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NHS Wales

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# NVCC ENABLING WORKS

## Air Quality Monitoring Quarterly Report





NHS Wales

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### Air Quality Monitoring Quarterly Report

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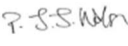
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### APPENDIX A

#### 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 19<sup>th</sup> July and 11<sup>th</sup> October 2023. Defra's Air Quality Index<sup>1</sup> 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 (NO<sub>2</sub>) Concentrations, 19<sup>th</sup> July 2023 to 11<sup>th</sup> October 2023

Monitor Type	Location	NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )
		Annual Average (annualised and bias-adjusted to 2022)
Diffusion Tube	Vel 1: Lamppost 15, Park Road	23.0
	Vel 2: Lamppost 17, Corner of Park Road and Park Avenue	22.9
	Vel 3: Lamppost 25, Pendwyallt Road opposite Lon Y Celyn	19.4
	Vel 4: Lamppost 1, Hollybush Inn	21.4
	Vel 5: Lamppost 7, Pendywyallt Road opposite No. 32	28.1
	Vel 6: Coryton Junior School	12.0
	Vel 8: Coryton Junior School – side entrance	15.3

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

### Summary of Monitored Zephyr Nitrogen Dioxide (NO<sub>2</sub>) Concentrations, 19<sup>th</sup> July 2023 to 11<sup>th</sup> October 2023

Monitor Type	Location	NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )	
		Average	Maximum Hourly
Zephyr Monitors	Lamppost 1, Z1381 Hollybush Inn	10	73
	Lamppost 15, Z942 Park Road	15.1	66.1

### Summary of Monitored Zephyr Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>) Concentrations, 19<sup>th</sup> July 2023 to 11<sup>th</sup> October 2023

Monitor Type	Location	PM <sub>10</sub> Concentrations (µg/m <sup>3</sup> )			PM <sub>2.5</sub> Concentrations (µg/m <sup>3</sup> )	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
Zephyr Monitors	Lamppost 1, Z1381 Hollybush Inn	6.4	40.4	25.1	3.7	27.4
	Lamppost 15, Z942 Park Road	7.7	35.6	23.5	4.8	21.6

### Summary of Monitored DM11 Pro Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>) Concentrations, 19<sup>th</sup> July 2023 to 11<sup>th</sup> October 2023

Monitor Type	Location	PM <sub>10</sub> Concentrations (µg/m <sup>3</sup> )			PM <sub>2.5</sub> Concentrations (µg/m <sup>3</sup> )	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
DM11 Pro Monitors	19 Park Road	13.2	26.4	18.5	12.7	25.6
	On-Site	14.7	160.2*	23.8	13.2	56.1*

\*Note that background colour applied is based on bandings which are classed for a 24-hour running mean PM<sub>10</sub> concentration not an hourly PM<sub>10</sub> concentration band.

## 1. INTRODUCTION

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- 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 (NO<sub>2</sub>) 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 19<sup>th</sup> July 2023 and 11<sup>th</sup> October 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 NO<sub>2</sub>. The tubes are designed to provide an indication of longer-term average NO<sub>2</sub> 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 NO<sub>2</sub> 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, Pendwyallt 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 (PM<sub>10</sub> and PM<sub>2.5</sub>) and NO<sub>2</sub> 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 (NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>) 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 (PM<sub>10</sub> and PM<sub>2.5</sub>) 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	180993
	Z942	Lamppost 15, Park Road	314782	180711
DM11 Pro	332	19 Park Road	314887	180597
	333	On-Site	314533	180939

## 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)<sup>2</sup>. The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation<sup>3</sup>.
- 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 **Table 2-3**.

**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 ( $\text{PM}_{10}$ )	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.

<sup>2</sup> 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)

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

- 2.2.5. The UK Government published its Environmental Targets (Fine Particulate Matter) (England) Regulations on 30<sup>th</sup> January 2023<sup>4</sup>. The regulations include a long-term target annual mean PM<sub>2.5</sub> concentration of 10µg/m<sup>3</sup> and an exposure reduction target of 35% when compared to 2018 levels, both to be met by 2040. There is also an interim PM<sub>2.5</sub> target, which is to be met by the end of January 2028, of 12µg/m<sup>3</sup> as an annual mean concentration and a 22% reduction in exposure when compared to 2018 levels.

