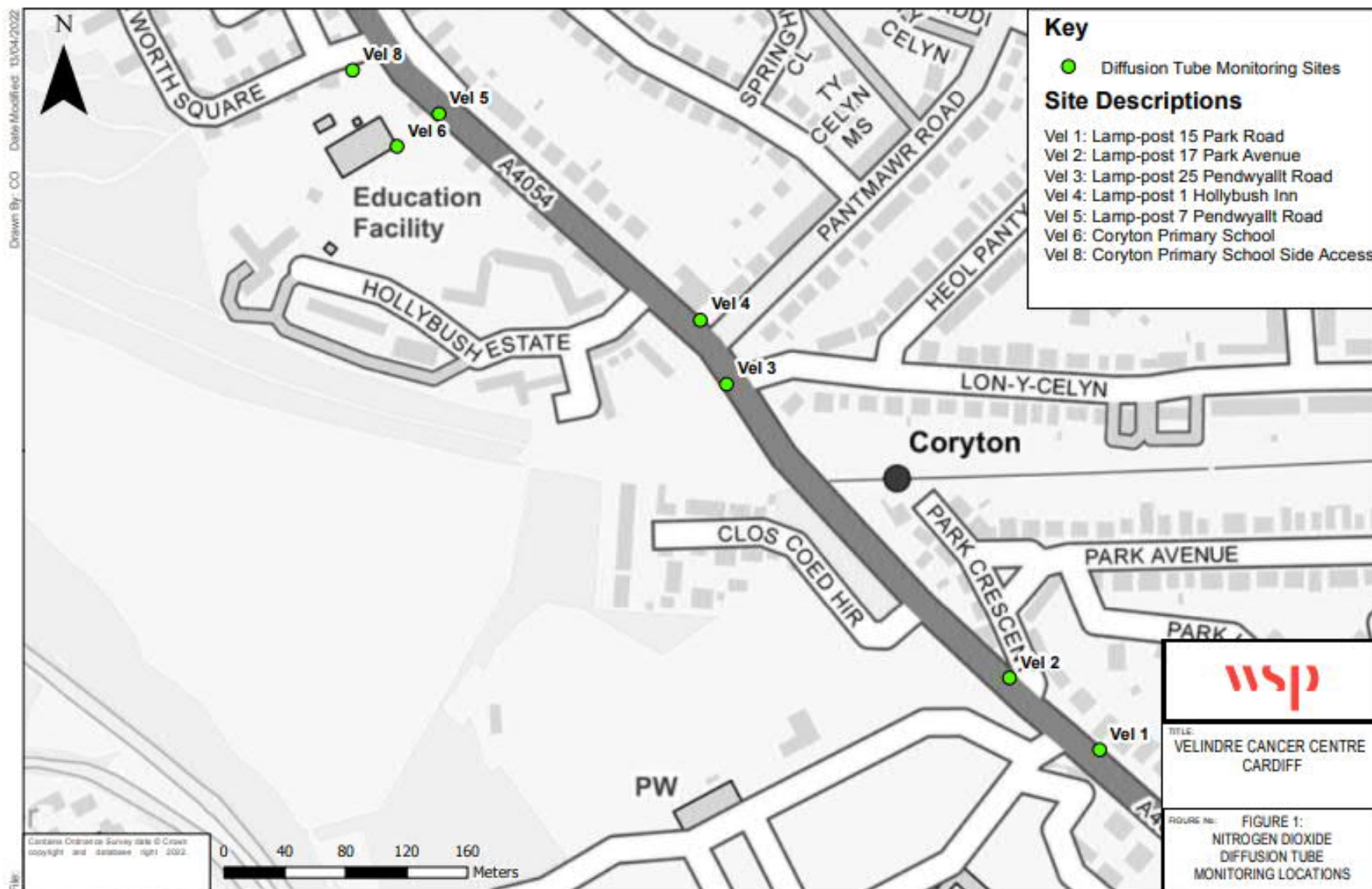
- 4.1.1. NO₂ diffusion tube monitoring was carried out at seven locations during the period 21st April to 19th January 2023. Concentrations were monitored at two locations using Zephyr monitors (NO₂, PM₁₀ and PM_{2.5}) and at two locations using a DM11 Pro (PM₁₀ and PM_{2.5}) during the period.
- 4.1.2. Monitored concentrations of NO₂, PM₁₀ and PM_{2.5} across the study area have been below the relevant objectives within this monitoring period. NO₂ concentrations were highest overall at the Vel 5 diffusion tube site which is located at Lampost 7, Pendywyallt Road opposite No. 32. This sample location is closer to the roadside than residential premises, or nearby footpaths, and will be impacted from emissions from vehicle exhausts.

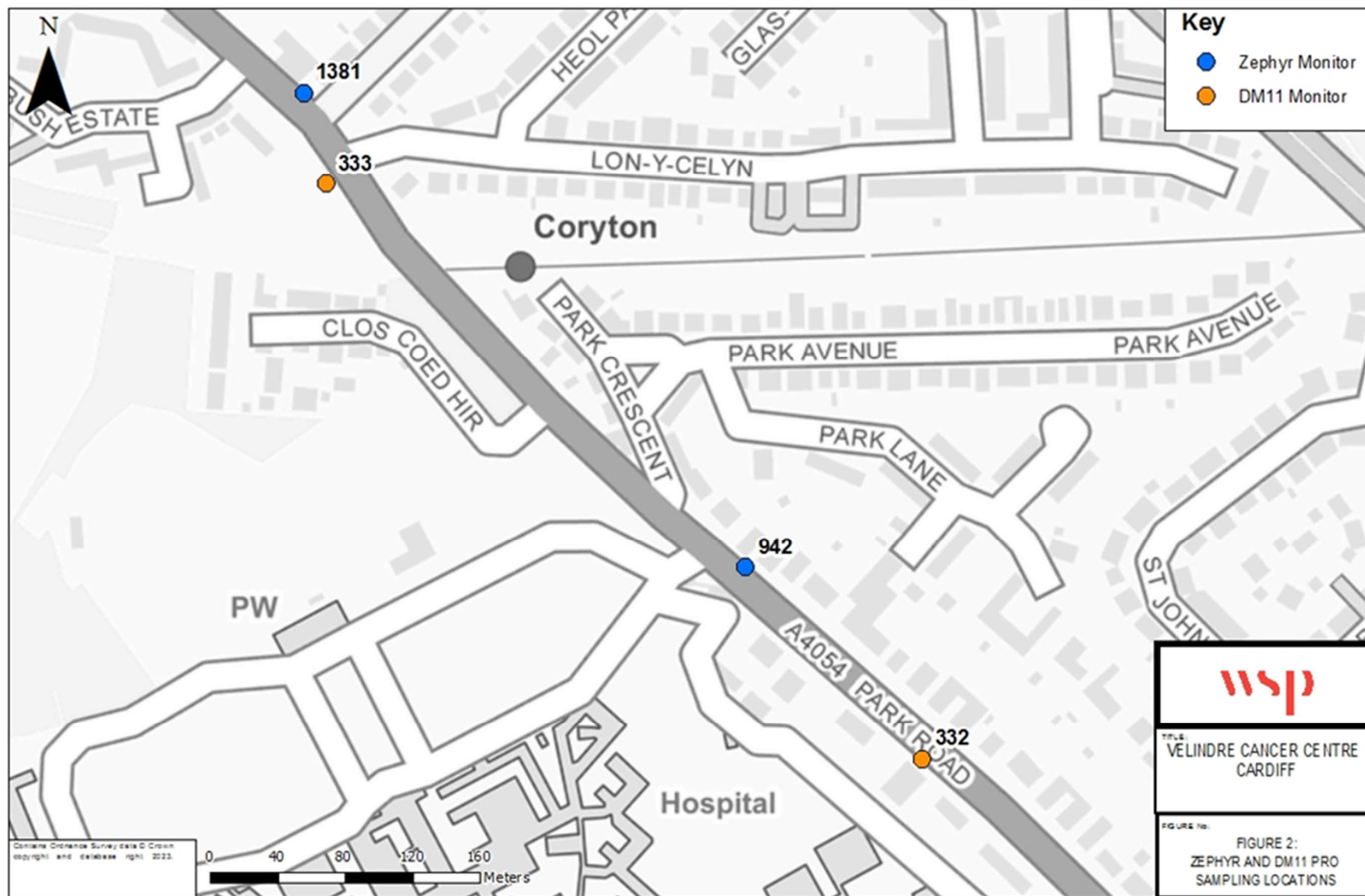
- 4.1.3. Monitored concentrations of NO₂, PM₁₀ and PM_{2.5} using the Zephyr monitors followed similar trends at both locations. In addition, monitored concentrations of PM₁₀ and PM_{2.5} using the DM11 Pros followed a similar trend at both monitoring locations. Average hourly concentrations of PM₁₀ and PM_{2.5} at the DM11 Pro were slightly higher than those monitored at the Zephyrs.

Appendix A

MONITORING LOCATIONS









The Forum
Barnfield Road
Exeter, Devon
EX1 1QR

wsp.com