## 2.3. DEFRA AIR QUALITY INDEX

- 2.3.1. A summary of available monitored concentrations for the period 19<sup>th</sup> July to 11<sup>th</sup> October 2023 are provided in Section 3. In addition, to the monitored concentrations, reference is also made to Defra's Air Quality Index<sup>5</sup> 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.

<b>Nitrogen Dioxide</b>										
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 <sup>3</sup>	0-67	68-134	135-200	201-267	268-334	335-400	401-467	468-534	535-600	601 or more

<b>PM<sub>10</sub> Particles</b>										
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 <sup>3</sup>	0-16	17-33	34-50	51-58	59-66	67-75	76-83	84-91	92-100	101 or more

<b>PM<sub>2.5</sub> Particles</b>										
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 <sup>-3</sup>	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**

<sup>4</sup> Environmental Targets (Fine Particulate Matter) (England) Regulations 2023

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

## 3. MONITORING RESULTS

### 3.1. NO<sub>2</sub> DIFFUSION TUBES

- 3.1.1. The results of the monitoring completed across the study area between 19<sup>th</sup> July and 11<sup>th</sup> October 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/m<sup>3</sup> 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 NO<sub>2</sub> Diffusion Tube Concentrations between 19<sup>th</sup> July to 11<sup>th</sup> October 2023**

Sampling Location	NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )			
	Monthly concentrations			Annual Average (annualised and bias-adjusted for 2022)
	From: 19/07/2023 To: 15/08/2023	From: 15/08/2023 To: 13/09/2023	From: 13/09/2023 To: 11/10/2023	
Vel 1	15.9	23.4	22.0	23.0
Vel 2	19.2	22.0	23.2	22.9
Vel 3	11.7	21.8	17.6	19.4
Vel 4	15.5	20.3	21.6	21.4
Vel 5	7.8	26.9	28.4	28.1
Vel 6	6.4	11.9	11.5	12.0
Vel 8	21.7	14.9	12.0	15.3

\* Results have been annualised following the methodology in LAQM.TG (22)<sup>6</sup>, 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.

<sup>6</sup> Defra (2022) Local Air Quality Management Technical Guidance (TG22) Sept 2022.

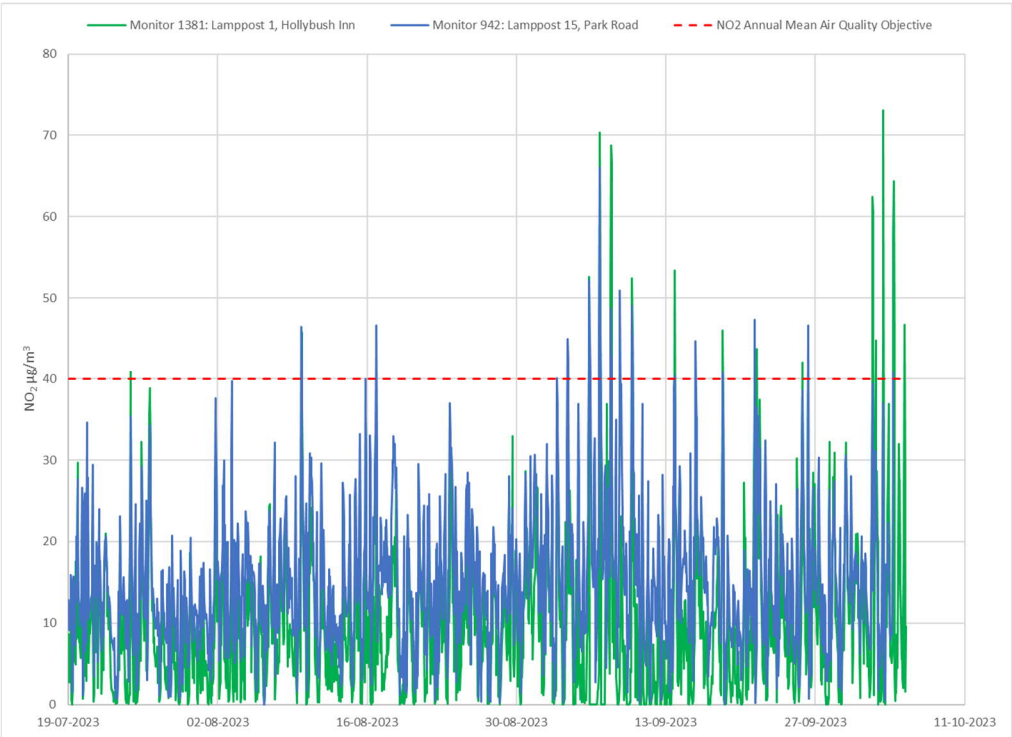
### 3.2. ZEPHYR CONTINUOUS MONITOR

#### Data Capture

3.2.1. During the monitoring period 19<sup>th</sup> July to 11<sup>th</sup> October 2023, the Hollybush Inn (Z1381) Zephyr had a 99% data capture whilst the Park Road (Z942) Zephyr had a data capture of 98.5%.

#### Nitrogen Dioxide

3.2.2. **Figure 3-1** shows the NO<sub>2</sub> data monitored at each of the Zephyr continuous monitors for the monitoring period and a summary of the monitored concentrations is provided in **Table 3-2**.



**Figure 3-1 - Monitored Zephyr NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>)**

3.2.3. Average NO<sub>2</sub> concentrations across the monitoring period at both the monitoring sites were well below the air quality objective of 40µg/m<sup>3</sup>. There were also no exceedances of the one-hour objective (200µg/m<sup>3</sup>) at either of the sites.

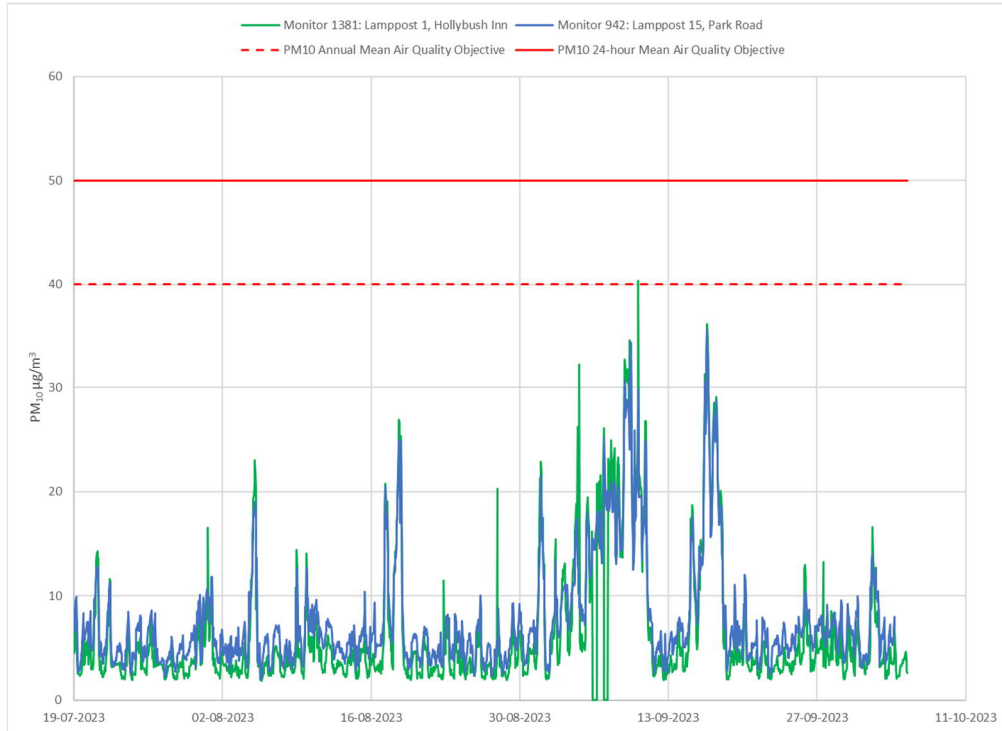
**Table 3-2 - Summary of NO<sub>2</sub> Concentrations (19<sup>th</sup> July to 11<sup>th</sup> October 2023)**

Monitor	Location	NO <sub>2</sub> Concentration Summary	
		Average of Hourly Concentrations	Maximum Hourly Concentration
Z1381	Lamppost 1, Hollybush Inn	10	73.0
Z942	Lamppost 15, Park Road	15.1	66.1

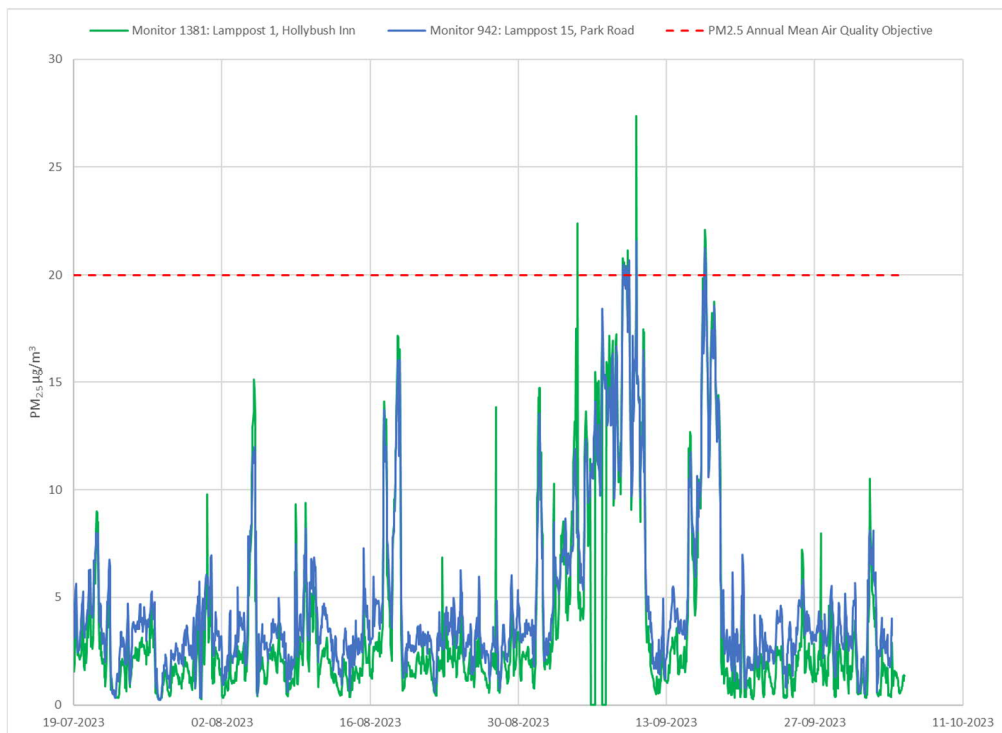
3.2.4. **Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>)**

3.2.5. PM<sub>10</sub> and PM<sub>2.5</sub> concentration data from each of the Zephyr continuous monitors are depicted in **Figure 3-2** and **Figure 3-3**, respectively, for the quarterly monitoring period. A summary of the monitored concentrations is provided in **Table 3-3**.





**Figure 3-2 - Monitored Zephyr PM<sub>10</sub> Concentrations (µg/m<sup>3</sup>)**



**Figure 3-3 - Monitored Zephyr PM<sub>2.5</sub> Concentrations (µg/m<sup>3</sup>)**

- 3.2.6. Average concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> at both the continuous monitors are below the respective annual mean objectives of 40µg/m<sup>3</sup> and 20µg/m<sup>3</sup> during the monitoring period. In addition, there were no 24-hour mean concentrations above 50µg/m<sup>3</sup>. Average concentrations of PM<sub>2.5</sub> were also below the target concentration of 10µg/m<sup>3</sup>.

3.2.7. Overall, the PM<sub>10</sub> and PM<sub>2.5</sub> concentrations follow a similar trend at both monitor locations, there were several peaks in both PM<sub>10</sub> and PM<sub>2.5</sub> 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 PM<sub>10</sub> and PM<sub>2.5</sub> and the peaks in concentrations only lasted for a short period of time.

**Table 3-3 - Summary of PM<sub>10</sub> and PM<sub>2.5</sub> Concentrations (19<sup>th</sup> July to 11<sup>th</sup> October 2023)**

Monitor	Location	PM <sub>10</sub> Concentrations (µg/m <sup>3</sup> )			PM <sub>2.5</sub> Concentrations (µg/m <sup>3</sup> )	
		Average	Maximum	Maximum 24-hour mean	Average	Maximum
Z1381	Lamppost 1, Hollybush Inn	6.4	40.4	25.1	3.7	27.4
Z942	Lamppost 15, Park Road	7.7	35.6	23.5	4.8	21.6

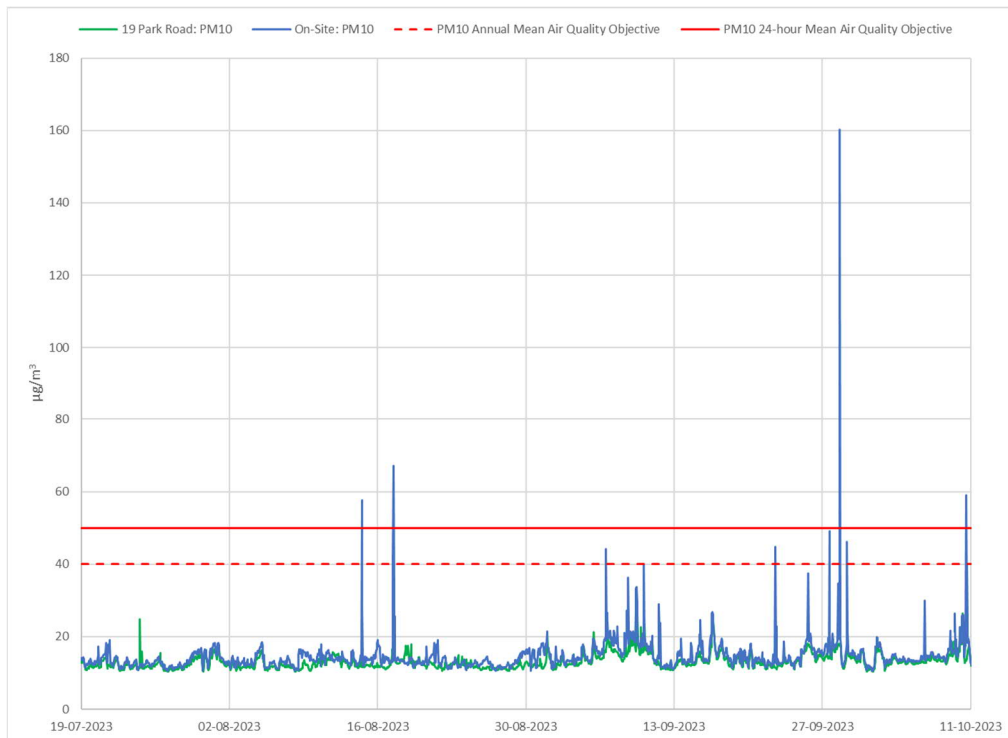
### 3.3. DM11

#### Data Capture

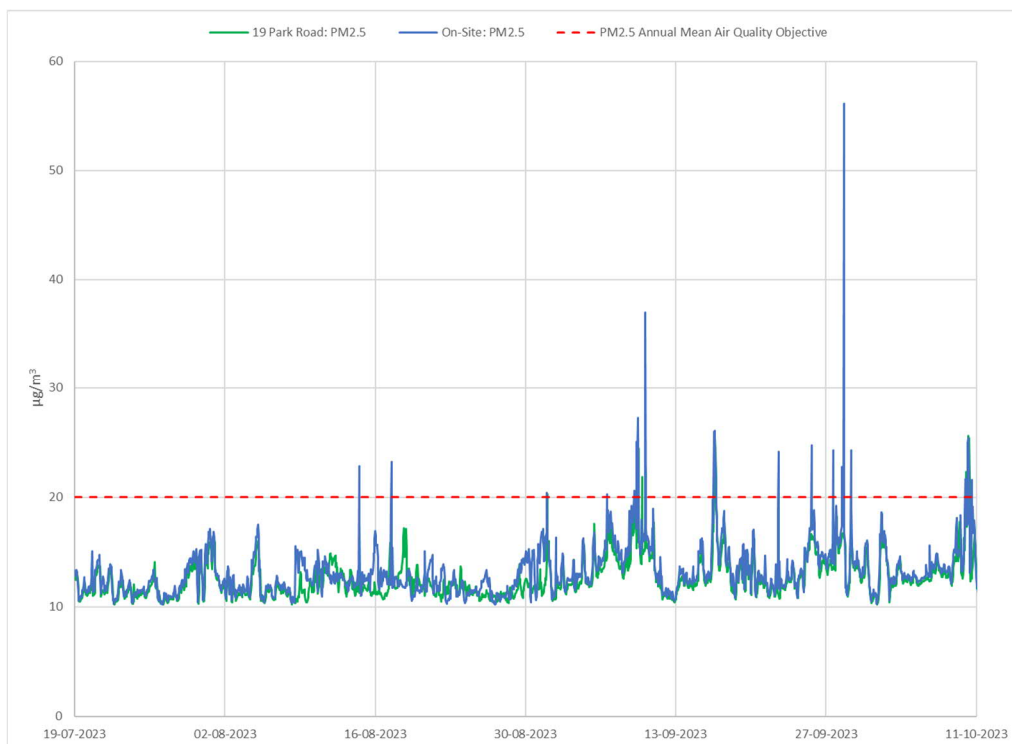
- 3.3.1. During the monitoring period 19<sup>th</sup> July to 11<sup>th</sup> October 2023, the DM11 Pro continuous monitors located On-site had 99.4% and on Park Road had 100% data capture.

#### Particulate Matter (PM<sub>10</sub> and PM<sub>2.5</sub>)

- 3.3.2. **Figure 3-4** and **Figure 3-5** respectively, show the PM<sub>10</sub> and PM<sub>2.5</sub> data monitored at the DM11 Pro monitors for the period 19<sup>th</sup> July to 11<sup>th</sup> October 2023. A summary of the monitored concentrations is provided in **Table 3-4**.



**Figure 3-4 - Monitored DM11 Particulate Matter Concentrations (PM<sub>10</sub>) (µg/m³)**



**Figure 3-5 - Monitored DM11 Particulate Matter Concentrations (PM<sub>2.5</sub>) (µg/m<sup>3</sup>)**

- 3.3.3. Average concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> at the continuous monitor are below the respective annual mean objectives of 40µg/m<sup>3</sup> and 20µg/m<sup>3</sup> during the monitoring period. In addition, there were no 24-hour mean PM<sub>10</sub> concentrations above 50µg/m<sup>3</sup>. Average concentrations of PM<sub>2.5</sub> were above the target concentrations of 10µg/m<sup>3</sup>.
- 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.

**Table 3-4 - Summary of PM<sub>10</sub> and PM<sub>2.5</sub> Concentrations (19<sup>th</sup> July to 11<sup>th</sup> October 2023)**

Monitor	Location	PM <sub>10</sub> Concentrations (µg/m <sup>3</sup> )			PM <sub>2.5</sub> Concentrations (µg/m <sup>3</sup> )	
		Average Hourly Concentration	Maximum Hourly Concentration	Maximum 24-hour mean	Average	Maximum
332	19 Park Road	13.2	26.4	18.5	12.7	25.6
333	On-Site	14.7	160.2*	23.8	13.2	56.1*

\*Note that background colour applied is based on bandings which are classed for a 24-hour running mean PM<sub>10</sub> concentration not an hourly PM<sub>10</sub> concentration band.

## 4. SUMMARY

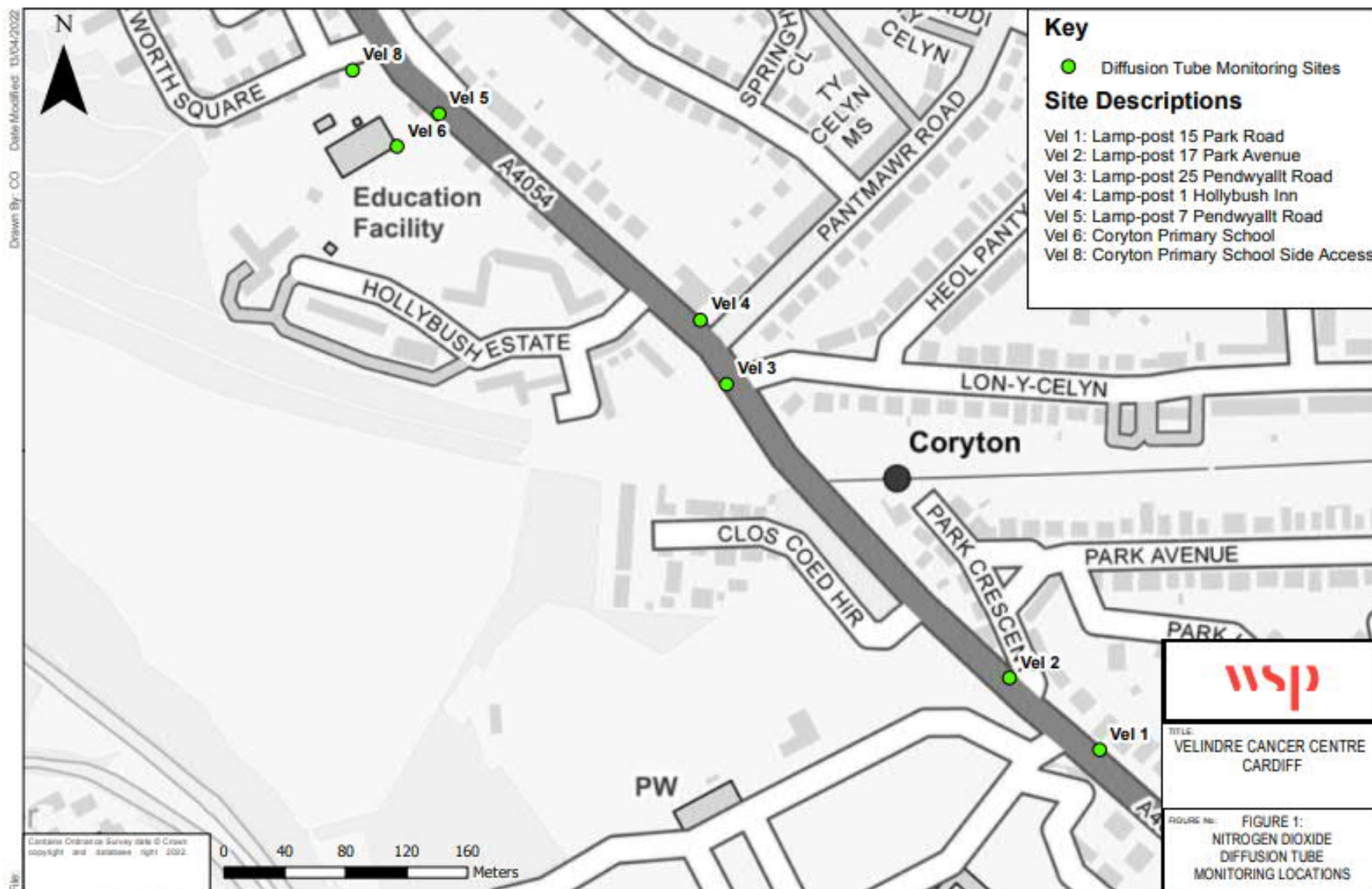
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- 4.1.1. NO<sub>2</sub> diffusion tube monitoring was carried out at seven locations during the period 19<sup>th</sup> July to 11<sup>th</sup> October 2023. Concentrations were monitored at two locations using Zephyr monitors (NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>) and at two locations using a DM11 Pro (PM<sub>10</sub> and PM<sub>2.5</sub>) during the period.
- 4.1.2. Monitored concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> across the study area have been below the relevant objectives within this monitoring period. NO<sub>2</sub> concentrations were highest overall at the Vel 5 diffusion tube site which is located at Lamppost 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 NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> using the Zephyr monitors followed similar trends at both locations. In addition, monitored concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> using the DM11 Pros followed a similar trend at both monitoring locations. Average hourly concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> at the DM11 Pro were slightly higher than those monitored at the Zephyrs.

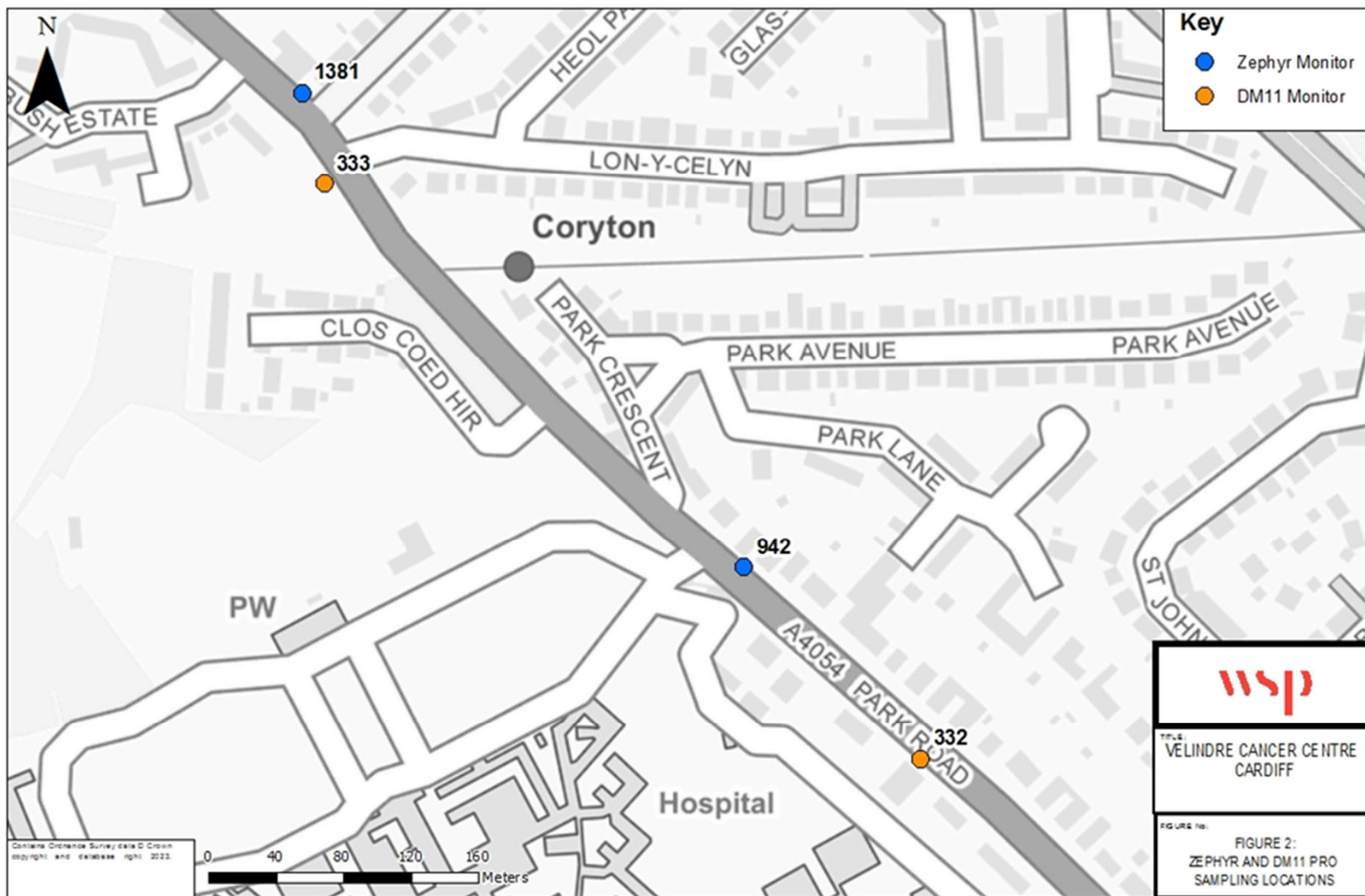
# Appendix A

## MONITORING LOCATIONS













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New North Road  
Exeter, Devon  
EX4 4GL

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